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Creole Remedies

Case studies of ethnoveterinary medicine
in Trinidad and Tobago

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Cheryl Lans

Creole Remedies: Case Studies Of Ethnoveterinary Medicine

Stellingen

1. The explication and validation of ethnoveterinary knowledge can lead to the identification and manufacture of effective veterinary medicines which are affordable to small farmers in developing countries (*this thesis*).
2. The Creole past is based on European and Amerindian elements of the folk culture which should be considered alongside and equal to those of Africa and India in the creation of a Trinidad and Tobago quilt comprised of diverse patterns (*this thesis*).
3. Modern medical scientists and veterinarians tend to unjustifiably reject indigenous knowledge because they cannot distinguish between the magical, spiritual and experiential elements in local practices (*this thesis*).
4. Using school children to write essays is an effective and efficient way to identify ethnoveterinary practices that can eventually lead to inexpensive medicines (*this thesis*).
5. Validated ethnoveterinary knowledge can help all interested farmers become better at the performance of farming (*Richards, 1989; Nitsch, 1991*).
6. Forms of knowledge are not graded on an evolutionary inclined plane with the Western sciences at the upper end and the non-Western forms spread on the lower end (*Marglin, F.A. 1990*).
7. Knowledge is the fruit of the efforts and resources provided by many persons and institutions in the past and present. Therefore, its contents do not belong to anyone in particular; It is the patrimony of humanity and, as such, should be shared and benefited by all in the present and the future. Not to disseminate it would be to waste the human efforts and the generally scarce resources applied to it (*FAO, 1993*).
8. 'Knowledge is effective action in the domain of existence.' *Matsumura and Varela (1992: 244)* as quoted by (*Röling N., Jiggins, J., and Coehoorn, C., 1999*).
9. Knowledge is the product of a political process in which competing knowledges are rendered subordinate. Sociological knowledge is a good example of this, in which the fetish with that three-headed beast known as Marx-Weber-Durkeim both acts as a tribal totem and is a marker of a political process in which many theoreticians and researchers have been relegated to a tribal wasteland (*Stanley, 1991*).
10. Tout hachie se rimed (every bush is a remedy).

Creole Remedies

Case studies of ethnoveterinary medicine in
Trinidad and Tobago

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Creole Remedies

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Tobago

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Preface

This book describes research done in the spirit of the pledge initiated by the Student Pugwash Group in the United States as quoted by Rotblat (1999).

I promise to work for a better world, where science and technology are used in socially responsible ways. I will not use my education for any purpose intended to harm human beings or the environment. Throughout my career, I will consider the ethical implications of my work before I take action. While the demands placed upon me may be great, I sign this declaration because I recognise that individual responsibility is the first step on the path to peace.

The research documents ethnoveterinary practices used in Trinidad and Tobago, which are based on ethno- or folk medicine. Folk medicine based on plant use is ancient as suggested by this brief history of medicine quoted by Dzaniš (1999):

The history of medicine

YEAR	PREVAILING MEDICAL ADVICE
2000 BC	Here, eat this root.
1200 AD	The root is heathen, say this prayer.
1500 AD	Prayers are superstitious, drink this potion.
1900 AD	That potion is snake oil, swallow this pill.
1950 AD	That pill is ineffective, take this antibiotic.
1999 AD	That antibiotic is synthetic, eat this root.

History of research proposal

The Caribbean Agricultural Research and Development Institute (CARDI) was the implementing agency for a Sheep Production and Marketing Project (CSP/M) funded by the Canadian International Development Agency (CIDA). The project worked with low-resource farmers in Barbados, Guyana and Tobago. Farmer-participants in Tobago used folk medicines as anthelmintics. Edward Evans the Production Economist attached to the CSP/M concluded that improved technologies [including purchased drugs] could not be justified under the socio-economic and cultural framework in which these farmers operated (Evans, 1992). A research topic was then born.

The research process was an attempt to reshape (bio) technological knowledge of ethnoveterinary medicine by bringing ethnoveterinary knowledge into western science. This necessitated a process of negotiation with veterinarians, Animal Science and Medicinal Plant journal editors and reviewers, in order to validate ethnoveterinary practices and to classify the practices into recommended versus non-recommended for further research.

Some of the knowledge claims on which ethnoveterinary practices are based are open to debate. Yet there is still the need to reach compromise, consensus or accommodation, so that a process of validation satisfactory to all parties can be achieved. The research is thus an attempt to facilitate joint action on ethnoveterinary remedies, since the market will not provide tropical plant-based medicines in the short term.

One idea that shaped the research came from Foucault (1980) who talks about an: 'insurrection of subjugated [non-scientific] knowledges' and 'render[ing] these knowledges capable of opposition and of struggle against the coercion of a theoretical, unitary, formal and scientific discourse.'

A second idea shaping the research was that: 'Knowledge is effective action in the domain of existence.' Maturana and Varela (1992: 244) as quoted by (Röling, N., Jiggins, J., and Coehoorn, C., 1999).

Validated ethnoveterinary knowledge can help all interested farmers become better at the performance of farming (Richards, 1989; Nitsch, 1991). Farm [performance] is not a matter of doing everything correctly, but of making a totality run in a satisfactory way using a pattern of continuous observation and adjustment (Richards, 1989; Nitsch, 1991). For instance the American product which is based on *Aloe vera* gel and is used to boost immune response in baby chicks was seen in Trinidad and Tobago as too expensive and a type of 'borrowing for resale' the pure *Aloe vera* which has traditionally been used by local poultry farmers for poultry production. However the research of Solvay Animal Health was of value to the local farmers since the research indicated that it was better to limit the use of the plant to the first two weeks of the chick's life rather than using a more broad-based approach.

What western thought has long seen as magical beliefs and practices are the real challenge posed by indigenous knowledge (Marglin, 1990b; Giarelli, 1996). The challenge for scientists is to reconsider not only the nature of medicine, but also the nature of science and scientific knowledge itself (Giarelli, 1996).

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I owe much to my promotors Professor Paul Richards of the Working Group Technology and Agrarian Development and Professor Niels Röling of the Chair Group Communication and Innovation Studies. Professor Niels Röling co-supervised the first phase of the research with Dr. Jan Diek van Mansvelt of the Department of Ecological Agriculture and encouraged me to continue to do the doctorate. Both Professor Paul Richards and Professor Niels Röling kept in constant touch during the fieldwork for the second phase despite their busy schedules and despite the uncertainty of the outcome. My co-promotor Dr. A. J.J. van den Berg of the Department of Medicinal Chemistry at Utrecht University, worked very hard in sorting through the chemical compounds and asked for changes in the text that would make it acceptable to the pharmacological audience. My co-promotor Dr. Gabriel Brown was the day-to-day supervisor for the fieldwork period and always cleared a space for me to work in his crowded office. He acted as a sounding board for many of my ideas and theories and provided much needed support and guidance. The Herbarium of the University of the West Indies made a valiant attempt to identify plant specimens with only a little complaint about their quality. Dr. Lionel Robineau of enda-caribe in the Dominican Republic provided friendly support and information on the under-researched plants.

The Editor and reviewers of the journal Preventive Veterinary Medicine were open-minded about Ethnoveterinary Medicine and made a thorough review of three articles that are presented as case studies in this book. The reviewers of Rural Sociology made a similar effort for one case study. The co-operation from the respondents was tremendous. The hospitality of all was wonderful. The demi tasse of local coffee that was always provided in Paramin was very much appreciated as was the 'bake and buljol / smoked herring' breakfasts provided on the hunting trips by Dr. Bridgewater. Thanks especially to my family for supporting me through the fieldwork period and not commenting too often on the paths not taken. The foresight and planning of my parents has helped me become what I am today. Without Tigger as justification and Dr. Brown's long hours, I would not have spent so many hours, days, perhaps months in the Medical Sciences library. Lastly this book is dedicated to Iris, Violet, Julia, Emily and Lucia; and to Peter Minshall a 'true Trini' inspiration.

Cheryl Lans
May 2, 2001

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Acronyms

ADB	Agricultural Development Bank
CACAM	Caribbean Association of Complementary and Alternative Medicine
CARAPA	Caribbean Association of Researchers and Herbal Practitioners
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community and Common Market
CARIRI	Caribbean Research Institute
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CPDC	Caribbean Policy Development Centre
CSP/M	Caribbean Sheep Production and Marketing Project
EBUTROP	Economic Biology of Under-Utilised Tropical Plants
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
IADB	Inter-American Development Bank
IICA	Inter-American Institute for Co-operation in Agriculture
IIRR	International Institute of Rural Reconstruction
IMF	International Monetary Fund
IPGRI	International Plant Genetic Resources Institute
IPR	Intellectual Property Rights
MALMR	Ministry of Agriculture, Land and Marine Resources, formerly Ministry of Food Production and Marine Exploitation
OAS	Organisation of American States
PAHO	Pan American Health Organisation
PBR	Plant Breeders' Rights
PGR	The Commission on Plant Genetic Resources
PSU	Poultry Surveillance Unit
THA	Tobago House of Assembly
TRAMIL	Traditional Medicine in the Islands
TRIPS	Trade-related aspects of Intellectual Property Rights
TTAIHP	Trinidad and Tobago Association of Integrative Healthcare Practitioners
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UVI	University of the Virgin Islands
UWI	University of the West Indies
WIPO	World Intellectual Property Organisation

Introduction

As Trinidad is an English colony, one's first idea is that the people speak English; and one's second idea, when that other one as to the English has fallen to the ground, is that they should speak Spanish, seeing that the name of the place is Spanish. But the fact is that they all speak French (Trollope, 1859).

1. Background and motivations for the study

Introduction

The first chapter of this book outlines the context and justification of the research and gives a brief overview of the potential for ethnobotanical research and the relevance of medicinal plants to human and animal health in the Caribbean.

Background

Herbal remedies are one of the world's primary therapeutic arsenals to fight disease (Croom, 1983; Lambert *et al.*, 1997). In November 1998 the *Archives of Internal Medicine*, the *Journal of American Medicine* and eight other speciality medical journals devoted whole issues to alternative medicines (Dalen, 1998). Well-known drugs developed from tropical diversity are Vinblastin and Vincristine from *Catharanthus roseus*, Tubocurarine muscle relaxant from *Talabash curare* and Strophanthin for congestive heart failure from *Strophanthus gratus*. Medicinal plant research often documents the ethnobotanical knowledge of Third World countries which still possess tropical forests as an initial step in the search for new drugs (Elisabetsky, 1991; Posey, 1990; Farnsworth, 1993). Ethnopharmacological surveys provide the rationale for selection and scientific investigation of medicinal plants, since some of these indigenous remedies are already used by significant numbers of people over extended periods of time and demonstrate the actual manner of plant use (Etkin, 1993; Burton *et al.*, 1986). Sales of medicinal plants are valued at £1.4 billion per annum in Germany, £116 million per annum in France and £88 million per annum in the UK (Masood, 1997).

One of the Caribbean region's major problems is access to timely and cost effective medical and veterinary services. Some human health concerns in the Caribbean region are Measles, Neonatal tetanus, Foot and Mouth, Leprosy, Rubella, Chagas' Disease, Tuberculosis, Onchocerciasis, Dengue, HIV, HBV, HCV, Malaria, Cholera, Hepatitis, Diabetes, Cancer, Heart Disease, Asthma, *Treponema pallidum* and Yellow fever (PAHO, 1996). Many Caribbean rural people are involved in the production, marketing and processing of medicinal and culinary herbs. Regional policy makers have recognised that many problems in primary health care are due to lack of knowledge and sensitivity to local health practices, and to the economic and cultural factors associated with these practices (Bentley *et al.*, 1988). There is potential for locally available herbal medicines to be used in primary health care and agricultural development. However available herbal products, have no clear statement of content, or medically related information on the package labels, and

have not been validated or certified by any recognised body. This concerns consumers (potential and actual) and medical practitioners who may unknowingly counter-prescribe these herbal products (Maurice and Cream, 1989). Not all of the plants reported to be useful are harmless (Oubré *et al.*, 1997; MacGregor *et al.*, 1989).

Ethnoveterinary medicine in this thesis is the local, mainly plant-based medicines used for animals. As defined by McCorkle (1989), veterinary anthropology is folk management of animal health in the context of the whole farming system, with consideration for other socio-economic and political realities. The study of ethnoveterinary medicine is typically undertaken to assess its usefulness, but the majority of the studies are descriptive. It has been a named and recognised area of academic interest since the mid-1970s. Biodiversity, ethnomedicine and ethnoveterinary knowledge are greatly influenced by cultural beliefs, religion, societal norms and trends and by the materia medica available in terms of local flora, fauna and minerals (Mathias-Mundy and McCorkle, 1997; Guyer and Richards, 1996). Multi-disciplinary fieldwork is necessary to understand all the aspects of its complexity. In Trinidad and Tobago ethnoveterinary knowledge is based on folk medicine, a phenomenon which has been documented in other cultures (McCorkle and Green, 1998). This study has documented the ethnoveterinary and ethnomedicinal knowledge in Trinidad and Tobago.

Creolization

The word Creole comes from the Spanish and means native to the settlement though not ancestrally indigenous to it (*criar* : to create, imagine, establish, found, settle and *colono* : a colonist, founder settler) (Brathwaite, 1971). In linguistics the word means a pidgin or reduced language that has become a native language to the local born population (Brathwaite, 1971). Glissant defines Creolization in the Caribbean as the cultural construct that distils the main constituents of Caribbean history. These are slavery, colonialism, and racism and the dehumanising experiences of transportation or migration (from Africa, Asia and Europe). Creolization processes integrate colonial historical experiences into a self-consciously de-centered, subversive and transformative creative Caribbean identity (Richards, 1996; Balutansky, 1997). Immigrants in their new Caribbean space use locally adapted technology which was obtained by matching the knowledge of their origins to the locally available plants for emergent health needs. Some of these plants might have been botanically related to previously known plants while others would have been seen for the first time. Creolized folk medicine then developed from the exploitation of synergy between the local knowledge of the Amerindian population and the external knowledge of the immigrants (Richards, 1996). Creolized folk medicine would not have been judged on the origins of its ideas and practices, but only on the standpoint that the plants used alleviated health problems (Richards, 1996).

Caribbean folk medicine is based on this synergy between European folk medicine; scientific medicine; African-based practices; Amerindian medicine and Indian-based medicine with inclusions from other sources. It is a product of inter-group borrowing or medical syncretism or 'the pattern of social institutions and cultural traditions that evolve from deliberate behaviour to enhance health' (Laguerre, 1987). Folk medicine as a system includes: home remedies; folk aetiologies of disease; preventative medicine; reproductive techniques; medicinal properties of plants; anatomical knowledge, and healers. This ethno[veterinary] medicinal study looks at some aspects of these different traditions. During

preliminary research conducted in 1995, hunters were found to be using plants from the forests for snakebites and for their dogs, while medicinal plants from different sources were being used by livestock and poultry farmers as anthelmintics, for reproductive purposes and as antidiarrhoeal agents (Lans, 1996). Very little information was found on ethnoveterinary medicines for pigs. These core traditions of ethnoveterinary medicine were recently documented and published for the first time (Lans and Brown, 1998 a & b). Studies on traditional medicines conducted in Trinidad and Tobago; Pereira (1969), Carew (1993), Ragbir (1996) and Rollocks (1991) are final year undergraduate projects. Due to this their work is not accessible to the general public. Herskovits and Herskovits (1947) and Mischel (1959) have also documented folk medicine. Simpson (1962), Mahabir (1991), Littlewood (1988), Laguerre (1987) and Wong (1976) focus on either one community or one ethnic group.

Scientific validation of the effects and side effects of medicinal plants is needed before they can be recommended (or not) for use (Farnsworth, 1993). Research is also needed to establish whether medicinal plants have fewer long term adverse complications, such as antibiotic resistance, than commercial drugs (Toyang *et al.*, 1995). This is important since a 1997 study has shown that seven species of bacteria from animals in Trinidad are showing increasing resistance to five antimicrobial/antibacterial drugs: gentamicin, trivetin, penicillin, amoxicillin and erythromycin (Suepaul, 1997). Lambie *et al.*, (2000) found that 50% of all *Escherichia coli* isolates from diseased broilers submitted to postmortem examination from 1990 to 1997 in Trinidad were resistant to several antimicrobial drugs. More than 85% of the isolates were resistant to streptomycin, tetracycline, and triple sulfa. Almost 50% of the isolates were resistant to amoxicillin, ampicillin, apramycin, gentamicin, neomycin and sulfamethoxazole-trimethoprim (see Table 3d for the most common parasites, bacteria and fungi). In Europe, some antimycotic drugs have become ineffective against *Microsporium canis* (Perrucci *et al.*, 1994). Additionally the routine use of acaricides in the Third World is counterproductive due to loss of animals' natural resistance to illness, the acaricides high cost and the resulting tendency for farmers to underdose (Fielding, 2000). The ethno[veterinary] medicinal research fits the call by the World Bank (and the Pan American Health Organisation (PAHO)) for public health research where public benefits exceed the economic returns that traditional investors typically seek (PAHO, 1997). PAHO (1997) has called for a science and technology system that dovetails with socio-economic realities. This entails linking the scientists who are dedicated to the production of knowledge and those dedicated to its utilisation.

Systematic understanding of traditional therapies and pharmacopoeias can contribute to the well being of local populations if the medicinal plant knowledge is proved non-harmful and incorporated into health, educational and environmental planning policy for the nation involved (Tarbes, 1989; Elisabetsky, 1991). This would result in a more appropriate and sustainable health system in Latin America and the Caribbean. Brazil's technological dependence on drug imports for the health service has been illustrated by Elisabetsky and de Moraes (1990). Only 281 out of 2000 drugs are locally produced. This not only drains foreign currency, but also limits the health service in certain ways. For example, since 1967 pharmacological research in the United States of America has focused on analgesics, anti-infectives, cardiovasculars and psychopharmacologics / neurotropics. However the World Health Organization (WHO) has reported that the main human health problems in developing countries are malaria, diarrhoeal disease, tuberculosis, leprosy and sexually transmitted diseases; and morbidity of lower income groups from non-communicable diseases like diabetes is high (Guilliford and Mahabir, 1998).

The context for the study

The Caribbean Agricultural Research and Development Institute (CARDI) was the implementing agency for a Sheep Production and Marketing Project (CSP/M) funded by the Canadian International Development Agency (CIDA). The project worked with low-resource farmers in Barbados, Guyana and Tobago. During quarterly monitoring discussions undertaken by this researcher with the farmers in Tobago who were participating in the CSP/M, the farmers revealed that they used ethnoveterinary medicines when they were short of funds. The need for low cost alternatives was inferred by Edward Evans, the Production Economist attached to the CSP/M. Evans conducted several economic evaluations of the participating farms and concluded that improved technologies [including purchased drugs] were outside the financial scope of small farmers or could not be justified under the socio-economic and cultural framework in which these farmers operated (Evans, 1992; Craig and Lans, 1993).

Farming incomes in Trinidad and Tobago are estimated to be 40-50% of the average national income (Evans, 1992). Other considerations for farmers are the high mortality rates for small ruminants, which are estimated at 40% (Robertson, 1991), and the cost of imported drugs which have increased by 35% since the flotation of the national currency in April 1993 (Evans and Ganteaume-Farrell, 1993). These price increases occurred because the fall in the price of oil in the mid-1980s made the government's previous macro-economic strategies unsustainable, the economy retracted and was pushed into structural reform by the International Monetary Fund (IMF) and World Bank. Trinidad and Tobago only recovered from this recession in 1994. Concentrate feed costs increased by 10%. These increases negatively affected farmers since feed and medication are estimated to comprise 60% of total direct operation costs (Evans and Ganteaume-Farrell, 1993). Low cost inputs are thus necessary and important to the future of livestock production in Trinidad and Tobago. Investments in commercial drugs are not sound in situations where farmers report that high numbers of animals are lost or stolen (Table 1).

Table 1. Summary of stolen, lost or dead animals in the 4 months prior to the November-December 1988, Tobago livestock census.

	Sheep	Goats	Cows
No. animals lost or stolen	118	37	21
No. farmers reporting lost / stolen animals	37	19	3
No. dead animals	625	149	48
No. farmers reporting deaths	167	84	31

Source: Osuji *et al.*, 1988.

In Tobago in 1992 there were 500 requests for parasitology, but only one post mortem examination was performed (Table 2). If a farmer does not know the cause of death of his animal then corrective farm management measures cannot be undertaken. Frequently animals become ill and die within 24-48 hours, often before the Veterinarian can be contacted. There are farmers who use anthelmintics so often (based on Extension advice) that they become ineffective after six months. The ideal situation would be for farmers to take a faecal sample to the Veterinary laboratory to identify the specific parasite. Time constraints and inadequate lab facilities make this option unrealistic. There are cases in which animals are sold or slaughtered after they have been medicated and there is inadequate testing of carcasses in the abattoirs (Lans, 1996).

Table 2. Summary of requests for examination in Tobago in 1992

	Dogs	Sheep	Cows	Goats	Pigs	Rabbit	Total
Hematology	34	1	1	0	0	0	36
Parasitology	2	458	3	3	0	1	500
Post mortem	0	0	0	0	1	0	1

Source: Tobago House of Assembly, Division of Agriculture, Forestry and Marine Affairs, 1992 Administrative Report.

Table 3a. Summary of diseases confirmed by species in Tobago

	Dogs	Sheep	Cows	Goats	Total
Dilofilaris	13	0	0	0	13
Endoparasitism	1	324	2	27	354
Hemoparasitism	1	0	0	0	1

Source: Tobago House of Assembly, Division of Agriculture, Forestry and Marine Affairs, 1992 Administrative Report.

In 1994, two veterinarians and three animal health assistants employed by the Tobago House of Assembly (THA) made 2084 veterinary visits and 65 revisits in Tobago (MALMR, 1994). Twenty-six types of clinical cases were recorded in 1992. The largest amount of the veterinarians' time in clinical cases went to 1197 cases of what was described as 'routine worm' (Tobago House of Assembly, 1992). Tables 3a,b&c show that most of the veterinarians' time is spent on deworming animals. Extension officers are not trained to provide specialised health information and disease control and the provision of their services to farmers is constrained by the same economic factors that constrain the veterinary service.

Table 3b. Clinical cases attended in Tobago in 1992

	Folk cure available (Lans, 1996)	Pigs	Goats	Sheep	Cows
Abscess	Yes	7	8	3	1
Abortion		0	2	4	0
Agalactia	Yes	6	0	1	1
Arthritis		1	0	0	0
Bloat	Yes	0	0	1	1
Cystitis		0	1	1	1
Coccidiosis		0	2	0	0
Dermatitis	Yes	0	1	1	0
Adult enteritis	Yes	3	0	4	3
Neonatal enteritis	Yes	23	0	0	0
Endoparasites	Yes	0	3	3	0
Joint ill		0	5	0	0

Table 3b. Clinical cases attended in Tobago in 1992 (cont.)

	Folk cure available (Lans, 1996)	Pigs	Goats	Sheep	Cows
Conjunctivitis		1	2	1	0
Clinical mastitis	Yes	1	16	0	7
Myiasis	Yes	2	8	0	1
Foot rot	Yes	0	1	2	1
Nutritional disorders	Yes	0	1	2	1
Pneumonia		0	2	4	0
Routine worm	Yes	0	488	696	13
Tetanus		0	5	4	0
Injuries	Yes	7	18	25	6
Lameness		5	4	3	2
General disability		5	6	6	6
Metritis	Yes	0	3	0	0
Retained placenta	Yes	0	0	6	3
Prolapsed vagina		0	0	5	5

Source: Tobago House of Assembly, Division of Agriculture, Forestry and Marine Affairs, 1992 Administrative Report.

Table 3c. Clinical cases in Trinidad, 1994

Disease	Folk cure available	Cows	Pigs	Sheep	Goats
Abcess	Yes	78	5	6	45
Anaplasmosis		214		1	4
Agalactia	Yes	21	11	5	5
Arthritis		1	1		
Babesiosis		44			
Bee sting		18		1	13
Bloat	Yes	28	1	12	11
Bovine cutaneous papillomatosis		44			
Coccidiosis		4	2	13	22
Dermatophilosis		33		1	
Teat occlusion		13			
Tetanus		2	4	15	38
Ecto parasitism	Yes	69	16	50	171
Adult enteritis	Yes	36	13	4	38
Neo natal enteritis	Yes	144	56	16	36
Endoparasitism	Yes	447	43	458	601
Foot rot	Yes	13	3	18	24
Umbilical hernia		5	5		1
Keratitis / conjunctivitis		17		1	3
Ketosis		3			1
Urolithiasis		1		2	17

Table 3c. Clinical cases in Trinidad, 1994 (cont.)

Disease	Folk cure available	Cows	Pigs	Sheep	Goats
Wounds / trauma	Yes	330	35	76	168
Lameness		46	1		14
Mange	Yes	4	1	18	22
Clinical mastitis	Yes	36	1	1	82
Malnutrition	Yes	50	3	9	16
Myiasis	Yes	134	3	26	84
M.M.A		2	15		1
Navel ill	Yes	44	0	1	8
Otitis		2	5		
Paralysis		2		3	
Pneumonias		54	23	17	80
Poisoning	Yes	15	1	11	8
Swine erysepelas			29		

Source: Annual Report 1994. Animal Health Sub-Division, Ministry of Agriculture, Land and Marine Resources.

Table 3d. Most commonly reported parasites, bacteria and fungi 1996

SPECIES	FREQUENCY
<i>Coccidia</i>	449
<i>Strongloides</i> species	54
<i>Trichostrongylidae</i>	204
<i>Bacillus laterosporus</i>	124
<i>Escherichia coli</i>	787
<i>Flavobacterium</i> species	103
<i>Klebsiella pneumoniae</i>	147
<i>Pasturella hemolytica</i>	97
<i>Proteus mirabilis</i>	104
<i>Pseudomonas aeruginosa</i>	115
<i>Pseudomonas</i> species	80
<i>Salmonella</i> species	63
<i>Staphylococcus epidermidis</i>	274
<i>Streptococcus enterococci</i> gp	161
<i>Streptococcus viridans</i> gp	142

Source: Ministry of Agriculture, Land and Marine Resources, 1998. Annual Report 1998. Veterinary Diagnostic Laboratory. Animal Health Sub-Division.

The north region of Trinidad is divided into eight districts and the south region into three. In 1994, four veterinarians, eight agricultural assistants, and eight animal health assistants staffed the North region. The South region had two veterinarians, five agricultural assistants and four animal health assistants. The financial constraints of the Ministry of Agriculture, Land and Marine Resources (MALMR), worsened under structural adjustment conditions. Veterinary services and supplies were insufficient to service farms on inadequate

roads, poorly serviced by telephones and transportation facilities (MALMR Annual Report, 1990) (see Table 3e).

Table 3e. Veterinary visits made per district in Trinidad, 1994

District	Visits	Revisits	Advisory	Total visits
St. George	1390	258	716	2364
Caroni	982	254	542	1778
St. Andrew/ St. David	726	124	152	1002
Wallerfield	320	104	189	613
Carlsen Field	619	871	87	1577
Victoria	1073	344	135	1552
Nariva / Mayaro	305	100	29	434
St. Patrick	995	144	434	1573
Tobago Leeward	1695	40	NR	1753
Tobago Windward	389	25	NR	414
Total	8494	2264	2284	13042

Source: Ministry of Agriculture, Land and Marine Resources, Animal Health Subdivision. Annual Report 1994.

Trinidad and Tobago's human and veterinary health service is heavily reliant on imported drugs (Ministry of Agriculture, Land and Marine Resources, 1991). During the early stages of IMF-structural adjustment, some allopathic drugs were not available to Ministry of Agriculture staff (Ministry of Food Production and Marine Exploitation, 1990). The Ministry's 1990 report also stated that revisits were curtailed and some calls to farms were deferred to be handled when there were other calls in the area. In situations such as these there may be a case for minor diseases (some of which are recorded in Table 3b) to be treated by farmers using ethnoveterinary medicines. A comparable table for Trinidad is placed in Appendix 1 (Table 20a). Table 20b in Appendix 1 lists the most commonly reported parasites, bacteria and fungi. Epidemics and fatal endemic diseases are more appropriately treated with commercial drugs and more resources may need to be devoted to these large-scale concerns in the future.

Economic constraints of the Ministry of Agriculture, Land and Marine Resources (MALMR) in the 1990s led to a reduction in bat control and rabies vaccination, which resulted in a rabies outbreak and 79 diagnosed cases in 1997/1998. The 1998 Annual Report of the Veterinary Diagnostic Lab reports paraprofessional staff shortages, inadequate funding including for stationary and supplies and obsolete and poorly performing equipment. Plate tests for *Mycoplasma gallisepticum* and *Mycoplasma synoviae* are the only poultry serology tests available. Other problems were the discontinuation of brucellosis serology due to the cost of the reagent. A lapse in standards led to infected animals being allowed in and 302 cases of brucellosis were subsequently identified in state herds (Annual Report, 1998). Previous to this Trinidad was considered free of *Brucella abortus* (Adesiyun and Cazabon, 1996). Developing world governments like Trinidad and Tobago have not been able to successfully utilise western-style medicine and delivery systems to meet their national veterinary service needs (Mathias *et al.*, 1996). If medicinal plants can be proved effective in scientific terms, the use of these plants can conserve hard currency, reduce health care costs and contribute to livestock health (Farnsworth, 1993; IIRR, 1994).

The focus and main purpose of this study

This research stands at the interface of Beta/Gamma, where Beta stands for the Natural Sciences and Gamma for the Social Sciences. Together, Beta and Gamma sciences are becoming increasingly involved in the 'interactive design' of technology, knowledge systems, natural resource use and other forms of 'land use negotiation' (Röling, 2000). The research stands at the interface because it is not content with the pure anthropological approach of focussing on connected systems of local knowledge (Ellen, 1996a); it is also concerned with transforming local knowledge into information. The research also addresses the question of how institutions can organise to realise technological solutions based on indigenous knowledge / information for those in need of low-cost, low-tech solutions to common agricultural problems, while protecting the integrity and credibility of extension as an information source.

Traditionally, veterinarians have tried to discourage traditional medicines in favour of the modern medicine in which they were trained (Fielding, 2000; Lans, 1996; Mischel, 1959). However as was illustrated above, in financial crises 'modern' medicines are economically unrealistic to those in the low income groups, those living in remote areas and sometimes to government ministries (Niehoff, 1959; Guèye, 1999; Lans, 1996). Ethnoveterinary remedies on the other hand are often freely available, or have a cost in proportion to the value of the animal, or are already part of the culture, often work and are relatively easy to administer (Fielding, 2000). Previous research (Lans, 1996) has indicated that there are minor illness that farmers can treat with medicinal plants if it can be established that these plants are safe and effective (Table 3b). Schillhorn van Veen and de Haan (1995) predict a new era of cost effectiveness in which disease control is mandated, financed and executed by the farmer or lay personnel. Shifting minor health concerns to farmers can then free the Veterinarians to concentrate on health problems that may be getting inadequate attention and resources (Lans, 1996). The provision of and availability of a local pharmacopoeia supported by scientific data could impact positively on the health status of animals whose owners have inadequate access to or resources for the use of modern drugs (Robineau, 1991; Waller, 1993; Elisabetsky, 1991), and on the livestock industry.

Documentation and preliminary evaluation of medicinal plants is a necessary first step in establishing whether these ethnoveterinary remedies can provide affordable options for farmers' veterinary health needs. Indications that this would indeed be the case was provided in the first phase of the research when it was discovered that farmers in the 'modern' and commercially viable poultry industry were successfully using ethnoveterinary medicines to meet the health needs of the poultry sector (Lans, 1996). The first and second phases of the research were designed to codify and record collective memory of medicinal plants and thus provide a broad picture of the ethnoveterinary knowledge base of livestock farmers, pet owners and hunters in both Trinidad and Tobago. Ethnomedicinal knowledge was also recorded because there are many interconnections between ethnomedicinal and ethnoveterinary knowledge. Documenting the ethnomedicinal knowledge is an important first step in tracing the origins of the ethnoveterinary knowledge in Trinidad and Tobago. The origin of the knowledge is important in the verification process, why things are done in certain ways, and if there are any theories behind the practice.

In addition to documenting and presenting the medicinal plants used in species-specific case studies, the medicinal plants listed in this thesis are also subjected to a non-experimental validation process. Experts in ethnoveterinary medicine consider that validation

is still a weak point in the discipline (Schillhorn van Veen, 1997). This validation process is seen as a preliminary step to establish which plants should have priority in future clinical trials or research projects to be undertaken at the School of Veterinary Medicine, St. Augustine, Trinidad. It is likely that the future clinical trials will be research projects undertaken by final year veterinary students. For example a 1998 study based on Lans and Brown (1998a) investigated the effects that *Aloe vera*, Poultry Red Cell™ and Acetic acid, alone or in combinations in the drinking water, had on the productivity¹ and profitability of a broiler growout program under field conditions (Padilla, 1998). A combination of Red Cell and vinegar gave the best average productivity (European Productivity Efficiency Factor (EPEF)). However if *Aloe vera* is grown on farm and 5% Acetic acid is purchased at \$TT 0.49/ 100ml, the *Aloe vera* water treatment produces the highest gross margin. Increasing farm plant biodiversity by planting *Aloe vera* can thus lead to increased farm profitability. A recent final year research study based on one of this author's initial Ph.D. proposals examined whether orally administered doses of *Aloe vera*, *Kalanchoe pinnata* and Levamisole™ could produce immunomodulating effects in broiler chickens (Johnson and Pargass, 2001).

Written, public knowledge is revised, tested and challenged by others and is not lost to future generations, it becomes 'universalised and immortalised, oral knowledge does not (Laguerre 1987). Creolization-based technologies are not judged on the basis of their origins, only that they work in the local context. Western science has become the main means of establishing whether a technology works and how (Nelkin, 1996). Analysis requires that all knowledge claims be subjected to a minimalist standard of rationality that requires that belief be apportioned to evidence and that no assertion about folk medicine or 'theory' (even the Doctrine of Signatures) be immune from or rejected without critical assessment (Hawkesworth, 1989). The non-experimental validation of the ethnoveterinary medicines was undertaken in recognition of the fact that western science has become the bench mark criteria by which other culture's knowledges are evaluated (Watson-Verran and Turnbull, 1995). Anthropologists like Posey (1998) and Hastrup and Elsass (1990) claim that anthropologists should not decide whether indigenous beliefs and practices are or are not scientific as this has colonial overtones. Other anthropologists claim that indigenous knowledge systems represent the cultural dimension of development and cannot be reduced to the empirical knowledge that they contain (Warren, Slikkerveer and Brokensha, 1995)². These anthropological reservations have some value, however validation of ethnoveterinary medicines is important since local veterinarians, including those at the School of Veterinary Medicine will not use local medicines without some form of validation. For example during the second research phase one unbiased veterinarian decided to research the effect of Neem (*Azadirachta indica*) on ticks, because the insecticidal properties of Neem were already published. An equivalent local plant (*Cordia curassavica*) existed, and its use to control ectoparasites had been published by a colleague (Lans and Brown, 1998a&b). However in contrast to Neem, little previous research work had been done on the insecticidal properties of *Cordia curassavica*.

¹ Enhanced flock performance in terms of decreased mortality and morbidity (Padilla, 1998).

² These viewpoints are examined in more detail in Chapter 3.

The evaluation of the ethno[veterinary] medicinal plants was conducted using a non-experimental method (Browner *et al.*, 1988; Heinrich *et al.*, 1992; Table 6), which consisted of:

1. botanical identification
2. reframing the folk medicinal data in terms of bioscientific concepts and methods
3. searching the chemical / pharmaceutical literature for the plant's known chemical constituents
4. searching the pharmacological literature to determine the known physiological effects of either the plant, related species, or isolated chemical compounds that the plant is known to contain; and
5. assessing whether the plant use is based on empirically verifiable principles; or, whether symbolic aspects of healing are of greater relevance (Heinrich *et al.*, 1992; Browner *et al.*, 1988).

The evidence gathered and the critical reflection / validation process which occurred during the documentation and preliminary validation of the medicinal plants will provide a 'developed, tested and critically-examined rationale' for locally used ethnomedicines and ethnoveterinary medicines (Hatten *et al.*, 2000).

Research objectives and Research questions

The objective of this thesis is to document ethno[veterinary] medicinal knowledge in Trinidad and Tobago and to explore whether it can usefully complement formal veterinary and medicinal knowledge; and if so, how ?

The main research questions

- Which practices can be identified as ethnoveterinary practices in Trinidad and Tobago and is ethnoveterinary medicine a separate field from human folk medicine ?
- How are ethnoveterinary medicinal practices being used for livestock, sport animals and pets ? And what kind of socio-cultural environment does this folk knowledge exist in ?
- Are the ethnoveterinary practices based on culture, religion, or on the indigenous knowledge of different subsets of the population ? Can these practices be traced to the original continents of Trinidad and Tobago's current population ?
- Are there positive things to say about this Creole legacy and does this folk medicinal knowledge fit a theory of [ethnomedicinal] agrarian creolization ?
- Are the folk/ethnoveterinary medicinal practices derived from a body of knowledge that is ancient, coherent and global in nature ? Do the different traditional medical systems that exist in Caribbean folk medicine share a common explanatory model ?
- Does the ethnomedical literature support the claimed uses of the medicinal plants?

In the thesis there will be no radical dis-identification with conventional biomedicine (Scheper-Hughes, 1990), and no 'flight from reason after the death of God' (Latour, 1998), but an attempt to create the necessary space for the folk medicinal paradigm to co-exist with western medicine. A framework of indigenous / ethnoveterinary knowledge that can interface with science and technology is more likely to influence scientific research agendas and development work (Sillitoe, 1998). This research will contribute to a systematic and comparative understanding of different ways of conceiving and treating human and veterinary medical problems which will add useful data to medicinal and pharmaceutical science (Tarbes, 1989). A methodology for the systematic cross-cultural study of traditional

medical systems and their diagnostic and therapeutic efficiency could provide an important contribution to the medical anthropological literature (Tarbes, 1989).

Traditional medicine is a health care system and both the botanical and cultural aspects of this system need to be studied (Croom, 1983). A holistic approach is necessary to properly document ethnoveterinary practices due to the strong influence that religion and culture and the environment have on this oral knowledge (Mintz, 1983; Ingold, 1996; Rappaport, 1993). A holistic approach will ensure that future scientific validation is not wasted on plants that are used only as cultural artefacts (Elisabetsky and de Moraes, 1990; Eigner and Scholz, 1999). This is important not only because of the waste of time, money and energy, but because negative results can lead to the discrediting of further effort (Eigner and Scholz, 1999). Weniger (1991) claims that drawing parallels between ethnomedical systems and the biochemical system is difficult because sickness and health are not only biological states, but also social, cultural and psychological phenomena. The so-called objective sciences - chemistry and pharmacology - are therefore not the only valid parameters to evaluate ethnomedicines (Weniger, 1991).

Documentation of both the ethnoscientific empirical material, and also the non-empirical dimension of this knowledge is necessary since the local symbolic system is an integral part of traditional knowledge (Giarelli, 1996). Knowing is a practical, embodied, situated activity, constituted by a past, but reconstituted and changing in current use of the practices (Escobar, 1999). Decontextualised models alter the relationship between person and environment by subordinating or obscuring the local details which generate meanings (Hornborg, 1996). It is in this context that Etkin (1993) cautions that cultural connotations and preparatory details need to be considered in the assessment of the 'efficacy' of medicinal plants. For instance how the knowledge of phytochemical potential translates to the circumstances of actual plant use during illness (Etkin, 1993). If culture influences the use of the plant-based medicine this is not sufficient reason to dismiss the use as 'non-scientific' since medico-religious or magical understandings of disease aetiology can at times lead to effective therapeutic or management action. For practical scientific reasons, therefore supernaturally motivated practices cannot truly be separated from other aspects of ethno[veterinary] medicine (McCorkle and Mathias-Mundy, 1992). This last point will be elaborated on in subsequent chapters.

Medical Anthropological research recognises that illness and healing are lived events (Scheper-Hughes, 1990). All popular clinical discourse³, western or non-western, utilises familiar and tangible referents, either through personalisation (e.g. obeah) or naturalisation (interaction of natural elements) (Littlewood, 1988; Tan, 1989). An anthropological study needs to deal with (non) biological forms of healing in terms of their own meaning-centred and emic⁴ frames of reference (Scheper-Hughes, 1990). Baer (1996, 1997) sets out four premises for a Critical Medical Anthropology. First, the recognition that local events can be influenced by external forces. Second, a holistic understanding of sickness and an examination of the power relationships that exist in medicine. Third, the realisation that all theories have a cultural basis, including the anthropological theories of sickness and healing. Fourth, the acceptance of research and theorising as social acts, that can be made into ethical acts. An analytical framework combining the emic perspective of ethnomedicine with

³ Discourses are historically, socially, and institutionally specific structures of statements, terms, categories, and beliefs or bodies of knowledge. As texts, they assert truths and claims for authority and legitimisation (Anonymous, 1999).

⁴ Emic - categories which are drawn from the way local people perceive things (Martin, 1995).

the etic⁵ measures of bioscience can generate new interpretations for cross-cultural, comparative studies of ethnomedicine (Browner *et al.*, 1988). The research fits into the framework of applied anthropology, which is a complex of related, research-based, instrumental methods which produce change or stability in specific cultural systems through the provision of data, initiation of direct action and/or the formation of policy (Peterson, 1988). Applied anthropology has been described as a process rather than a field (Warry, 1992). In this process the relevant stages are discovery/planning, intervention and evaluation. A dialectical relationship exists between theory and praxis in applied anthropology since applied anthropology seeks to use the insights offered by ethnography as a basis for intervention and planned change, advocacy and information dissemination as well as theory development (Johannsen, 1992; Giarelli, 1996; Rappaport, 1993).

Fieldwork was conducted from September 1996 to September 2000. Semi-structured interviews and participant observation were used to collect the data. The approach was partly anthropological using the definition of anthropology as a specialism of non-specialism (Rappaport and Overing, 2000). Research methodologies based on knowledge-based action provided the framework used to collect the ethnoveterinary and ethnomedicinal data. These are non-traditional methodologies. This type of research can lead to stronger linkages between organisations and research centres and to organisational knowledge development and improvement (Nereu *et al.*, 1997).

An overview of the book's contents and the structure of the book

The structure of this book consists of Parts 1, 2 and 3. An introductory chapter gives the overview and background. Chapter 2 gives details on agriculture in Trinidad and Tobago with a focus on livestock and poultry production. Part 1 consists of Chapters 3, 4 and 5. Chapter 3 outlines the methodological approach taken. The approach compares 'hard' and 'soft' science, and gives a brief overview of social constructivism and knowledge-based action. Chapter 4 examines the concepts and theories embedded in folk medicine and the origins of the folk medicine in the Caribbean. Chapter 5 provides details on the methods used to collect the data. Part 2 consists of nine case studies. Chapter 6 outlines the folk medicinal terms used and includes case study 1 on pigs. Chapter 7 includes case study 2 on commercial poultry and case study 3 on game cocks. Chapter 8 contains case study 4 on ruminants and case study 5 on reproductive health. Chapter 9 includes case study 6 on pet dogs and case study 7 on hunting dogs. Chapter 10 comprises case study 8 on horses. Chapter 11 contains case study 9 on [human] ethnomedicine.

Part 3 contains the synthesis and conclusions. Chapter 12 looks at the actor networks involved in science and folk medicine, pointing out some of the processes by which knowledge is accepted into or excluded from science. Chapter 13 outlines the published Caribbean medicinal plant research and the attempts by various actors to incorporate herbal medicine into primary health care in the Caribbean. Chapter 14 examines the cultural factors that shape ethnomedicinal creolization. Chapter 15 contains the conclusions.

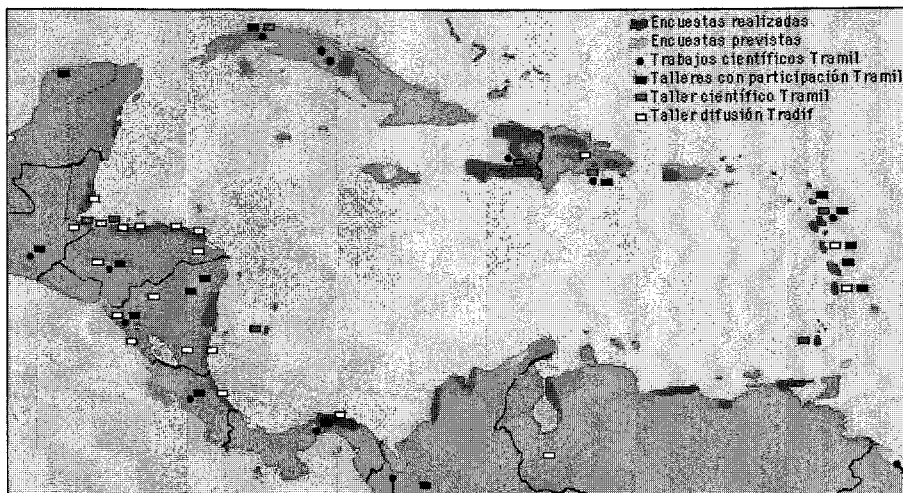
⁵ Etic - categories taken from the way the researcher perceives and classifies the world (Martin, 1995).

Agriculture in Trinidad and Tobago

Ontology concerns the kind of world we imagine that we are dealing with before we go out to explore it. For example what sort of people are we dealing with ? What sort of societies ? How does social change take place ? (Bevan, 2000).

2. Agriculture in Trinidad and Tobago

Trinidad and Tobago is one country consisting of two adjacent islands located just northeast of the Venezuelan coast. Trinidad was first a Spanish, then a British colony. Both islands became independent of Britain in 1962 and attained the status of a republic in 1976. The republic is located between latitudes 10 ° and 11 ° north and spans longitude 61 ° west. The republic has a combined area of 5070 km². Geologically, Trinidad is an outlier of the South American continent. It lies 18 km north-east of Venezuela, and has an area of 4769 km². Tobago lies 35 km north of Trinidad and has an area of 301 km². The wet season lasts from June to December. The human population of 1.25 million is multi-ethnic, religious and cultural. The population increases at 1% annually. In Trinidad, the major population centres are concentrated along the west coast and along an east-west transportation corridor in the north of the island. Map 1 (used with the permission of Enda-Caribe) shows the Caribbean proper and those countries with population groups originally from the Caribbean.



Map 1. The Caribbean

During the 1700s, Trinidad belonged as an island province to the vice royalty of New Spain along with modern Mexico and Central America (Besson, 2000). The Dutch and the Courlanders had established themselves in Tobago in the 16th and 17th centuries and produced tobacco and cotton. However Trinidad in this period was still mostly forest, populated by a few Spaniards with their handful of slaves and a few thousand Amerindians (Besson, 2000). Spanish colonisation in Trinidad remained tenuous. In 1762, after three hundred years of Spanish rule San José de Oruña (St. Joseph) and Puerto España (Port of Spain) were hamlets rather than towns. Because Trinidad was considered underpopulated, Roume de St. Laurent, a Frenchman living in Grenada, was able to obtain a Cédula de Población from the Spanish King Charles III on the 4th November, 1783. This Cédula de Población was more generous than the first of 1776 and granted free lands to Roman Catholic foreign settlers and their slaves in Trinidad willing to swear allegiance to the Spanish king. The land grant was thirty two acres for each man, woman and child and half of that for each slave brought. As a result, Scots, Irish, German, Italian and English families arrived. The Protestants among them profited from Governor Don José Maria Chacon's generous interpretation of the law. The French Revolution (1789) also had an impact on Trinidad's culture since it resulted in the emigration of Martiniquan planters and their slaves to Trinidad who established an agriculture-based economy (sugar and cocoa) for the island (Besson, 2000).

The population of Puerto de España (Port of Spain) increased from under 3,000 to 10,422 in five years and the inhabitants in 1797 consisted of mixed-races, Spaniards, Africans, French republican soldiers, retired pirates and French nobility (Besson, 2000). The total population of Trinidad in 1797 was 18,627; 2,500 of which were "white", 5,000 were "free blacks and people of colour", 10,000 were slaves and 1,082 Amerindians. In 1797, General Sir Ralph Abercromby and his squadron sailed through the Bocas and anchored off the coast of Chaguaramas. The Spanish Governor Chacon decided to capitulate without fighting. Trinidad became a British crown colony, with a French-speaking population and Spanish laws (Besson, 2000). The conquest and formal ceding of Trinidad in 1802 led to an influx of settlers from England or the British colonies of the Eastern Caribbean.

After the abolition of slavery and the collapse of the French planters' cane economy, the 'French Creole' planters and the peasant population of mixed Spanish-Amerindians turned to cocoa cultivation. By the 1950s cocoa had become a staple in Trinidad's export market and was responsible for a growing middle-class. Early Caribbean settlers helped tie the Caribbean into international markets as suppliers of sugar cane, spices, bananas and arrowroot. These crops have not provided sustainable incomes to small scale growers, and have resulted in environmental degradation.

The history of sugar cane and cocoa meant that livestock production was always marginalised. This is clearly seen in the figures presented by the Minister of Agriculture in the 1999 Budget Speech. The export earnings for agriculture were TT\$553.0 million, which represented 24% of non-oil exports and 8.1% of total exports. The contribution of sugar to this figure was \$217 million or 38.3%, fruit and vegetables contributed 9.6% or \$52.9 million, fish and fish preparations contributed \$41.1 million or 7.4% and cocoa and coffee contributed \$38.1 million or 6.9%. The contribution of livestock was not reported. The only initiatives reported for livestock in this budget were the establishment of a Livestock and Livestock Producers Board comprised of stakeholders to assist in the promotion and

development of the sub-sector, and a new subsidy of TT\$2000.00 for pasture establishment. There were also subsidies for tractors.

Trinidad and Tobago is heavily dependent on imported food because of the historical legacy of sugar monoculture. At the small farm level, a wide variety of fruits, vegetables, root crops, legumes and livestock were produced for subsistence and/or sale on the local market. However plantation owners were reluctant to diversify from sugar and thus lose the social and political privileges that were linked to sugar monoculture (Pemberton, 1990). They firmly believed it was more sound economically speaking to export sugar and import everything else. According to Bennett (1986) 'forty years ago it was the general consensus of opinion among the plantocracy of Trinidad, that any poultry or livestock project would be doomed to failure, due to our tropical environment, in particular the wet and humid season, which created a haven for internal parasites. In addition to the fact that our grasses were not nutritious enough and that no cereal grains were grown in the tropics to provide concentrate feed supplements'.

These attitudes are the basis for the current marginality of the livestock sector. The agriculture sector is also weak because historically peasant farmers were considered poor credit risks by the Canadian, American and British interests that controlled the banking system until the mid-1960s. This attitude towards small farmers was reinforced by the colonial education system which taught disdain for manual labour in general and agriculture in particular. In addition, because farming is still associated with slavery, it has never been, and is still not, a first-choice occupation for the ex-slaves and their descendants. To this day it is still considered something 'to escape from'.

Of those involved in agriculture in 1990, squatters were approximated at 25,000, and legal landholders at 35-40,000, 79% of the farming population was over 40 years old, of which 56% was over 50, and only 2% were less than 25. Pemberton (1990) traces the downward trend in agricultural employment from 23.4% in 1970 to 9.4% in 1986. Centralised government employment and the high wage industrial sector has escalated the exodus from agriculture (McElroy and de Albuquerque, 1990). Wages in construction were generally high relative to that in agriculture. The Public Works program (a form of social support for low income workers) was characterised by higher wages and also by the fact that the number of hours worked per day was negligible in contrast to agriculture which involved long hours with higher risks and smaller financial returns (Harrison, 1994).

In the 1960s the Government attempted to restructure the agriculture sector, and to break the dichotomy between plantation and small scale farming by the implementation of the State Lands Development Project (Pemberton, 1990). In this project five-acre plots with the infrastructure for beef, dairy or pig production were leased out to farmers. The Agricultural Development Bank (ADB) gave credit to farmers, based on this project and on private farmer initiatives, but this credit was often given for political rather than economic reasons. The negative impact of this 'political credit' has contributed to the poor performance of the agriculture sector. Government also subsidised fertilisers and animal feeds to encourage farming. One veterinarian-farmer's view of this procedure and on Trinidad and Tobago's livestock policy in general is given in Box 1.

Box 1. The livestock industry in the 1980s - 1990s according to Dr. Steve Bennett.

Panel discussion 93.04.22. Speaker: Dr. Steve Bennett.

I don't know if I'm here to contribute, I'm here to learn because I am at a terrible loss. I stand before you a bitter man, a bitter farmer. I have spent 30 years in farming and in 18 months I am at the verge of financial bankruptcy. It has all been due to mismanagement through Government, through greed, through lack of consideration from the meat importers who want everything for themselves with no effort to try to stimulate local farming. The hardest place to hit a man is in his pocket. The oil boom has been a tragedy for farmers. We were poultry farmers and hatching eggs, baby chicks, feed and processing were all subsidised. In truth and in fact they subsidised inefficiency. They made everybody a poultry farmer, because once you were a poultry farmer, you could make out no matter how you did. If your mortality went up you had a subsidy coming in. Today we are making almost as much on a chicken as we did when it was subsidised. Instead of the mortality being 14% it is down to less than 5 %. The conversion instead of being 3 lbs. of feed to 1 lb. of bird is now 2.1 to 1. We have become more efficient, more realistic about what we can do. But the buyers hold meetings and tell us they are prepared to buy our animals if we cut it up like America, put it in packages and sell it to them in the same way. We are in the infancy of the livestock industry. We are just creeping, we haven't got off our knees yet. The United States and other countries have been in the industry for years, give us a chance, make an opening for us. It is up to you Trinidadians, it is up to you meat importers, to you Government men that are giving out lavish import permits to bring meat in from Ireland, which you can land at \$3.00/lb. That's meat that is subsidised by the European Common Market. The amazing thing is that it is not the agricultural ministry that is giving these permits, they are the ones that know what is going on, they have an extension team, it is the Ministry of Industry and Commerce.

When you have sincerity of purpose, you put your sweat and your guts and your work into it, and people sit in their air-conditioned offices and slam their doors in your face it is not good enough. We cannot go on this way. We have a pig industry, we have shown you that we can raise pigs. Yet one importer gets a license to import 1.2 million kg and then he tells you that your pigs are too fat, the market is bad and he cannot take your pigs again. The price of pigs on my place dropped from \$130.00 to \$66.00. Anything that I couldn't sell off the sow I drowned, because if I reared it and fed it any more I would lose more money. I have the Agricultural Development Bank down my throat, I have the banks I deal with down my throat, something I never knew in my life before. All for what reason, for going into agriculture, for going into livestock. Our structure is all wrong. Government does not care at all about agriculture, far less livestock. They allow cheap meat to come in because you are buying cheap protein. Folks I cannot tell you about marketing, I have to ask for help.

In the post-World War II era of 'progress by unlimited growth', 'industrialisation by invitation' was seen as the way to 'develop' the Caribbean. Western corporations set-up 'screwdriver' assembly industries and light manufacturing plants when local Governments promised them cheap labour, tax holidays and tax laws on profit remittances. The emphasis given to import substitution in manufacturing led to shoddy manufactured goods and worsened the agricultural terms of trade. Both consumption and intermediate goods were obtained by the agricultural sector at inflated prices, and this raised costs of agricultural production and affected competitiveness. These factors were compounded by a formerly over-valued currency (Bishnodat, 1988).

Oil is the major source of export earnings in Trinidad and Tobago, as high as 90% for some years of the boom of 1974-81 (Harrison, 1994). The share of petroleum in the total output at current market prices moved from 25% of GDP (Gross Domestic Product) (1966-73) to 40.5% (1974-87) and 24.5% in 1988-90 (U.S. Department of Commerce, Bureau of Economic Analysis, 1999). Also important are the petroleum-based industries (natural gas, fertilisers, methanol, iron and steel). A dramatic increase in domestic consumption contributed to overvaluation of the currency with a resulting decline in non-oil exports and in the non-oil sectors of the economy such as agriculture (U.S. Department of Commerce, Bureau of Economic Analysis, 1999).

In 1988, agriculture was considered the second largest industry providing 2% of the country's foreign exchange earnings and occupying a third of the cultivated land. However, the sugar-producing State enterprise CARONI accounted for most of this. Agriculture's contribution to GDP moved from 6.6% in 1966-73 to 3.7% in 1988-90. The contribution of sugar to agricultural GDP in 1998 was 44% (1999 MALMR Budget Speech).

Trinidad and Tobago used the high oil prices in the 1970s to expand public sector employment and to develop its economic and social infrastructure, including the natural gas sector. The fall in the price of oil in the mid-1980s made these strategies unsustainable; the economy retracted and was pushed into structural reform by the IMF and World Bank. Between 1983 and 1993, per capita income fell by four percent per year, unemployment soared, and there was a significant migration of relatively skilled labour (U.S. Department of Commerce, Bureau of Economic Analysis, 1999). A severe recession ensued until 1994. Since 1994, the economy has stabilised and grown at an average rate of three percent a year, mostly as a result of high foreign investment in natural gas-related industries and growth in the services sector. Fiscal and monetary management since the mid-1990s has been dictated by structural adjustment policies. Inflation has been kept low, unemployment has been gradually reduced, and social indicators are improving. However poverty remains at 21 percent of the population and is associated with unemployment (including underemployment) of 17 percent (<http://Worldbank.org/external/lac>). The capital-intensive energy sector and the narrow economic base continues to curtail job creation (Tables 4a&b).

Table 4a. Key Economic Indicators

Income, Production and Employment	1996	1997	1998
Nominal GDP	5,449	5,878	6,420
Real GDP Growth (pct)	3.8	3.2	5.0
GDP by Sector : Agriculture	114	123	123
GDP by Sector : Manufacturing	447	493	595
GDP by Sector : Services	2,794	3,068	3,449
GDP by Sector : Petroleum	1,451	1,627	1636
GDP by Sector : Government	541	472	516
Per Capita GDP (US\$)	4,288	4,614	5,005
Labour Force (000s)	530	541	554
Unemployment Rate (pct)	16.2	14.5	13.8
Money Supply Growth (M2) 2/	-0.8	5.8	6.1
Consumer Price Inflation	3.3	3.8	5.0
Exchange Rate (TT\$/US\$)	6.03	6.29	6.29
Total Exports FOB	2,490	2,542	2,319
Exports to U.S.	1,094	998	853
Total Imports CIF	2,134	3,036	3,003
Imports from U.S.	800	1,563	1,393
Trade Balance	341	-494	-684
Balance with U.S.	294	-565	-540
External Public Debt (September 1998)	1,858	1,541	1,420
Fiscal Deficit/GDP (pct)	-0.01	0.1	-1.3
Current Account Deficit/GDP (pct)	10.2	-9.9	-10.6
Debt Service Payments/GDP (pct)	6.0	8.0	4.6
Gold and Foreign Exchange Reserves	545	706	827

(Millions of U.S. Dollars unless otherwise noted)

Source: Central Statistical Office (CSO), BOP figures are compiled by the Central Bank.

Table 4b. Petroleum / Natural Gas Sector in the Latin American / Caribbean region (1997)

	Value Added (% of GDP in current prices)	% of Merchandise Exports	% Central Government Revenues
Ecuador	14.0	29.6	43.8
Mexico	8.0	10.0	38.0
Peru	10.5	5.5	8.1
Trinidad & Tobago	23.0	55.0	21.0
Venezuela (1996)	26.6	76.9	60.0

Source: [http:// World bank.org/externa./lac/lac](http://Worldbank.org/externa/lac/lac).

The public sector still accounts for 25% of employment compared to a combined employment of 20% in agriculture, mining, and manufacturing. In June 1998 employment in agriculture was 42,300 (1999 MALMR Budget Speech). Since 1992, government has

followed IMF/World Bank mandates and partially or fully privatised the majority of state-owned companies and dismantled most trade barriers. In April 1993 the government removed exchange controls and floated the TT Dollar (U.S. Department of Commerce, Bureau of Economic Analysis). Trinidad and Tobago is highly import-dependent, with the United States supplying about 51.5 percent of total imports in 1997 (U.S. Department of Commerce, Bureau of Economic Analysis). The food import bill from January to June 1997 was \$743.5 million and \$720 million for the same period in 1998 (1999 MALMR Budget Speech).

There are 512,000 ha. of arable land (Dindial, 1991). There has also been a loss of agricultural land to more profitable and speculative uses like the construction of large-scale tourist resorts and tourism-related infrastructure (McElroy and de Albuquerque, 1990). Modernisation, industrialisation, and tourism have failed to stimulate agricultural productivity. The positive links between tourism and local farming have been largely unrealised. On the contrary, there have been rising food imports, declining fish and farming activity and a decline in agriculture's contribution to GDP between 1960 and 1980. From 1985 to 1989, the average annual contribution of domestic agriculture, excluding sugar, to the GDP increased from 1.5 - 2.1%. In the period 1988 to 1996 Trinidad and Tobago had the smallest variability in agriculture (2.5%) as a percentage of GDP in Latin America and the Caribbean (Tavernier, 1999). This means that there was very little variation in agriculture's contribution to the rate of growth. The sector contributed \$480.5 million (1985 constant prices) or \$776.3 million in current prices to GDP from January to June 1998 (1999 MALMR Budget Speech).

The modernisation of the sector (Agricultural Sector Reform Programme (ASRP)) is being funded by a loan from the Inter-American Development Bank (IADB). A special section in the Policy and Planning Department called the Programme Co-ordinating Unit (PCU) is responsible for the implementation. In the short term, the IADB-funded program is expected to generate foreign exchange through increased exports and more rational land utilisation, and it will foster economic diversification and increased sectoral employment. The US \$65 million loan has been tied to a series of reforms (IADB, 1995). The components of the reform program include trade and price policy, land use policy and administration, restructuring and divestment of state-owned enterprises like CARONI and public policy reform to improve agricultural support services and sector policy, programming, and budget functions. There is also a complementary IADB loan of US \$9 million to finance technical co-operation / private sector participation. The program also includes assistance to rural communities to mitigate the social and environmental effects of the adjustment.

Livestock Production

In Trinidad and Tobago farmers generally have less than six acres of land and 25% are landless. There are some feedlot systems but more commonly farmers tether or graze animals on the roadside verges, communal pastures, family land, or unused land. A number of farmers cut fodder on the roadside verges or [in Tobago] collect it after the authorities have cut the verges. The domestic market in Trinidad and Tobago is limited, agriculture is low-input, and marketable surplus is small. Most farmers are part-time and input costs in Tobago are higher due to shipping costs from Trinidad. There are also transport costs to ship goods from Tobago to Trinidad. Farmers are a very diverse group who move in and out of farming. Some farmers have no real 'farms', but they have animals on houselots. Poultry and pigs are usually raised in intensive modern systems. There are some large and small

ruminant feedlot systems, on deep litter and on slatted floors, but by and large, ruminants are still traditionally raised as a low-input, low operating cost investment. Small ruminant farmers in the Caribbean are not solely profit-maximisers (Evans and Ganteaume-Farrell, 1993). These farmers keep sheep for social security reasons since they have high reproductive rates and lower economic risk of loss and are readily converted into cash (Craig and Lans, 1993). The niche market for fresh, local meat is very small, since the average householder and their political representatives are interested in cheap imported food (see Box 1). Livestock are traditionally sold on an ad-hoc basis to hucksters, but that pricing is random and sometimes bears no relevance to the weight nor quality of the animal. Sometimes animals are sold for "next-to-nothing" if the farmer is in desperate need for cash. Farmers sometimes accept orders for festive occasions like the Muslim festival of Eid. This market is unsteady and small (Craig and Lans, 1993).

The livestock industry contributes approximately 0.1% or \$18.6 million to GDP (Evans and Ganteaume-Farrell, 1993). Trinidad and Tobago is considered to be 100% self-sufficient with respect to pigs, poultry meat and eggs. For milk, beef and veal, and mutton, the levels of self-sufficiency reported are 17, 25 and 20%, respectively (Evans and Ganteaume-Farrell, 1993). The islands are estimated to have 37,000 cattle, 74,000 pigs, 36,000 small ruminants and 18 million poultry (Dindial, 1991). Poultry farming is one of two productive, intensive and efficient forms of meat production in Trinidad and Tobago (Ministry of Food Production and Marine Exploitation, 1989). Government subsidies have been removed, and most of the inputs for poultry production (hatching eggs, feed ingredients, equipment and drugs) are imported. In 1991 the population of broilers was 17.5 million birds, broiler breeders 270,000 birds and layers 375,000 birds (Dindial, 1991). Poultry production increased by 10% in 1998 but typically fluctuates to match consumption.

Ninety-percent of dairy farms have less than 25 head of cattle. The estimated annual milk production is 16.9 million kg of fresh milk of which 10.2 million kgs are processed by Nestlé (Trinidad Guardian 16th October 1997, pg. 5). The domestic market size is estimated at 110 m kg. The Trinidad and Tobago Holstein Breeders Association and Dairy Farmers Association represent 569 dairy farmers who supply fresh milk to Nestlé at \$2.55 / kg (Trinidad Guardian 16th October 1997, pg. 5). The Government milk subsidy was \$1.00 / kg, and Nestlé's contribution is \$1.55. This price is a 25% increase instituted on September 29, 1997 from \$2.00. The previous Government subsidy of \$0.90 was established in 1972. Nestlé has milk collection centres at Orange Field, Las Lomas, Turure and Wallerfield (Trinidad Guardian 16th October 1997, pg. 5). Milk production increased by 5% in 1998.

In 1986 there were 16,300 head of cattle (beef and water buffalo) and an estimated 1,593 beef cattle farms and 984 water buffalo farms. Eighty percent of these were under 25 head. Beef production in 1983 was 1.4 million kg and declined to 1.21 million kg in 1996 (Trinidad Guardian 16th October 1997, pg. 5). Local production of sheep and goats was 0.60 million kgs in 1996. Under the current trade regime, small-scale production of sheep is unprofitable (Evans and Ganteaume-Farrell, 1993), although the ruminant sub-sector has been targeted by the government of Trinidad and Tobago as an essential component of a revitalised agricultural sector (Evans, 1992). Rabbit production is confined to a few established rabbitries and some backyard operations (Dindial, 1991). The population is estimated at less than 3,000 and there is limited demand for the meat. Pig production is dealt with in the case study on pigs in Chapter 6.

Part 1: Background, Perspectives and Methodology

Contriving my own fable, as I grow stiff and uncited, before the necrologists get at me
(Geertz, C. 2000, cited by Nigel Rapport, 2001).

Soft science, hard science, mirror images

Theory is certainly not to be treated as sacrosanct and enshrined in 'texts' to be endlessly pored over like chicken entrails (Stanley and Wise, 1990)

3. Soft science, hard science, mirror images

Methodology

Methodology provides both theory and analysis of the research process while Epistemology is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate (Maynard, 1994). Epistemology includes questions about what is defined as knowledge, and under what circumstances, what differentiates knowledge from beliefs, who is seen as a legitimate knower and how competing knowledge claims are adjudicated (Maynard, 1994). Epistemology is important because the way that research questions are framed shapes the questions that can be asked and provides clues and directions as to where answers can be sought (Ferguson, 1997). Different ways of knowing can be categorised into four characteristics: epistemology, transmission, innovation and power (Röling, 1988; Marglin, 1990c).

Soft science

As an interdisciplinary discipline anthropology has sometimes claimed an 'intellectual poaching licence and an amateurish use of all manner of information which enables the examination of complex systems' (Rapport and Overing, 2000). Applied anthropology typically means analyses of particular human problems, situations, or processes for the purposes of understanding their causes, dynamics, and consequences; and, in some instances, for developing courses of action designed to influence those situations or processes so that they are brought into agreement with [the researcher's] goals or values (Rapport, 1993). Sillitoe (1998) considers that harnessing anthropology to technical knowledge in order to facilitate development will put the discipline at the centre of the development process before others "steal Anthropology's disciplinary clothes" (Ferradás 1998).

In the past anthropologists have tended to select research projects that could at worst do little harm and that might occasionally serve some good purpose (Kielstra, 1979). These researchers tried to exercise as little influence as possible on the social phenomena they studied and left the active intervention in the situation to other agencies (Kielstra, 1979). Positivistic approaches in anthropology are based on three deeply embedded views of its objectives: 1. Knowledge accumulation is an end in itself, 2. Studies are preferably done on tribal and peasant societies to which anthropologists have easy access. These more or less autonomous, traditional communities do not change while contemporary society, which does change, is a less suitable subject of study. Unchanging societies provide the theoretical basis for the evolutionist, diffusionist or functionalist anthropologists who assume the existence of more or less closed and finite social systems in order to demonstrate their

theories of social equilibrium (Kielstra, 1979), 3. Long-term studies are preferable to short-term analyses of cultural systems (Kielstra, 1979; Weaver, 1985; Shore and Wright, 1996).

While still existing, these traditional attitudes have been joined by the more contemporary views of Posey (1998) and Hastrup and Elsass (1990) who do not support the idea that the anthropologist should use his/ her knowledge for a particular cause by deciding for example whether indigenous beliefs and practices are or are not scientific as this would be a modified form of colonialism. Some anthropologists also claim that local knowledge should not be treated as a marketable category and encoded in Intellectual Property Rights regimes since that would reinforce Cartesian dualisms (Pálsson, 1996; Posey, 1998). If indigenous knowledge systems represent the cultural dimension of development (Warren, Slikerveer and Brokensha, 1995), these anthropologists say, then they cannot be reduced to the empirical knowledge that they contain. If a culture is a system as some anthropologists maintain, then when a cultural item is removed this removal disrupts the set of relationships into which it is locked, and the cultural item cannot be imported into another culture without bringing with it some of the trappings of those former relationships and disturbing its new surroundings, therefore cultural change is problematic (Milton, 1996). While macro issues such as communication across cultural boundaries have been happening for millennia, this continues to befuddle the culture/system anthropologists who wonder how such a thing is possible (Milton, 1996).

There are constraints to taking a critical approach in anthropology, for example some clinical anthropologists are asked to function solely as cultural interpreters and their critiques of health care arrangements and their political-economic environments are not welcomed (Baer, 1993). Nereu *et al.* (1997) state that society is the victim of the distancing of science from social change since research outcomes often end up forgotten on some dusty shelf without any practical application other than support for further theoretical research.

Hard science

Western science has often been used as the standard by which other knowledges should be evaluated (Watson-Verran and Turnbull, 1995). Combatants over socially controversial issues enlist scientific experts to support their causes resulting in science serving conflicting agendas (Nelkin, 1996). Science is frequently portrayed as being of unequivocal social benefit, which if properly funded (and given unrestricted freedom to conduct curiosity-driven research unencumbered by excessive public or government control) would eventually solve all problems (Middendorf and Busch, 1997; Rotblat, 1999).

The failure of centrally planned systems and their scientific products is often cited as a justification for the continuation of a production and profit based approach to agricultural research (Zimdahl, 1998). Positivistic scientists assume that there is a radical separation between science and politics, and science and society. The scientific 'citadel' is a 'culture of no culture' (Franklin, 1995). Science need not be done in the public interest nor should democratic principles guide science, since the lay public would bring un-informed subjectivity (values, beliefs, attitudes and politics) to the scientific decision making process (Middendorf and Busch, 1997). These 'subjectivities' are labelled as 'externalities' to science that have little bearing on the practice of science and are seldom integrated into decision making (Zimdahl, 1998). The scientists' only obligation is to operate from within the existing paradigm and make the research results known to the public (Rotblat, 1999). The increasing

corporate involvement and funding of science is not seen as involvement in politics and the external society but as a way of conducting research in the public's interest which is conveniently funded by the commercial organisation (Zimdahl, 1998).

When research is funded by corporate entities to serve their short-term needs only one set of production-related questions are asked and only one type of research (technological tinkering at the margin of science) is conducted (Zimdahl, 1998). Since externalities are excluded and evidence that dominant paradigms are flawed is treated as an externality for long periods; science proceeds along non-neutral paths determined by the short-term production goals. Every new technological step gives rise to new steps and new directions and closes off others (Zimdahl, 1998). Information that can be quantified assumes importance beyond its true value while the alternative approaches are shelved and the hypotheses that are not recognised drop out of sight. According to Dolby (1979) if a problem is not resolvable by immediate empirical test most scientists abandon the issue as non-science. Science is then only what can be derived by the rules of logic (Marglin, 1990c; 234). Editors in the top science journals are full-time professionals who are very sensitive to the latest scientific trends and very cautious about publishing new work where the level of rigour cannot be as high as work in familiar territory (Lawrence, 1999).

There are other reasons why alternative theories find it hard to maintain themselves in a world of 'normal science'. Scientists' reputations hinge on the validity of their research conclusions (Ikerd, 1993; Paigen, 1982). To ignore the existence of something real means a scientist fails to make a discovery -disappointing but not harmful to the reputation, so scientists are more willing to do this than take conclusion risks. What counts for the scientist is replication and comparison, but controlled-experiments are 'out of time' (Richards, 1989). Farmers' sequential performances are always 'in time' and embedded within their particular context. What counts for the farmer is fitting available resources to changing circumstances so that they make it through the season (Richards, 1989). Farmers take decision risks, the risks of wrong choices among alternatives (Ikerd, 1993). The scientists' risk is often smaller than the farmers' risk of a wrong decision based on the scientists' conclusion.

Scientific knowledge bases its claim to superiority on the basis of universal validity while local knowledge is assumed to be bound by time and space (Raedeke and Rikoon, 1997). Some ecological science has been recognised as 'local' and situational so that what is learned about one population or one conservation strategy in one place at one time is not readily transferable (Hinrichsen, 2000). While Elisabetsky and de Moraes (1990) caution that culturally specific practices are not universally applicable, Kloppenburg (1991) calls local knowledge 'mutable immobiles', with little utility outside of particular places. It is then the role of scientific disciplines like Agroforestry to identify which aspects can be translated and adapted to fit into other situations. However before the advance of science ordinary people were responsible for carrying local knowledge to new regions, where, if relevant, it was quickly adopted (McClure, 1982). Busch and Lacy (1983) and Wittrock (1985) have stated that 'the vested political interests that guide some science diverts attention from questions of ends; what is the good society? to questions of means; how can productivity be increased ? When society as a whole feels some negative effects from this approach to science and agriculture, these deleterious consequences are dismissed by some scientists and farmers, or are redefined as adjustment problems, or tolerated as the price of scientific progress' or claims are made that scientists are not responsible for the misapplication of science (Banuri, 1990; Rotblat, 1999). The technological disasters of the late twentieth century like Bhopal, Chernobyl, the Challenger and environmental degradation suggest that expert assessments

need to be tempered by broader visions in the same way that the common-law system has promoted the integration of expert knowledge with layman's values, ethics and perceptions (Nandy and Visvanathan, 1990; Jasanoff, 1999).

There are scientists who have claimed that scientific positivism and detached observation are no longer considered necessary conditions in the search for scientific truth (Barrett, 1997; Autumn, 1996; Rappaport, 1993; Krumeich, 1994; Paredes, 1997). Polanyi (1967) claims that if tacit thought forms an indispensable part of all knowledge it is impossible to establish a strictly detached, objective knowledge. Jiggins and Röling (2000) among others are calling for a new social contract for science (Lubchenco, 1998; Latour, 1998; Zimdahl, 1998; Gibbons, 1999; Rotblat, 1999). For them, science is not only part of the problem but very much a source of solutions since it is difficult to opt out of science (James Lovelock). Post-normal science goes beyond 'normal' (in the Kuhnian sense) (Funtowicz and Ravetz, 1993; Jiggins and Röling, 2000). It would include widespread involvement in, if not a total democratisation of, science. This type of science produces 'socially robust knowledge' with three aspects: it is valid inside and outside the laboratory; its validity is achieved through involving an extended group of experts, including 'lay' experts; and thirdly this participatory-generated knowledge is likely to be less contested (Funtowicz and Ravetz, 1993; Gibbons, 1999). Externalities such as health and safety of living things, resource and energy use and other societal goals would be internalised in this type of science (Zimdahl, 1998). Research would become a co-learning activity that develops mutual accountability (Jiggins and Gibbon, 1997). Co-learning develops ways of understanding the world that re-enter society and affect action in society (Jiggins and Gibbon, 1997). In other words science as knowledge-based action or a form of reflective activity underlying rational action: action is then concerned with change; is present and future oriented; and requires the anticipation of the effects of action, rather than the interpretation of prior event (Vasquez, 1977).

Cerneia (1995) claims that: 'Science becomes applicable and theory becomes practical when it first allows us a definite grip of empirical reality'. The reality is that ethnoveterinary knowledge in Trinidad and Tobago exists in a politically charged environment. The project of validating ethnoveterinary medicine cannot come into existence if the range of interests gathered around the project do not intersect (Latour, 1993). It is thus necessary to show what the scientific interests are in Trinidad and Tobago. There are some local extension agents, animal health assistants, agricultural chemical agents, scientists and veterinarians who undervalue ethnoveterinary knowledge in favour of the scientific principles in which they were trained. There are others who are actively promoting the use of this knowledge. The reasons for both attitudes towards ethnoveterinary knowledge will be examined using the constructivist perspective that all knowledge is socially constructed, with both strengths and weaknesses.

The Social Construction of Scientific Knowledge

Foundationalism or naïve idealism is the idea that truth exists independently of the knower (Maynard, 1994). The social shaping of theory is not commonly known because scientific knowledge hides its labour process through a series of textual means (Stanley, 1990). Social constructivism is the treatment of scientific knowledge and other knowledge as social constructions. Using this viewpoint, fact making becomes a social enterprise, and 'truth' becomes relative and contextual (Pinch and Bijker, 1987; Hubbard, 1988; Alatas,

1993; Foucault, 1980). The principle of epistemic relativity states that all beliefs are socially produced, so that all knowledge is transient, and neither truth-values nor criteria of rationality exist outside historical time (Baber, 1992). The social production of knowledge comes from the social life of scientists, their shared goals and understandings, codes of conduct, definitions of time and space and created self-identities (Franklin, 1995). The [scientific] epistemological stance can be described as [scientists] power to create the world from their own point of view, which then becomes the truth to be described (Maynard, 1994). Epistemic relativity means rejection of the doctrine of judgmental relativism which means that all beliefs are equally valid, in the sense that there can be no rational grounds for preferring one to another, for it allows each group to disqualify the criticism of others by claiming that there are no common grounds for argument (Baber, 1992; Scheyvens and Leslie, 2000).

Pinch and Bijker (1987) talk about three stages of the social construction of scientific knowledge. In the first stage there is some interpretative flexibility in the findings, so scientific controversies are present in this stage. The level of confidence in the scientific model by the scientific community increases with the level of scientific confirmation (i.e. scientific activities that cumulatively corroborates the theory's hypotheses or the fraud's claims) (Deichmann and Müller-Hill, 1998; Bradshaw and Borchers, 2000). In the second stage scientific flexibility reduces as papers, findings and models are published, disseminated, debated and cited giving rise to new funding and new research. A scientific consensus builds as to what the 'truth' is. Typically younger scientists defer to the judgement of eminent scientists and don't express contrasting opinions. This process of creating scientific orthodoxy is called 'closure' (Pinch and Bijker, 1987). Or in other words 'research creates controversies while science puts an end to the vagaries of human disputes' (Latour, 1998). In the third stage Pinch and Bijker (1987) propose that the closure mechanisms can be related to the 'wider social-cultural milieu'. Latour (1993) criticises both the theory and the application of social constructivism to science. Part of the difficulty is how to have an account of the historical contingency of all knowledge claims, a commitment to valid accounts of an existing reality, and also retain the capacity the subject all knowledge claims to critical scrutiny (Hawkesworth, 1989; Kerr, 1998).

Mainstream scientists criticise social constructivism because they are reluctant to reveal the ambiguities and uncertainties built into science for fear of diminishing their public credibility (Dolby, 1979; Bradshaw and Borchers, 2000). Franklin (1995) points out that the epithet 'antiscience' used to describe any critical studies of science suggests that scientists accept only internal-disciplinary criticism dedicated to improving results or preventing fraud. The sense of threat felt by scientists (as evidenced in the 'science wars') when their disciplines are questioned as foundational belief systems reveals the importance of science as a source of deeply-felt cultural values (Franklin, 1995). Scientific entities like genes can assume cultural meanings and lay people 'hijack' scientific symbols. Conversely scientists like sociobiologists draw moral and philosophical lessons from science and other scientists 'hijack' religious imagery such as the 'bible' or 'book of man' used to describe the human genome (Nelkin, 1996).

Scientific knowledge is hierarchical internally, and even more hierarchical externally, (i.e. it disenfranchises those outside the knowledge network) (Dolby, 1979; Marglin, 1990c). Eminent scientists are deferred to and lesser scientists are constrained from expressing contrary views (Dolby, 1979). The élitism in science and technology is not seen as problematic since the scientific élite see themselves as the only appropriate group to make scientific, technological and policy decisions based on authoritative knowledge, given an

increasingly complex world which requires highly technical and specialised expertise (Middendorf and Busch, 1997; Jasanoff, 1999).

The social construction of scientific knowledge becomes important when scientific bodies like the International Council for Science (ICSU) are asked to carry out a study on the concept of 'traditional knowledge' (Dickson, 1999). This took place in the context of the signing of the Declaration on Science and the Framework for Action at the 1999 World Conference on Science in Budapest, and the 26th General Assembly of the ICSU in Cairo, Egypt (Nakashima and Guchteneire, 1999). Prior to the signing debate took place on whether indigenous knowledge (IK) was scientific or not and scientists expressed surprise at seeing the issue on the agenda. Scientists suggested that including indigenous and traditional knowledge on the agenda might lend ill-deserved credibility to IK or open the door to anti- and pseudoscientific⁶ approaches like creationism and astrology. Nakashima and Guchteneire (1999) wondered whether the discomfort of the scientists might be related to their unwillingness to view science as one knowledge system among many. The debate led to a discussion on the nature of scientific knowledge itself; for example what makes the theory of natural evolution 'scientific' and thus distinguishable from astrology when neither can be replicated or reproduced? (Anon, 1999).

The ICSU's critical study on traditional knowledge' and other publications on indigenous knowledge inscribe a formerly subjugated knowledge in the hierarchical order of power associated with science (Foucault, 1980). These scientific 'inscriptions'.... 'can be recombined in various ways, communicated across space and time and they thus become very important and significant' (Latour, 1986). However the original oral knowledge and its holders are not so important and need 'scientific validation' by the ICSU (O'Brien and Butler Flora, 1992). Validation 'acts to reaffirm the order of development, the stamp of approval or denial rests at the top of the development or scientific hierarchy' (O'Brien and Butler Flora, 1992). Scientific objectivity is a 'translation' that scientists use to deny other people access to decision or fact making power (Hubbard, 1988).

Hubbard (1988) claims that: 'science is made by a self-perpetuating, self-reflective group, by the chosen for the chosen', not for the poor and marginal. These latter, left out of the Science network, continue to use 'non-empirical belief systems' or cultural rationality which is then both a means to survive and also 'attempts to achieve certainty' (Brown and Mikkelsen, 1990; Krinsky and Plough, 1988). Cultural rationality is based on folk wisdom, peer groups, and traditions. This type of rationality asks non-technical questions like why do we need this product? It also looks at direct and personal effects of social, technical and environmental risks.

The dichotomy between science and traditional knowledge has increasingly been questioned and the overlaps and disjunctures between them have been outlined (Franklin, 1995). The phrase 'knowledge communities' emphasises the dynamic networks of actors, processes of negotiation and the diverse ways in which knowledge is constructed and performed (Richards, 1993; Raeder and Rikoon, 1997). The phrase 'communities' implies that individuals may participate in an utilise multiple knowledge communities. Finally the word 'community' also reflects the idea that the boundaries between knowledge groups are

⁶ The American National Institutes of Health has a new National Center for Complementary and Alternative Medicine (NCCAM) which replaces the predecessor, the Office of Alternative Medicine (OAM). The OAM was called a 'child of politics, that gained a reputation as a counterculture enclave for pseudoscience'....and it was condemned for sponsoring inconclusive research and bestowing prestige on practices that resembled "witchcraft" (Stokstad, 2000).

not closed and that there may be considerable overlap between knowledge communities. Knowledge communities influence and reflect the organisation of science and folk medicine. What scientists and lay people perceive as potential management options and constraints and where lay people and farmers look for potential alternatives depends on the individual's participation in different knowledge communities. The social construction of knowledge is revisited in Chapter 12.

The definition of indigenous knowledge based on that developed by Ellen (1996a) is local, orally transmitted, a consequence of practical experimentation reinforced by experience, not easily recognised as theoretical, repetitive, fluid and negotiable, shared but asymmetrically distributed, largely functional, and embedded in cultural matrices. Questions related to the terms indigenous and traditional are where a particular body of knowledge has to be called indigenous and how old it has to be to be called traditional (Pálsson, 1996; Agrawal, 1995). A distinction between empirical/ordinary knowledge and non-empirical/non-ordinary knowledge is preferable (Giarelli, 1996). The latter category would include witchcraft, magic and spirits (Giarelli, 1996).

The popular pharmacopoeia of Trinidad and Tobago is the result of a Creole pan-Caribbean culture, closely linked to history, and the result of a South American Indian, African, European and Asian heritage (Lans, 1996; Moodie-Kublalsingh, 1994; Littlewood, 1988; Simpson, 1962; Niehoff, 1959). Cultural knowledge is the contextual glue that binds the use of tacit and explicit knowledge and gives it meaning (Bontis and Choo, in press). Tacit knowledge is embedded in people and difficult to access, communicate or share with others because it is the noncodifiable accumulation of skills that results from learning by doing (Porac *et al.*, in press). There are four aspects of tacit knowledge according to Polanyi (1967): functional, phenomenal, semantic and ontological. Learning the technical skills related to indigenous knowledge depends on technology acquisition support systems (Ingold, 1996). These are systems of apprenticeship or relationships between more and less experienced mentors or practitioners in hands-on contexts of activity. There is no blueprint, only instructions or rules of thumb that take on meaning in the context of the engagement with the environment and in a socio-cultural and historical background (Maturana and Varela, 1987; Escobar, 1999). This does not mean that there is always a systematic body of cultural representations (Ingold, 1996; Maturana and Varela, 1987). The continuity of the apprenticeship relationships is essential for the continuity of a technical tradition (Ingold, 1996). The death of knowledgeable individuals, lack of verbal transfers to the next generation, and acculturation, all impact negatively on culturally encoded indigenous knowledge (Longuefosse and Nossin, 1996; Douglas, 1995).

Knowledge-based action in [Veterinary] Medical Anthropology

Science is increasingly seen as a social process of making narratives where meanings are contested and stabilised for a time through the productive relations of power (Morawski, 1988). This means that the epistemological paradox of using political enterprises like feminism or knowledge-based action research to achieve a more accurate, coherent and less masculinist science can be resolved through the reconsideration and alteration of existing social relations of power (Morawski, 1988). Objective, value-free science is being replaced by a science in which social conditions, ethical conduct, and identification with the research subjects are integral components (Barrett, 1997; Autumn, 1996; Pálsson, 1996). Rappaport (1993) calls for an engaged anthropology that would comprehend contemporary

problems in anthropologically derived terms, but would resemble applied anthropology in trying to develop programs that would correct these problems. Anthropology's traditional tools—such as ethnographic interviews and participant observation—are thus employed within the framework of a more general research action methodology (Giarelli, 1996).

Informed, directed and committed action is often referred to as 'praxis' (Hatten *et al.*, 2000). Praxis research questions the validity of 'etic' interpretations⁷. The truly 'reflective practitioner' (Hatten *et al.*, 2000) actively participates in the moulding of the social order through 'praxis'. Praxis or knowledge-based action can be defined as a property of individuals that emerges from the interactions of the theories (beliefs) that they hold, the actions that they practice, the values that they assume, and the contexts that they interpret of the 'world around them' (Bawden, 2000). The Community-centred praxis approach recognises that all action, even the casual observation characteristic of positivistic research affects a system and that inaction is consequential and thus ultimately partisan (Warry, 1992; Singer, 1994). Action/praxis research takes this insight within its approach (Nereu *et al.*, 1997). Each researcher is an actor in the research process. Each researcher brings particular values, self-identities and experiences to the research; however we do not know how these stances affect the research (Holland and Ramazanoglu, 1994).

Non-experimental validation

Phyto-therapeutic products are usually compared with allopathic drugs based on their unproven effectiveness, their variability, impurity and the potential health hazards they might cause. In comparison pure compound formulations are assumed to be effective, standardised, pure and safe (Elisabetsky and de Moraes, 1990). However until recent times there were 607 drug products used in the USA market for at least 18 years with no officially recognised substantial evidence of effectiveness in well-controlled studies (Elisabetsky and de Moraes, 1990). These non-evidence based drugs were not described as unconventional or snake oil because they were introduced from within the mainstream of western medicine⁸ (Dalen, 1998). In this sense western science-derived technologies are different from Creolization-derived technologies. As stated before, Creolization-based technologies are not judged on the basis of their origins, only that they work in the local context.

Western science has become the main means of establishing whether a technology works and how. The non-experimental validation of the ethnoveterinary medicines was undertaken in recognition of that fact. In this research farmer's knowledge is taken and validated scientifically and in the future there are plans to return this validated knowledge to farmers. This approach can be justified in engaged anthropology, one of whose aims is to identify indigenous institutions or processes that could be strengthened and to support processes that could lead to culturally appropriate or effective corrective programs (Rappaport, 1993). There are precedents to this type of engagement. The Leiden Ethnosystems and Development Programme (LEAD) is involved in collaborative multi-country projects on indigenous knowledge and practice in agriculture and food production (Slikkerveer, 1995).

⁷ Etic interpretations are those which at some level cannot be judged by the actors (Warry, 1992).

⁸ More of this discussion will follow in Chapter 12.

Role of the researcher in the research

It cannot be argued that theory emerges from research since most researchers start from a theoretical perspective. Rigour in research involves being clear about one's theoretical assumptions, the nature of the research process, the criteria against which 'good' knowledge can be judged and the strategies used for interpretation and analysis (Maschia-Lees *et al.*, 1989; Maynard, 1994). There is a difference between personal and theoretical reflexivity, the former being seen as the unique thoughts, feelings and experiences of the researcher while the latter is a theoretical understanding of the site from which one is working (Kelly *et al.*, 1992). There are few canons about the practical role of the anthropologist apart from the old one of remaining objective and staying away from the native women (Hastrup and Elsass, 1990). By taking the place of the researched into account we can raise questions about what the research is for (Holland and Ramazanoglu, 1994).

Cox (1997) claims that choosing applied research may bring conflict with community power groups and brokers and also a loss of professional peer support. Anthropological advocacy has been called a contradiction in terms and advocacy has been said to be incompatible with anthropological scholarship (Hastrup and Elsass, 1990; Shore and Wright, 1996). Applied work is often unpublished because there is a split between theory and practice which is said to be linked to masculine ideas of science which exclude advocacy, activism and commitment from "real science" and determine what counts as publishable material (Jiggins, 1989; Katz, 1996). However one argument for doing native applied anthropology is that the problems studied are part of the lives of the researchers which makes it reasonable to address them professionally regardless of their theoretical interest (Rappaport, 1993). To advocate an applied anthropological approach means examining one's values as a researcher, seeing if they are relevant and making them explicit. Secondly the researcher's values must be appropriate to the discipline; they should be of sufficiently high generality to avoid subordination to any particular social or political agenda or party (Rappaport, 1993). Thirdly the anthropological account needs to be a precise, accurate and well-grounded account that stands up to hostile and critical scrutiny (Rappaport, 1993). Praxis does not guarantee truth nor do good hypotheses guarantee effective practice (Kay, 1994). A praxis approach focuses analysis on how theory is transformed by actions that are inherently instrumental and strategic in nature (Warry, 1992).

Cerneia (1995) claims that 'Science begins with application, so that in order to be of use, research must be inspired to establish what the relevant issues are and then apply the necessary remedies'. Using this view of Science, this research fits into alternative research on alternative agriculture (van Mansvelt, 1994); then into the framework of veterinary anthropology. The methods used to collect the data fit into extractive research type 2 (Matrix 1) (Waters Bayer, 1994).

Matrix 1. Extractive vs. Participatory research into Indigenous Knowledge (IK)

Type of research	Resulting science	End product
Extractive research type 1, unrestrained pursuit of information leads to market valuation of content	Science can become the factual recording of what is, which is then used to justify the present, but ironically from within an ideology of social change (Westkott, 1979)	Academic research of IK Reduction to data that can be manipulated for analysis and publication in order to 'advance' science and philosophy and one's own career (Waters-Bayer and Bayer, 1994)
Extractive research type 2, technical research into IK (Thrupp, 1989)	To explain or improve development or academic project (Thrupp, 1989)	Results are 'validated' to develop 'scientised packages' for wider dissemination (Thrupp, 1989)
Extractive research type 3, socio-economic research into IK (O'Brien and Butler Flora, 1992)	To increase production for a national or global market (O'Brien and Butler Flora, 1992)	New products, new drugs
Participatory action research, enriching Research	Social transformation. Recognises the marginalisation caused by 'universal science' and its creation of ignorance (Vitebsky, 1993)	Working with local people and their 'science' to transform their worlds and increase their self respect and voice or empowerment (Waters-Bayer and Bayer, 1994)

Sources: Westkott, 1979; Waters-Bayer and Bayer, 1994; Thrupp, 1989; O'Brien and Butler Flora, 1992; Vitebsky, 1993.

Ethnomedicinal creolization

The continuing reference to the sacred world means that the world has not become a disenchanted one that is no longer mediated by mysteries and miracles or sacraments and saints (Rapport and Overing, 2000).

4. Ethnomedicinal creolization

Introduction

Cultures are situated historically, and should be viewed in a theoretical framework that critically examines their embeddedness in social, economic and political structures (Baer, 1997). The Amerindians came by canoe to Trinidad and Tobago from the Orinoco delta; the Spanish were looking for gold; the Africans were abducted by slave traders; the French were displaced by the French Revolution and by the capture of other Caribbean islands by the British; the British came with the colonial establishment, and the other settlers saw Trinidad as a place to make a new start in the New World (Besson, 2000). Caribbean folk medicine is based on this marriage-à-cinq: European folk medicine; scientific medicine; African-based practices; Amerindian medicine and Indian-based medicine; a product of inter-group borrowing or medical syncretism (Laguerre, 1987). Folk medicine is called 'bush medicine' in the West Indies (Dennis, 1988). This term may have British origins. The term Creole usually refers to things of local/West Indian origin and is sometimes used to contrast East Indian from African/European elements (Aho and Minott, 1997).

A medical system is 'the pattern of social institutions and cultural traditions that evolve from deliberate behaviour to enhance health' (Laguerre, 1987). One aspect of folk medicinal beliefs that is ancient and globally known is the Doctrine of Signatures. Paracelsus (Theophrastus Bombast von Hohenheim, 1490 - 1541) developed this Doctrine from a much older set of beliefs. The belief was known in China, India, Africa and South America, and in some places it was present before 2000 BC (Nyazema *et al.*, 1994). Nicholas Culpeper spread the belief in England in the seventeenth century (Blunt and Raphael, 1994). The Doctrine claims that features made by God identify the plant with a specific disease or part of the body or more simply 'like cures like' (Sofowora, 1982; Etkin, 1988). For example plants with heart-shaped leaves are good for treating heart disease, plants exuding a milky juice are believed to increase lactation in women (Sofowora, 1982; Etkin, 1988). In Belize and in Amazonian Ecuador it is believed that pain is cured by producing pain therefore stinging nettles are used to cure headaches⁹ (Amason *et al.*, 1980; Davis and Yost, 1983). A belief that plants growing in dark places should be good for rheumatism led to the use of the willow *Salix* species, whose bark subsequently produced salicin -salicylic acid- aspirin (Nyazema *et al.*, 1994). Hausa, Zimbabwean and Israeli healers treat circulatory ailments and jaundice with red and yellow plants (Sofowora, 1982; Etkin, 1988; Nyazema *et al.*, 1994). In Zimbabwe three of six plants used because they produce red coloured decoctions

⁹ A recent study at the Plymouth Postgraduate Medical School in Devon found that stinging nettles (*Urtica dioica*) produced anaesthesia when used by patients with osteoarthritis of the thumb (Randall *et al.*, 2000).

had antischistosoma activity comparable to the expensive praziquantel (Nyazema *et al.*, 1994). There are many illustrations of the Doctrine of Signatures providing false leads.

Another global belief is the hot/cold dichotomy. People in different cultures throughout the world for example Amerindian, Chinese, East Indian, Portuguese and Spanish view illnesses, symptoms and remedies as 'hot' or 'cold' (Aho and Minott, 1977). The British expression "feed a cold, starve a fever" is a well-known example of a hot/cold classification (Butt Colson and de Armellada, 1983).

Syncretism in medicine is a process whereby adoptions and adaptations are made selectively from incoming systems (Butt Colson and de Armellada, 1983). Essential, indigenous elements may be reinforced and modified by incoming ideas, but basic structures, objectives and characteristics of the indigenous remain identifiable and a continuity is achieved (Butt Colson and de Armellada, 1983). Syncretism in Caribbean medicine is defined by Brodwin (1998) as participation in four health cultures at once: globalised scientific biomedicine, its historical form derived from the former colonial power (British, Dutch, French, Spanish), the local island variant, and the syncretic set of popular folk medicine which has grown out of much older European, African and Amerindian traditions (Brodwin, 1998). Folk medicine as a system includes: home remedies; folk aetiologies of disease; preventative medicine; reproductive techniques; medicinal properties of plants; anatomical knowledge, and healers (Laguerre, 1987).

Folk remedies fall into several classes: certain well-known European medicinal herbs introduced by the early Spaniard colonists that are still commonly cultivated; indigenous wild and cultivated plants, the uses of which have been adopted from the Amerindians; and ornamental or other plants of relatively recent introduction for which curative uses have been invented without any historical basis (Morton, 1975). This invention would have been facilitated by the widespread introduction of plant species from all over the world for ornamental and medicinal reasons (Bayley, 1949).

The naturalistic system refers to the ethnomedicinal beliefs in which natural causes like cold, heat, wind, dampness and an upset in the balance of the basic body elements are the major causes of illness (Dressler, 1980; Butt Colson and de Armellada, 1983). A disturbed physical equilibrium gives rise to disease. Treatments and responses to illness are empirically based, determined by signs and symptoms and explainable within the natural order of things (Berlin and Berlin, 1994). Self treatment or treatment by a herbalist or someone knowledgeable is the norm (Berlin and Berlin, 1994).

Trinidad and Tobago folk medicine has a historical classification of diseases into hot and cold. Some researchers consider that the hot-cold concept of health and illness is absent in Spanish folk medicine and did not exist at the folk level in the past (Tan, 1989). These beliefs are now widespread in Latin America and the Caribbean, and according to Foster (1953) were derived from the élite and scholarly Hippocratic-galenic traditions that were brought to the Spanish colonies by Spanish physicians and clergy. Spanish medical practice at the time of Columbus was based on classical Greek and Roman medicine with diffusions from Arab medicine. Other Hippocratic principles are the oppositions of raw / cooked, hot / cold, wet / dry, sweet / sour. In addition, wellbeing is determined by a balance between different elements, bile, phlegm, and blood (Strobel, 1985).

There is research documenting an Amerindian system of hot and cold beliefs that differs from the Hippocratic tradition in that it encompassed the whole cosmos (Messer, 1987; Peña, 1999). There were only two elements and the concepts of warm and cold were not humours or physical elements (Peña, 1999). Everything that was masculine, celestial or came from above was considered warm; everything that was feminine came from below and was cold (Peña, 1999). Messer (1987) and Butt Colson and de Armellada (1983) accept the influence of Hispanic humoral medicine on post-16th century Mesoamerican indigenous thought, however Aztec, Mayan and Zapotec medicinal and cosmological systems have different hot-cold concepts. Butt Colson and de Armellada (1983) also argue that several major, widespread categories of illness and treatments also have a mainly indigenous, Amerindian derivation.

Butt Colson and de Armellada (1983) base their argument on ethnographic data derived from remote, mostly unacculturated Amerindian societies of the recent past and of today and historical evidence in 17th century literature on Carib peoples. Butt Colson and de Armellada (1983) focus on the following points: the existence amongst these Amerindians, as amongst many Latin American Creole and peasant groups, of certain specific and distinctive forms and interpretations of illness, their causation's and cures. These include the binary oppositions of hot and cold, the notion of imbalance accompanying the concept of the mediate and harmonious state; soul loss through shock and fright; the capture of the soul; whirlwind or cold air sickness and illness from contagious and powerful forces. However the Amerindian cosmovision had sufficient in common with the European theory to facilitate syncretism where coincidences occurred such as the hot/cold, bitter/sweet, high/low and strong/weak oppositions (Butt Colson and de Armellada, 1983).

Hot/cold theories are found in Asia (Ayurvedic medicine), Latin America and parts of Africa. The Trinidadian hot/cold system is not humoral in the sense that balance must be established between hot and cold, it is cathartic in that remedies are taken to remove heat from the system (Littlewood, 1988). Heat comes from the sun, work, sleeping, burns, cooking, and reproductive activities. Linked to the hot/cold dichotomy is a system of blood beliefs where an excess or lack of cold or heat in the body through exposure or diet causes illness. Blood then becomes 'bad' or dirty. Illnesses with skin changes such as chicken pox, measles, rashes, urticaria, impetigo, ringworm, eczema, are associated with 'too much heat in the body' (Bayley, 1949; Aho and Minott, 1977; Mitchell, 1983).

This may derive from the Aztec classification of 'heat' or 'hot' illnesses manifesting themselves as irritation, and the idea that an overheated state rendered one vulnerable to illness (Messer, 1987). Female Warao herbalists in Eastern Venezuela use the concept of bad blood (Wilbert, 1983). This concept is also used by Spanish New Mexicans (Conway and Slocumb, 1979). Another Aztec theory is that fever was caused by internal problems which could be eliminated with diuretics, purgatives or digestives (Ortiz de Montellano, 1975). These 'hot' conditions are treated externally with cool lotions like bay rum (the commercial preparation of *Pimenta racemosa*), limacol and milk of magnesia or bush teas. They are also treated internally with bushes classified as cool such as *Stachytarpheta jamaicensis*, *Ageratum conyzoides* or *Chamaesyce hirta* (Aho and Minott, 1977). Other illnesses linked to 'overheated' or 'hot/bad blood' or 'hot food' are fever, pressure and headaches (Bayley, 1949; Aho and Minott, 1977; Mitchell, 1983). Eating cold foods when the body is 'hot' can lead to illness. Also ironing as a 'hot' activity and then opening the fridge can lead to 'colds'. Teas are used for 'cooling' if there is too much 'heat' in the body. Cooling teas are used prophylactically when they are taken to keep the body healthy by cooling the

'system', or the bladder, meaning that they remove the 'heat' or impurities in the system (Littlewood, 1988). Cooling teas become treatment when they are taken for undiagnosed or unspecified illnesses or when feeling unwell. Purges reduce the heat further and 'clean the blood' or remove unwanted foetuses. Purges are also used to remove internal parasites and for reproductive problems. 'Cold' is associated with experiencing a sudden change in temperature, drafts or getting wet (Mitchell, 1983). Parts of the body associated with 'coldness' are the mole (fontanelle), chest, head, back, womb, eyes, ears and knee, phlegm, discharge and arthritic pain (Mitchell, 1983). Aching is associated with 'cold' in the Aztec system and several illnesses are attributed to the unhealthy penetration of excess cold and moisture (Messer, 1987). Liniments, poultices and laxatives are used for cold and for gas (wind) (Mitchell, 1983). Illnesses associated with coldness are influenza, asthma and the common cold (Aho and Minott, 1977). There are also 'hot' plants to stimulate the blood or to treat 'cold' illnesses, and 'hot' external applications like 'soft candle' 'grated nutmeg' and hot poultices (Laguerre, 1987; Littlewood, 1993). 'Hot' teas used for colds and fevers are *Leonotis nepetaefolia* and *Chromolaena odorata* (Aho and Minott, 1977).

Gas (wind) is associated with pain in the stomach but also in the joints and back and with pain that travels around the body (Mitchell, 1983; Littlewood, 1988). Medicines are administered in accordance with the identity between cause and effect. Expulsion of disease causing impurities is the primary mechanism by which bodily equilibrium is restored (Mitchell, 1983). Folk medicines achieve cures through 'bitterness', 'cutting', 'cooling', 'building', 'purging or washing out', and 'drawing out' (Mitchell, 1983).

Personalistic explanations of illness are explained by the active aggression of some agent which might be human, non-human, or supernatural like souls, deities, demons, ancestors and sorcerers (Dressler, 1980; Davis and Yost, 1983). The sick person is a victim of aggression or punishment directed against him for reasons that concern only him (Butt Colson and de Armellada, 1983). Dressler (1980) wrongly subsumes all personalistic beliefs under the African-based tradition of obeah. Wrongly because Warao [Amerindian] personalistic explanations dominate over those of natural causation and some of these explanations persist in the Caribbean (Wilbert, 1983a&b). Obeah is a form of sorcery usually associated with evil; it is not legally practised. Obeah can be used to cause illness or misfortune or to worsen existing illnesses. Diagnosis of personalistic conditions is based on the retrospective presumption of an etiologic agent and a person with special knowledge or powers is necessary for treatment (Berlin and Berlin, 1994). Obeah is explained more fully in the section on African-based knowledge.

In Trinidad and Tobago Asian-based spiritual healing comes from Hindu priests who 'jharay' the individual or animal using special leaves. For Christians spiritually originated illness is treated by faith healers such as 'Shouters', Shangoists or Spiritual Baptists, or with Spanish-romanic prayers, *Scoparia dulcis* and candles (Aho and Minott, 1977). 'Shouters', Shangoists or Spiritual Baptists are syncretic combinations of African Yoruba practices and Roman Catholicism. Shango priests often incorporate bush remedies in their healing practices with prayers and rituals (Aho and Minott, 1977). The role of the Shango leader (often a woman) as a bush healer is as important as her role of religious leader (Mischel, 1959).

Maljo is more closely linked to ethnoveterinary medicine than Obeah. Maljo or 'Mal yeux', also called 'bad eye' or 'blight' is another aspect of the personalistic system of ethnomedical beliefs. It occurs when a jealous or envious person looks at a person or animal

and verbally admires it. Afterwards the living object begins to decline and could die. In Mesoamerican cultures infants are conceived to be cool, have sweet blood and to be vulnerable (attractive) to witchcraft and the evil eye which are both hot concepts in these cultures (Messer, 1987). In Trinidad and Tobago calves and kids have red pieces of cloth around their necks to prevent them from mal yeux, other animals have a blue spot painted on, sometimes with blue wound spray (Negasunt™ or other blue- coloured sprays used for myiasis prevention and treatment). To protect growing plants [from evil spirits], there are blue coloured bottles attached to poles in visible places, in the gardens or plots.

Gender roles may lie behind the Caribbean construction of the malady of Maljo or 'Mal yeux', also called 'bad eye' or 'blight'. This aspect of the personalistic system of ethnomedical beliefs occurs when a jealous or envious person looks at a person or animal and verbally admires it. Afterwards the living object begins to decline and could die. Unfortunately, the dominant gender code and the structural subordination of women make both real and symbolic threats to children's health all too common. Because Caribbean masculinity emphasises fathering children but not necessarily supporting them, there is keen competition among women for husbands and providers (Brodwin, 1998). Women regard each other with suspicion and jealousy, and such emotions fuel accusations of pathogenic attacks on their children (Brodwin, 1998).

Heinrich *et al.* (1992) record the properties of medicinal plants according to indigenous criteria: hot like onions, hot like chilli, sweet, bitter, astringent, burning, gelatinous, foaming, sour, aromatic (cooling). In her article, Strobel quotes a Guyanese respondent claiming that "quinine tablets are sour because sourness works on the gall bladder, which is the site of malaria". Strobel (1985) uses this example to demonstrate that western medicine is transformed and reinterpreted according to Creole criteria. Western medical interventions are simply considered more complex than the traditional Creole philosophy (Strobel, 1985; Littlewood, 1988). The Creole medical system is fairly flexible and fits the philosophy 'according to the circumstances' (Strobel, 1985; Littlewood, 1988). Strobel (1985) considers that traditional Creole medicine is a global approach and people utilise all available health care alternatives in a pragmatic way (Hill, 1985). Preventive medicine is practised by keeping the body in balance through proper use of diet, drinking 'bush' teas to help keep the blood 'clean' and keeping the hot/cold balance by avoiding certain behaviours or situations like taking a bath when the body is hot (Hill, 1985).

In Creole medicine there is a progression beginning with an individualised prevention of illness and ending with a specialised therapy. Home remedies are tried for minor illnesses, or if visiting the doctor is inconvenient due to distance or long waits at the medical facilities. When home remedies fail, specialists are called in after discussion with family, friends and neighbours (Hill, 1985). Conversely folk medicine is tried if biomedicine fails. If a natural cause is not immediately apparent, a supernatural explanation is used (Mischel, 1959; Strobel, 1985). The process of elimination is important in the diagnosis of the illness (Strobel, 1985). There are two more essential points of this medical system: (1) there is no barrier between mystical and scientific interpretations; (2) everyone has to determine what works for him/herself. These two Hippocratic traditions have been incorporated into Creole philosophy, which has a concept of the body as an integral part of the universe (Strobel, 1985).

Creolization

Creoleness, hybridity, mestizaje etc stands for the ethnic plurality of the Caribbean and other colonised places (Price and Price, 1997; Balutansky, 1997). Creolization in the Caribbean is the cultural construct that distills the dehumanising experiences of Caribbean history into a self-consciously de-centred Caribbean identity (Balutansky, 1997). Creolization as cultural syncretism gives rise to the subversive and transformative creativity of the Caribbean (Balutansky, 1997). Creolization in language emerged when ocean-borne trade of various European nations brought those citizens in touch with those in Africa the Caribbean and the Pacific (Richards, 1996). Community networks developed of people from different language groups and a pidgin language often developed into a fully formed Creole tongue that made communication possible between the groups of different origins (Richards, 1996). An analogous process in agrarian development and in folk knowledge development would be the exploitation of synergy between external and indigenous elements in the elaboration of local technologies and this synergy is a cross-cultural unceasing transformation (Richards, 1996). Technology development by immigrants would then involve matching available knowledge from different sources to available ethnomedicinal knowledge for emergent health needs. Good Creolization therefore means that the origin of an idea is not important, only that it works in the local context (Richards, 1996).

Bles is one Caribbean Creole disease that is called a culture-bound syndrome in Biomedicine. It affects children and its main causes are traumas like falls, shocks and exertion (Vilayleck, 1996). Another Caribbean Creole disease found is marasmi, translated into biomedicine as infant malnutrition. One East Indian element that is resorted to by the Creole population in Trinidad and has become partly Creolised is jharay.

Origins of folk medicine

Have traditional medicinal practices deviated from those of the source continents Africa, India, South America and Europe? McClure (1982) traces the belief that purges can prevent disease caused by food to the ancient Egyptians. Some of the literature traces folk medicine only to its African roots. Mahabir (1991) complains of this in his justification for focusing solely on the Indian heritage. Even though similarity of use is not sufficient to establish the origin of particular cultural features, each case study compares ethnoveterinary practices to ethnomedicinal practices in India, Africa, South America, Europe and Africa.

Tracing the origins of the folk medicine knowledge becomes important in the verification process, why things are done in certain ways, and if there are any theories behind the practice. For instance one of my sources indicated that the Hindu period of mourning is 9 days. There are also Hindu practices where ground Neem or leaves and flowers are offered for 9 days. A herbalist mentioned 'malomay for cooling, and for a clean out, take for 9 days then take a purge out'. In Catalonia and Almería, Spain, prayers are often associated with the administration of herbal remedies and the number 9, and other odd numbers, is utilised to decide the number of plant parts to use or the period of consumption of the medicine (Martínez-Lirola *et al.*, 1996; Bonet *et al.*, 1999). When chronic illnesses are treated in Almería, Spain, treatment is usually interrupted every 9 days for a week's "rest" (Martínez-Lirola *et al.*, 1996).

Sofowora (1982) details the collection of *Ageratum conyzoides*, which is collected at night to use in treating a child who cries too often for no known cause and witchcraft is suspected. In the dead of night the plant identified in the day is approached, 9 or 7 (for male or female respectively). *Aframomum melegueta* seeds are chewed and spat on the plant while the appropriate incantations are recited, the plant is then harvested (Sofowora, 1982). Nine is also a magic number in Belize (Arnason *et al.*, 1980). Morton (1981) claims it is an important Maya number used for leaves of a plant, drops of a medicine or days to take a medicine. The Amerindian community practises the nine-night wake. In Dominica and other islands a person is buried within 24 hours in a token affair. However a large and festive wake is held 8 days later, these are important social and community events (Banks, 1956). However there may be other reasons for the number 9 being an important one in Trinidad and Tobago culture, for example the novenas or nine days/nights of prayer and nine first Fridays in the Roman Catholic religion.

Supernatural emic can sometimes indicate etic efficacy (McCorkle and Mathias-Mundy, 1992). The mosquito bush or duppy/jumbie basil (*Ocimum micranthum*) received one local name from its odour (the methyl cinnamate in the essential oil) the chemical is now reputed to be a mosquito repellent (Bayley, 1949). In previous decades nothing was known of yellow fever, and it was thought to be spread by the malignant vapours or duppies that came from the swamps (Bayley, 1949). It was noticed that when the *Ocimum micranthum* plant was broken and hung in the house, (probably to keep for medicinal purposes like colds and cooling), the duppies/jumbies kept away.

The written text in the following sections describes the diverse background of the knowledge, and who in which group possessed knowledge and why. The historical descriptions of the Trinidad and Tobago population suggest the diverse background of the knowledge base and the fact that the 'local' knowledge is in fact mobile and utilisable in other places. This is important given the struggle between science which claims universal applicability, and non science, which is sometimes assumed to be the opposite (Latour, 1986).

Amerindian-based knowledge

Genetic research has suggested that present-day North and South Amerindians originated from the same single migration of an ancient Asian population in the Pleistocene (Pena, 1999). There is considerable controversy over the origins of Amerindian culture (Haslip-Viera *et al.*, 1997). When Cristóbal Colón 'discovered' Trinidad in the 1498 there were several Amerindian tribes; the Shebaio, Aruacas, Nepoio, Yao, Pariagoto, Chaimas, Tamanaques, Chaguanes, Salives, Quaquas and Caraibes. These Meso Indians (population 10,000 - 40,000) lived in coastal and riverine villages and were fishermen, hunters and gatherers (Borde, 1876). Amerindians brought domesticates like guinea pigs (*Cavia porcellus*) and dogs to the Caribbean (Siegel, 1991). Amerindians do not operate from the dualisms that separate humans from spirits, animals, plants or things; mind and body, thinking and feeling or nature and culture (Lawrence, 1998; McCorkle and Green, 1998). They practised a universal belief in spirits of nature but deities were not worshiped (Besson, 2000). Medicine men served as curers and advisors due to their ability to contact spirits.

The Aztecs considered work to be 'heating' and drank refreshing or cooling beverages before work in order to keep themselves cool (Messer, 1987). Concepts such as moisture and winds tied to concepts of illness and the idea of 'readjustment' of body heat through administration of herbs, potions and massage are also linked to Amerindian beliefs (Messer, 1987). Bitterness is often associated with heat and strength while coolness is associated with weakness in describing the hot/cold quality of herbs or, for the use of the curers, who drink bitter brews to increase their resistance to illness and evil (Messer, 1987).

Amerindian culture was almost completely hispanicized by the Catholic missionaries of the Cisterciensan and Capuchin orders, who set up missions along the east and south coasts of Trinidad. Some Amerindians re-crossed the Gulf of Paria to the mainland, but those who stayed accepted the culture and Catholic faith and gradually became assimilated (Banks, 1956). An example of their assimilation by the missionaries is the continuing celebration of the Santa Rosa festival in Arima. Siparia and Arima were established by the Spanish Capuchins who came from the Santa Maria province of Aragon in 1756 - 1758. In 1757, the Capuchins friars dedicated their Arima mission to the first New World saint, Santa Rosa. In 1787, the Arima mission was enlarged to accommodate the Amerindian people who had been displaced from Tacarigua, Caura and Arouca (Besson, 2000). By the 1770s, Amerindians were racially mixed with the Spaniards, mestizos and Africans. The Spanish-Amerindian mixtures came to be known as the cocoa panyols.

Brereton (1981) has written that the Amerindians influenced the lifestyle of rural Trinidadians before they disappeared, especially through the Spanish and the 'peóns' of Venezuelan origin. Also from the Amerindians comes the use of plants to excite dogs to hunt (Honychurch, 1986). Other aspects are rituals that include *Nicotiana tabacum*, and the significance attached to dreams (Butt Colson and de Armellada, 1983). The intoxication of fish before capture is considered to come from the Amerindians (Borde, 1876). However ichthyotoxic (fish killing) plants were used in Spain before 1255 and are still used there and in South East Asia (Álvarez Arias, 2000). The use of *lignum vitae* (*Guaiaecum officinale*), for women's problems and sexually transmitted diseases may have Amerindian origins (Lawrence, 1998). Amerindian origins were seen in Tobago in the first phase of the research. An individual remedy to induce oestrus included cedar bark (*Cedrela odorata*). The Tacanas in the Bolivian Amazon use a decoction of cedar bark for post partum haemorrhage (Bourdy *et al.*, 2000). Amerindian culture also has personalistic explanations for sickness (Banks, 1956; Davis and Yost, 1983). There is an underlying aspect of their culture claiming that all human relationships are potentially dangerous (Banks, 1956). It is claimed that this theme underlies their couvade¹⁰ and other rituals and purifications and the Amerindian theory of sickness.

¹⁰ Couvade (Fr. *couver*, "to hatch"), widespread custom among native peoples, whereby the father, during or immediately after the birth of a child, complains of having labor pains, and is accorded the treatment usually shown to pregnant women. The social function of couvade is held to be the assertion by the father of his role in reproduction or of his legal rights to the child. The underlying belief is that the souls of babies are weakly attached to their bodies and the couvade and practices of rest and dieting protect the soul for the first nine days after birth (Taylor, 1950; Butt Colson and de Armellada, 1983).

European-based knowledge

The religious orders, especially the Dominicans, Franciscans and Augustinians, Capuchins, tried to establish themselves in Trinidad from 1591 (Besson, 2000). The last Aragon Capuchin came to Trinidad in 1758 (Besson, 2000). The friars organised missions at several areas which are still the major villages and towns in Trinidad (Besson, 2000). In the late 1700s, the settlers started to arrive in Puerto d'España. The French plantation owners who came with their slaves and families were driven from their estates in Grenada, Martinique and Guadeloupe by the tumultuous times and the conquering British. Some were French royalists who fled from the French Revolution in France and its aftermath in the Caribbean, others were serving with the British forces in the Caribbean. Amongst these were the Count of Lopinot and his four sons, Chevalier de Verteuil, Chevalier de Bruny, Marquis de Montrichard and Vicomte de Bragelonne (Besson, 2000). These Chevaliers had a profound influence on social attitudes and are referred to again in Chapter 14. The French did not discover or conquer Trinidad but because they constituted a large proportion of the population (twenty Frenchmen to every Spaniard) and as the élite they influenced the culture of the society (Joseph, 1837). French words are still part of the local dialect of Trinidad, often as "Patois".

The term "French Creole" should but does not always include the free people of colour, the children of the French planters of the early times with their African slaves, and later, their mulatto, quadroon and octoroon mistresses (Besson, 2000). Some of these children were recognised by their fathers and legitimised and freed, receiving education's at French universities and inheriting land and property, their children becoming in turn the doctors, lawyers and school masters in the latter part of the 19th century. This minority, their aspirations and their effect on folk medicine are examined in Chapter 14.

In 1832, the population of Trinidad consisted of 3,683 whites, 16,302 mixed, about 700 Amerindians, 20,265 slaves and 4,615 'Aliens and Strangers' (Besson, 2000). Several English and Scottish merchants and their families settled and ran the import-export trade in the post-Cedula years (1783-97). The English community comprised of expatriates who only came to Trinidad to govern and work, but not to settle, while many of the Catholic English and Irish intermarried with the French Creole population. Charles Warner served as Attorney General between the 1840s and the 1860s. He was responsible for the "Anglicisation" of this period (English textbooks, English laws, English schooling, Anglican Church) and became the "bête noire" of the French Creoles and the Catholics (Besson, 2000).

The first group of Portuguese came to Trinidad as early as 1630 as explorers bound for Brazil. Portuguese Sephardic Jews came in the late 18th century. Madeirans escaped from economic straits and religious persecution in 1846 and 1847. The Portuguese opened dry goods stores, rum shops and adjoining small groceries on the estates (Besson, 2000). With continuous immigration to reunite families the entire Portuguese community comprised 2000 members by the turn of the 20th century. Eventually the Portuguese were absorbed by intermarriage into the larger Roman Catholic community, consisting of Afro-French, Afro-Spanish, Irish and English settlers (Besson, 2000).

Madeira was colonised by the Portuguese in the 15th century and slaves and indentured labourers were brought to the islands. According to Rivera and Obón (1995), there were no natives in the islands to teach the newcomers about the local herbs. However folk medicine was vital because of the lack of doctors and was almost exclusively in the hands of older women. Looking for ethnomedicinal origins in Madeira is complex because of the movement of plants and people. Madeiran ethnopharmacology is based on 39 native Macronesian species, 151 Mid-European and Mediterranean species used similarly to those in Portugal, and 69 exotic species from the African Portuguese colonies, Brazil and the West Indies (Rivera and Obón, 1995).

Some research on the European influence on folk medicine has been conducted (Bennett and Prance, 2000). There are 216 introduced species that are used by populations in northern South America (Brazil, Colombia, Ecuador and Peru). Twenty-one percent of these plants are of European origin, fourteen percent are from Eurasia and seventeen percent are of Mediterranean origin. Asprey and Thornton (1953-1955) claim that the name *semen contra* now used in the West Indies as the Creole name for the introduced European plant *Chenopodium ambrosioides* was originally one of the names of the drug *Santonica* derived from the introduced European plant *Artemisia cina* B. *Artemisia* was also used as an anthelmintic but perhaps less effectively. Spanish traditions were handed down from the original colonial heritage but are reinforced by visits and migrants escaping the turbulent politics of Venezuela. Bruni *et al.* (1997) claim that the use of the stigma and styles of *Zea mays* as a diuretic is found only in those parts of Italy where the Spanish influence was strong. This ethnomedicinal use is also found in Trinidad and in Latin America and is still found in Spain (Wong, 1976; Girón *et al.*, 1991; Bonet *et al.*, 1992; Raja *et al.*, 1997; Blanco *et al.*, 1999). Multiple plant mixtures are used in Caribbean folk medicine especially in 'lochs' for respiratory problems. A similar practice is seen in Murcia and Cartagena, Spain where the guiding principle is: 'the more plants used, the more the medicinal properties are increased' (Alcazar *et al.*, 1990).

Hispanic prayers are used in Latin America for healing and against mal yeux. These Spanish-romantic prayers, like the 'oracion' prayer are used during 'santowah' (santigual) which is the Spanish equivalent of jharay. The ceremony includes sweet broom (*Scoparia dulcis*) which is used to sprinkle holy water. Some of the prayers kept secret in Trinidad can be found for sale in Cuban shops in Miami (S. Moodie-Kubalsingh, Institute of Languages, University of The West Indies, pers. comm. August, 2000). Moodie (1982) claims that these prayers (magic rather than religion) came to the New World with the conquistadors. In Almería, Spain, folk magical plant therapy for warts, evil eye, hepatic ailments or swellings consist of a ritual in which an incantation ("prayer") is recited and a plant (*Malva* species, *Marrubium* species, etc.) is used (Martínez-Lirola *et al.*, 1996). In Tuscany the concept of the evil eye exists and *Foeniculum vulgare* is put into a red cloth and hung on the animal (Pieroni, 2000). Red cloths are also used in Trinidad and Tobago.

Some 'French Creoles' were amateur naturalists and one, T.W. Carr, compared the native *Parthenium hysterophorus* to the European *Artemisia* in appearance and smell, calling it 'country wormwood' or 'absinthe bâtarde des antilles' in his flora. In Trinidad rashes are bathed with St. John's bush (*Justicia secunda*, Acanthaceae). It is claimed that this plant imparts a red colour to the bath water. In Europe the red pigment from crushed flowers of St. John's wort (*Hypericum perforatum*) represents the blood of St. John at his beheading,

because the herb is in full flower on June 24th, St. John's Day. Case study 9 contains more on the European influence.

Chinese-based knowledge

Chinese Tartars (192 men and one woman) were brought to Trinidad on the 12 October 1806, on a ship called the 'Fortitude'. These men were brought to cultivate tea but most were dissatisfied with local conditions and returned on the 'Fortitude' (Joseph, 1837; Besson, 2000). The 23 who stayed made a living as entrepreneurs and creolized. Emancipation of slaves in 1838 created a labour shortage. To fill this shortage 2,500 mainly male Chinese were brought legitimately to Trinidad as indentured workers, or were 'shanghaied' (abducted by European traders). Panti traders described Hakka prisoners as pigs on the bills of lading and shipped them to the Caribbean and South America. All of these immigrants arrived between 1853 and 1866. Almost 9,000 more Chinese immigrants came voluntarily from British Guyana to Trinidad over the next century (Besson, 2000). The Chinese soon left indentureship to become entrepreneurs and family members from China joined them (Besson, 2000). Harris (1991) has recorded the use of medicinal plants by the Chinese community in Trinidad.

African-based knowledge

de las Casas sailed with Columbus' third voyage of 1498. In 1510, he was ordained as a priest and gave up his own Amerindian slaves. In 1515, de las Casas urged Cardinal Ximenes to send a commission of inquiry to the West Indies to investigate the demise of the Amerindians. African slaves were proposed as an alternative that was readily acceded to. The majority of the slaves came from the Bight of Biafra and Central Africa. Smaller numbers came from the Gold coast and the Windward coast (Lans, 1996). Personalistic explanations of sickness of African origin are subsumed under the term obeah. An obeahman is sought for illness caused or influenced by another human. Obeah includes healing as well as a whole range of 'magic' that is used for success in love, career and harming enemies. Obeah is associated with male practitioners, can be counteracted by another practitioner, by the use of talismans or by Catholic prayers (Littlewood, 1988). According to Honychurch (1986) *Theretia nerifolia*, *Abrus precatorius*, *Hippomane mancinella*, *Nerium oleander* have associations with obeah and can only be cut at certain times of the moon. Some brews are left overnight in the dew to acquire maximum efficacy (Bayley, 1949).

Table 5a shows the diverse background of those of African origin who came to Trinidad in 1813, and also those from the other Caribbean islands owned by different European powers. In the early years of slavery many of the slaves were born in Martinique and Guadeloupe and possessed an African-French-Caribbean culture that included Patois as the main language. New slaves arriving from Africa had some impact on this culture. One example of the Creolization process is given: surelle means sour in Old French while sorrel is a sweetened drink made at Christmas time from *Hibiscus sabdariffa*. *Hibiscus sabdariffa* is used for hot and cold drinks in Sudan and Egypt (Ali *et al.*, 1991). Specialists in folk medicine may have been among those abducted from Africa. All of these factors would increase the probability of borrowing medical knowledge from other groups, the medical syncretism described by Laguerre (1987).

Table 5a. Birthplaces of African-born and Creole slaves, Trinidad, 1813

Africans	Number	%
Senegambia	1500	10.7
Sierra Leone	599	4.3
Windward Coast	882	6.3
Gold Coast	1093	7.8
Bight of Benin	1075	7.7
Bight of Biafra	5509	39.4
Central Africa	2555	18.3
Mozambique	11	0.1
Unidentified	756	5.4
Subtotal	13980	100.0
Creoles Trinidad	7064	60.7
British colonies	2563	22.0
French colonies	1575	13.5
Spanish colonies	118	1.0
Unidentified	373	2.7
Subtotal	11629	100.0
Total	25673	

Source: Higman, 1979.

Indian-based knowledge

When the Portuguese indentured labour like the Chinese before them left the plantations to become entrepreneurs, the planters in Trinidad asked the British government and the local authorities to bring people from India to work on the plantations. On May 1845 the first ship, the *Fatel Rozack* brought 225 Indians to Trinidad. After that there was a steady influx of 141,615 people and their knowledge from 1845-1917 (Weller, 1968). The great majority came from the United Provinces of Agra and Oudh and Bihar (Weller, 1968). Hindi or a variant (especially Bhojpuri) was their main language and Hinduism their main religion. A significant minority were Moslem. The majority were simple country folk from traditional communities of village India. Table 5b shows their provinces of origin.

The Indians entered a system of indentureship. After five years of plantation work they had a choice of a free return passage to India or a small parcel of land in Trinidad to live on. In 1853 the Trinidad Government began to change the free return passage guarantee and more immigrants and their children stayed (Weller, 1968; Mohammed, 1995). Successive waves of immigrants strengthened the Indo-knowledge base and also brought plants and animals. Settlers added Indian culture to the Trinidad mosaic.

'Vaidyas' (physicians) may have come to Trinidad and Tobago in the closing years of indenture in the early 1900s. Trinidad Planters complained that labourers were recruited who were unfit for agricultural work such as jewellers, silversmiths, barbers and similar castes; such people only went 'to swell the ranks of ineffectives on arrival' (Weller, 1968). These immigrants may have had a greater Ayurvedic knowledge. According to Samaroo (1975) and La Guerre (1984) some Brahmins disguised their caste to escape from the strife in the UP and Bihar States and from the 1857 Mutiny.

Table 5b. Origin of Indian immigrants to Trinidad from 1908

PLACE	NUMBER OF IMMIGRANTS
BENGAL/ AMJERE/ BOMBAY/MADRAS/ OTHERS	5
BIHAR	120
UNITED PROVINCES OF AGRA AND OUDH	1248
CENTRAL PROVINCES & PUNJAB	13
CENTRAL INDIA & NATIVE STATES	78
ODUH	983
TOTAL	2,447

Source: Weller, 1968.

These Brahmins resumed their traditional roles in Trinidad and Tobago as professionals either during or after indentureship ended, recreating an Indian knowledge network under Trinidad and Tobago conditions. Occasional recent Indian migrants would have reinforced the existing Trinidad knowledge. The type of healers found in Trinidad now are the "Ojhas" and "masseurs" (Mustapha, 1977). The "Ojhas" (Hindu pundit or Muslim imam), have magico-religious forms of healing and the 'masseurs' provide more a physical type of healing called 'cracking' 'rubbing' and 'vein pulling'. In 'vein pulling' pain is believed to originate from one 'vein' lapping over another, or by a twisted 'vein'. The masseur grasps the patient's vein with his fingers, pulls upwards and puts it back in place. This causes considerable pain and the entire leg becomes numb for a few minutes (Mustapha, 1977). The masseur's ability to massage away pains affecting the muscular and skeletal system is learnt by experience, and from their fathers. The skilled ones are visited before the medical practitioner. The majority of these healers see people at their homes (Mustapha, 1977). There are few differences between folk medicine among Hindus and Muslims in the local knowledge network. The Muslim minority may have absorbed the Hindu practices (Mustapha, 1977). The experience and the ability of the healer to cure a particular ailment and his availability at the time needed are what matters, religion is less important.

There are personalistic explanations for some illnesses in Indian populations. Recovery from this type of sickness would mean a prayer-based healing called 'Jharay' which involves praying on the sick person [or animal] or on the food eaten by him/her (Mustapha, 1977). Illnesses are regarded as evil spirits taking possession of the body and bringing about an abnormal state. Priest healing or 'Jharay' involves praying on the sick person [or animal] or on the food eaten by him/her. Depending on the religion of the priest/healer the prayer is taken from the 'Gita', 'Vedas' or the 'Quran' (Mustapha, 1977). There is a general form of 'Jharay' used to cure any kind of illness, and there are specific kinds for curing special diseases, like jaundice, headache and toothache (Mustapha, 1977). The general form of 'Jharay' is used in curing diseases of the mind brought about by evil spirits. It is also used to dispel fear, 'najar' (mal jeux), fever, sores, insect stings, and safe delivery of babies (Mustapha, 1977).

Aho and Minott (1977) described one Hindu-based jharay ceremony. The healer used a pinch of salt, five bird peppers (*Capsicum annum*), five grains of garlic (*Allium sativum*), five mustard seeds, and five cocoyea broomsticks (*Cocos nucifera*). These ingredients are passed over the baby from head to toe five times. Each time she repeats in Hindi, "who maljo is this, go back to them; leave my baby alone". At the end of this prayer she throws all the ingredients into a nearby fire made for this purpose. No one can look at the fire

otherwise the maljo will attach itself to the looker. The ritualised fire symbolises the burning up of the maljo inflicting the baby.

Well-known Ayurvedic plants/foods/spices are black pepper (*Piper nigrum*), long pepper (*Piper longum*) and ginger (*Zingiber officinalis*) (Eigner and Scholz, 1999). Plant uses still considered East Indian-based are those associated with Hindu and Moslem rituals like Phagwa. Datur (*Datura stramonium*) flower is boiled for Phagwa. Datur is also associated with intoxication more dangerous than that of alcohol. Turmeric (*Curcuma domestica*) is used to prepare Hindu brides as in India (Scartezzini and Speroni, 2000). Tulsi (*Ocimum sanctum*) is used in Hindu rituals.

Inscriptions

'By working on papers alone, on fragile inscriptions which are immensely less than the things from which they are extracted, it is still possible to dominate all things, and all people. What is insignificant for all other cultures becomes the most significant, the only significant aspect of reality' (Latour, 1986). Latour's phrase becomes important when considering two research questions: are the folk/ethnoveterinary medicinal practices derived from a body of knowledge that is ancient, coherent and global in nature? Do the different traditional medical systems that exist in Caribbean folk medicine share a common explanatory model?

Commonalities in ethnomedicine are partly derived from the movement of peoples and plants from place to place. For example *Aloe vera* and *Punica granatum* are reputed to have been introduced to ancient Egypt from Eastern Africa and South - West Asia respectively (Reeves, 1992). Another aspect of the explanation lies in the 'inscriptions' that have been copied and recopied since Egyptians wrote on papyri.

Early recognised compilers of existing and current herbal knowledge were the Greeks Hippocrates, Aristotle, Theophrastus (b. 370 BC), Dioscorides and Galen. Roman writers were Pliny and Celsus (Kay, 1996). Dioscorides (Pedianos Dioskurides) included the writings of the herbalist Krateuas, physician to Mithridates VI King of Pontus from 120 to 63 BC in his De Materia Medica (Codex Vindobonensis) (Blunt and Raphael, 1994). De Materia Medica was translated into several languages and Turkish, Arabic and Hebrew names were added to it throughout the centuries (Blunt and Raphael, 1994). Latin manuscripts of De Materia Medica were combined with a Latin herbal by Apuleius Platonius and were incorporated into the Anglo-Saxon codex Cotton Vitellius C.III. These early Greek and Roman compilations became the backbone of European medical theory and were translated by the Arabs Avicenna (Ibn Sīnā, 980 - 1037), the Persian Rhazes (Rāzi, 865 - 925) and the Jewish Maimonides (Kay, 1996). Translations of Greek medical handbooks and manuscripts into Arabic took place in the eighth and ninth centuries. Arabic folk medicine developed from the conflict between the magic-based medicine of the Bedouins, the Arabic translations of the Hellenic medicine and Ayurvedic medicine (Slikkerveer, 1990). Spanish folk medicine was influenced by the Arabs from 711 to 1492 (Hernández-Bermejo and García Sánchez, 1998).

Translations of the early Roman-Greek compilations were made into German by Hieronymus Bock whose herbal published in 1546 was called Kreuter Buch. A Dutch translation Pemptades by Rembert Dodoens (1517-1585) was translated by Charles de L'Écluse (Carolus Clusius, 1526-1609), and was published in English by Henry Lyte in 1578 as A Nievve Herbal. This became John Gerard's (1545 - 1612) Herball or General Hiftorie of

Plantas (Blunt and Raphael, 1994; Kay, 1996). Each new work was a compilation of existing texts with new additions. Women's folk knowledge existed in undocumented parallel with these texts (Kay, 1996). Forty-four drugs, diluents, flavouring agents and emollients mentioned by Discorides are still listed in the official pharmacopoeias of Europe (Blunt and Raphael, 1994). The Pilgrims took Gerard's work to the United States of America where it influenced American folk medicine (Kay, 1996).

Francisco Hernandez, physician to Phillip II of Spain spent the years 1571 - 1577 gathering information in Mexico and then wrote *Rerum Medicarum Novae Hispaniae Thesaurus*, many versions of which have been published including one by Francisco Ximenez. Both Hernandez and Ximenez fitted Aztec ethnomedicinal information into the European concepts of disease such as "warm", "cold", and "moist", but it is not clear that the Aztecs used these categories (Ortiz de Montellano, 1975). Juan de Esteyneffer's (Johann Steinhöfer) *Florilegio medicinal de todas las enfermedades* compiled European texts and added 35 Mexican plants. This Florilegio is still used by Mexican healers. Castore Durante published his *Herbario Nuovo* in 1585 describing medicinal plants from Europe and the East and West Indies. It was translated into German in 1609 and Italian editions were published for the next century. In Trinidad and Tobago a similar process took place. Ewen (1896) translated parts of Dr. de Grosourdy's *El Medico Botanico Criollo* and published his translation in the *Journal of the Trinidad Field Naturalists' Club* 1894 - 1896 as the '*Economic uses of the Compositae*'. Ewen was one of the writers who saw similarities between European plants like 'wormwood' (*Artemisia absinthium*) and the native 'wild wormwood' (*Parthenium hysterophorus*).

The syncretism process in Jamaica is described fully by Sheridan (1991). The medical profession in Jamaica ranged from Creole doctresses to Fellows of Royal Colleges of Physicians and Surgeons (like William Wright below) and included charlatans and quacks; but the health of slaves was principally dealt with by overseers and knowledgeable slaves (Sheridan, 1991). Thomas Thistlewood, born in Lincolnshire, left journals and papers of his days as an overseer/plantation owner from 1750 to 1786. Thistlewood copied descriptions of medicinal plants from *The Useful Family Herbal* by John Hill, M.D., 2nd ed., London, 1755; he also had a copy of *Several Chirurgical Treatises* by Richard Wiseman, London, 1676. In addition to these texts Thistlewood acquired medical knowledge from befriended medical staff in Jamaica and had a garden of local medicinal plants (Sheridan, 1991). Thistlewood combined all of his knowledge and experience into a journal entry called *Receipts for a Physick*, 1770. Dr. William Wright, Thistlewood's contemporary combined Creole and European medicine with the collection of native Jamaican medicinal plants. Wright included 149 plants in his *Herbaria* written from 1773 -1813.

This brief history gives a partial explanation of some of the parallels in folk knowledge found in different cultures.

Methods: data collection and non-experimental validation

Many things afterward become mere superstition, which were originally knowledge. You cannot warm-up the old superstitions. You must make a fresh start with genuine knowledge. This knowledge, however, must be gained in a spiritual way -not through the mere physical world-of-the-senses (Steiner, 1924. Koberwitz Lecture 6)

5. Methods, data collection and non-experimental validation

First phase data collection

Method refers to techniques for gathering research material (Maynard, 1994). Praxis research requires non-alienating methodologies that are dialogic and participatory in nature (Warry, 1992). There is considerable intracultural variability, rather than cultural homogeneity in Trinidad and Tobago. Hence there was no attempt to have the data be 'representative' of the nation as a whole, but of its constituent parts. The flexible Creole medical system and its highly individualised nature imply that identical recipes of multiple plant remedies are unlikely to be obtained (Plotkin, 1990). In order for pharmacological evaluation to have a sound basis, the ethnomedical information has to be complete (Souza Brito, 1996). Important considerations are who diagnosed the disease (practitioner, patient, researcher) and what were the criteria used for diagnosing the disease reported (Croom, 1983). Cognitive phenomena will include, how farmers and hunters classify livestock diseases and how they conceptualise the interrelationships, functions, and malfunctions of different organs and physiological systems (Mathias and McCorkle, 1997). This information is important since these cognitive processes guide selection of therapeutic (curative), prophylactic (preventive), or other (sale, slaughter) practices in response to disease (Mathias and McCorkle, 1997).

Complete information assists the pharmacologist reading the research in the selection of the appropriate model for investigation of the targeted plant species, and also helps the phytochemist choose an appropriate means of isolating the active substances (Souza Brito, 1996). It is necessary to determine which part of the plant is used, how it is conserved (fresh, dried or suspended), how it is prepared, and what are its adverse effects, if any (Souza Brito, 1996). Hence the need for a multi-method strategy to collect the data.

Steps in the data collection

Locating and selecting key respondents

The population of interest was individuals knowledgeable on ethnoveterinary medicines. There are aspects of folk medical knowledge that are held in common by a population (Robineau, 1991). However each group (regional, religious, ethnic, families),

additionally holds specific folk knowledge. There is also occupational specialisation; for example hunters know canine ethnoveterinary practices. Individual healers and herbalists also have specialist knowledge (Etkin, 1993; Lans, 1996). A random sample does not fit the socio-cultural conditions in which folk medicinal knowledge exists (Etkin, 1993). Etkin (1993) and Posey (1990) consider it erroneous to seek consensual reports of normative (shared/common) behaviour, which is then (inappropriately) extrapolated to a community generally. The potential effectiveness of the research design could not be estimated in advance, since there is little published information on where key respondents are located or which ethnoveterinary practices are common in which areas.

The methods outlined below are part of the hybrid inter-disciplinary methodology characteristic of ethnoveterinary research. This hybridisation ensures that equal attention and respect is paid to local and western-scientific perspectives (Mathias *et al.*, 1996). The first phase of the research involved data collection carried out for 5 months in 1995. This data collection can be divided into four parts: the school essay method; the group and individual interviews; the focus group workshops and the secondary literature review. The school essay method used in the first step of the data collection is a Rapid Rural Appraisal (RRA) tool. There is some published literature about using children in research (Perezgrovas, 1996; González-Tejero *et al.*, 1995; Sofowora, 1982). The group interviews and the workshops used in the second and third steps of the data collection fall under the category of Participatory Rural Appraisal (PRA) (Rocheleau, 1994; Catley and Mohammed, 1996). PRA puts more emphasis than RRA on involving rural people in the research and evaluation process. Both PRA and RRA provide for the collection and analysis of data within weeks after the completion of fieldwork.

Triangulation is important in RRA and PRA and means looking at things from various perspectives. To achieve this means applying different methods, using different sources of information, collected by different people, and cross-checking to become more accurate through successive approximations (Waters-Bayer and Bayer, 1994). Triangulation is important because oral knowledge is sometimes transmitted with errors, omissions and exaggerations which are then accepted uncritically by succeeding generations (Nyazema *et al.*, 1994). The combination of the school-essay method, interviews and workshops used in this research is an example of triangulation.

The data collection carried out for five months in 1995 can be divided into four parts: the school essay method; the group and individual interviews; the focus group workshops and the secondary literature review. The school essay method is outlined below.

The first step: the School essay method

The school essay/questionnaire method generated a purposive sample of ethnoveterinary key respondents. A purposive sample entails finding respondents who know about the research topic. Key respondents in this research are individuals knowledgeable about ethnoveterinary medicines. There are different kinds of key respondents, for example each group (regional, religious, ethnic, families), holds specific folk knowledge, beyond that held in common by the population (Etkin, 1993). Some key respondents obtain additional knowledge of medicinal plants through occupational specialisation, for example animal breeders, herbalists and healers (Etkin, 1993; Lans, 1996).

The student essay method was chosen to be efficient, practical and to fit with the central theme of the undertaken research that knowledge should be shared with those being researched. From their participation it was hoped that the students would strengthen their cultural heritage and become aware of other ways of learning and other sources of knowledge besides curriculum-based learning. It was anticipated that the existing ethnoveterinary knowledge and its holders would be hard to locate. The student essay method was chosen to generate a purposive sample. Quite often University students are used to collect scientific data. This option was not considered practical for two reasons; firstly the difficulty of finding non-biased University students, secondly the inability to pay them. Hence the choice of students between the ages of 12 and 15. The participation of students is relevant for this Trinidad and Tobago research because folk knowledge is already orally transmitted from grandparents and great aunts to children. In addition it is part of Trinidad and Tobago culture that some children, usually male, are given the care of small ruminants as part of their upbringing. In addition essay writing is part and parcel of school-based learning. Using the students also removes the question of 'entrance' and 'gatekeepers'. I was able to introduce myself and my research to the informants of the students by mentioning the student's names.

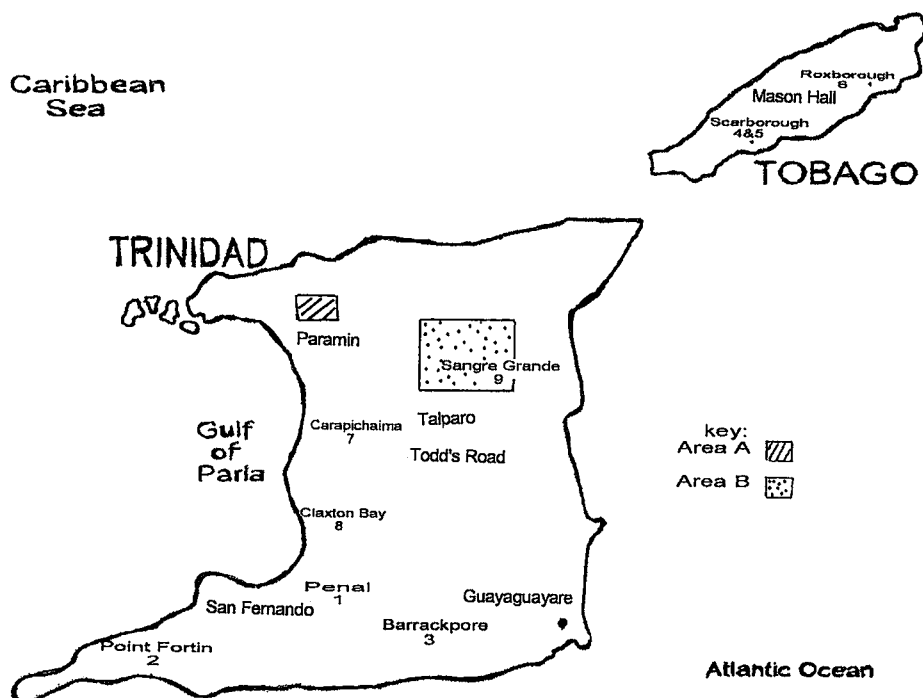
The school essay method used in this research was an adaptation of that used by Sutton and Orr (1991) in Bong County, Liberia. Sutton and Orr claim this essay approach reduces the following biases that arise in the interviewer role:

1. Modelling bias is the projection of the interviewer's views onto those studied. Using essays confines this modelling bias to the various socio-cultural sub-groups, for example children and their parents or neighbours. In this research I would consider this type of bias in the following way: when the students were speaking to their parents and neighbours about 'bush' the researcher was not present to influence the discussion. However when I interviewed the key respondents the students had spoken to, my attitude was that 'bush' was a researchable topic. This sometimes led these key respondents to suggest that I check books or specialists for information, i.e. a more 'official' source, rather than themselves. However 'unofficial' information had been considered 'good enough' for the original student's essay.
2. Strategic bias is the expectation of benefits by the subject (Sutton and Orr, 1991). Writing an essay to please the grader would be a form of strategic bias, also respondents who expect money or gifts in exchange for information.
3. Familiar and less restrained prior relationships between interviewer/interviewee, [children and parents/neighbours], reduces acquiescence and response set answers, and the biases of an outsider. In addition, illiterate and remote people can be reached, and many interviewers should give many points of view.

The school essay method involved 242 students from nine secondary schools geographically spread throughout Trinidad and Tobago. The sampling frame was the national telephone list of 95 secondary schools. An initial sample of 26 schools was chosen to include the following variables: rural, urban, ethnicity, gender and geographical spread. Port of Spain and environs, the East-West corridor, and the second city of San Fernando are considered urban; the larger the distance from these areas, the more rural the districts are considered to be. Letters were written to the 26 school principals explaining the research into ethnoveterinary practices, outlining what was required of the students, why their participation

would help the study, and asking permission for their students to participate in February 1995. Schools without phones would have been difficult to work with. Secondary schools were chosen so as to obtain the age group from 12-15. These children would not have been busy preparing for the Common Entrance Exam, taken at age 11, or the 'O' level school-leaving exam taken after age 16. The 20-30% of Trinidad and Tobago children not in school were left out of this method. Also un-addressed is the issue that those children in charge of animals are not evenly spread among schools and non-schooled, or geographically. These factors introduce some bias that could not be controlled.

From this first sub-sample, a final sample size of nine schools was considered to be the maximum that the researcher could deal with in the five-month research period, taking into consideration ongoing teacher industrial action, the expected numbers of essays/questionnaires that would have to be read, the number of students that might have to be contacted again to confirm or explain their responses and the number of respondents that they might identify (Map 2).



Map 2: Geographical location of the chosen schools

Teachers assumed responsibility for the essay method in school 1 Penal, school 3 Moruga, and school 8 Claxton Bay, so the researcher did not speak to these students. After selecting the schools, the students were then visited in their classes. The basics of participatory research (Baldwin and Cervinkas, 1993) were explained to the students, and they were told why their contribution was needed. Classroom teachers reinforced what the researcher wanted from the students after each presentation. The researcher was in each class for approximately 20 minutes in which time the students did not ask any questions about the research. Greater emphasis was placed on whether they understood why their help was needed, and if they understood what they needed to find out and write about. It was also emphasised how the students fitted into the specific research. The students were told about the researcher's field experiences with farmers in Tobago, which provided the initial research question, and they were also told about the final thesis product of a book of Ethnoveterinary Medicine practices. In addition everyone involved in the research process would learn from it, including themselves. The students were then asked to interview parents, friends and neighbours about ethnoveterinary medicines and write what they found in essays. Eight questions were written on the blackboard (Fig. 3.) and the students were asked to consider these eight questions in their interviews, and in their essays. The students were told of the importance of questions 1 and 2 since the information they gathered would have to be checked. The eight questions which were also included in the questionnaires

1. Your name (name of child).
2. Name of person/farmer, address, phone number.
3. Type of animal.
4. How do they know it was sick ?
5. What sickness did the animal have ?
6. Name of plant used.
7. How do they know about this plant ?
8. Do they use the moon to either pick the plant or treat the animal?

Fig. 3. Essay questions

Question 8 was included because it is well known that farmers in Trinidad and Tobago use the moon in their farm performances, what is not clear is how. The essay approach provided an opportunity to obtain a wide variety of answers to this question.

One school in Trinidad out of eight and all in Tobago asked for questionnaires instead of essays. The schools considered these would be easier for the students. Each of these schools received 30 questionnaires, except Roxborough. This exception is explained below. The Essay approach of Sutton and Orr (1991) was altered in the following ways: the students did not have to write the essay in school; they were not required to use good English; have neat writing; or write any specific length of essay. Only the information in the essay was important. The students were promised a prize for the best response. The best responses were those with useful information on a variety of species, that named a variety of plants and how they are prepared. In addition the information in the responses had to be the same as that said by their respondents or other sources.

The students were traced when school began in September 1995 to give them each a small 'prize', and locate their sources. While giving them the prize, based on the information in their essays, the students were asked the names, addresses and telephone numbers of their sources. These sources were then interviewed by phone or in person to verify the information.

Breakdown of the responses by school

Penal

One key respondent was identified from the Penal questionnaires. The Penal students returned 12 forms out of 17 in total. On verifying the information one of these students admitted to inventing the information because he had no one to speak to (a research hazard also experienced by Sofowora (1982). Five other Penal students recorded illnesses that Vets had treated, two mentioned no disease, one was half correct (disease right, treatment conventional), four did not name any plant, and two mentioned commercial drugs.

Sangre Grande

Twelve out of 24 essays from Sangre Grande Junior Secondary were only on dogs and spoke about Cotton bush (*Gossypium* species). One essay which was mainly on dogs led to an experimenting farmer. Two students mentioned a link between cashew and chickens that no one else spoke of and two students provided half of the information collected on rabbits in the entire research.

Point Fortin

There were few essays from this school but they were posted back promptly. This group of essays provided regionally specific information.

Carapichaima

These students returned seven non-useful responses, six were taken from books and the father of one student got the information from a pharmacist. However seven essays provided useful information and another 7 gave details of how to prepare the plants.

Moruga and Claxton Bay

In Moruga the agriculture teacher assumed responsibility and the researcher did not speak to the students, no responses were received from him and he could not be contacted in subsequently. In Union-Claxton Bay the Agriculture teacher assumed responsibility, one essay was done, but the teacher lost it. The Claxton Bay students were in the 4th form like the students from Signal Hill described below.

Tobago

Tobago was visited one week after Trinidad, which meant that the students in Tobago were spoken to in the last week before the close of the semester for the Easter holidays when school had an informal ambience. This may have affected the results. Signal Hill students were older students. Questionnaires from Scarborough produced one respondent. The questionnaires from Roxborough were lost by the children in the June-July holidays and were redone in September 1995. They had useful information but were received too late.

The students described 30 different types of diseases/ conditions, 25 plants and eight non-plant medicines. As expected some students did have their own animals or were helping their families with animals. They were able to share their experiences while others learnt new things. Fifty of the 78 responses were from female students. In Trinidad and Tobago there are more female students than male doing well in school and the trend is increasing at University level. There is also the factor that the female students may have responded better to a female researcher or that children of a certain sex have easier access to certain types of information (Sofowora, 1982).

Carapichaima students produced essays that were well written and detailed. However Point Fortin with a much smaller response rate was second in terms of number of diseases and remedies written about. This shows that it is the content rather than the number of the responses that is important. Students asked both male and female sources for information on folk medicine for livestock. Most of the remedies described fell into the categories of reproduction and internal parasites.

Despite the number of plants named, diseases identified and sources identified, the school essay method involved more work than anticipated. The reasons for the extra work are outlined: Most of the school principals had to be reminded to send back the essays. Most of the students had to be traced to locate their sources of information, since they did not put the name and/or address of their sources of information, or their own addresses and phone numbers. Form 2 students in Carapichaima and Form 3 students in Sangre Grande did not return any essays. This may have been a decision of the teachers. For instance before my presentation in Carapichaima an official looked at the school records to choose the best form for me to speak to. The choice of children from the third form in Penal Junior Secondary, Point Fortin Junior Secondary and Carapichaima Junior Secondary was a mixed blessing. They did '14-plus' exams in June and moved to other schools in September. This meant the researcher had to go to their old school principals with a list of names and find out their new schools. It was therefore more time consuming than speaking to the Form 2 Sangre Grande students who were all still in the same school. The positive factor was that the students in the third form of the three mentioned schools seemed to have taken the essay assignment more seriously. The fourth form students of Signal Hill would have been preparing for 'O level or school leaving exams the following year, and this may explain their non-response. The form 2 Sangre Grande students took the assignment more personally, i.e. used the researcher's name, and wrote about their own pets. The results from Tobago were insufficient and late. A chain referral or snowball sample then became necessary in Tobago.

There was a teacher strike on-going in April 1995, for this reason the researcher did not speak to the students of Penal Junior Secondary school. This school's principal asked for questionnaires since it was her perception that this would be easier for the students. This request was not anticipated so the questionnaire was based on the same questions as the essays so that no bias would be introduced. The Penal school teacher who returned the questionnaire forms sent a note saying that the students did not understand it. Unfortunately this was one of the schools where the researcher did not make a presentation to the students. The difference in effectiveness of essays versus questionnaires may lie in the fact that essays are an integral part of the school system and need no pre-testing or explanation. Questionnaires may not be an appropriate tool for children to request cultural and oral knowledge from their elders. The questionnaire may not have been an appropriate tool for the research; it may have seemed too inflexible. For instance the last three questions ask about the plant used, but as some students pointed out in the questionnaires, some folk medicine is not based on plants. However the essay-writing students included information on non-plant folk medicine without problems.

Judging from the addresses of the children on their essay/questionnaires, the schools 1, 7 and 9 had a student population from a large and predominantly rural area (Map 2), and the geographical spread was sufficient to capture data from multiple rural locations and different ethnic groups. This characteristic of the school essay method proved useful in

assessing which plants are commonly used for the same ailment, and also uncovered a few rare and little known plant species (Lans, 1996).

The school essay/questionnaire method produced poor results in the three schools where the teachers assumed responsibility and the researcher did not speak to the students. This reduced the number of returned (or valuable) responses by 85. In three other schools, only one of two classes spoken to eventually participated, removing 67 possible responses. In one Tobago school, the students lost their questionnaires, further reducing the response rate. In addition individual students in all schools chose not to participate, or either did not know or could not find key respondents (Lans, 1996).

If the key respondents confirmed the information written in the essays it was considered reliable. In addition, some of the information was revalidated in the workshops that followed. The essay method proved valuable as a means of introducing the research to the key respondents. This was important because cultural knowledge is shared in networks of relationships, and the time limits of the research did not allow the researcher to develop the necessary linkages. Sofowora (1982) considers that enquiries made from parents or relations are the most reliable methods of collecting information on folk medicine since parents are not likely to tell their children half-truths about a subject which they know to be part of his school work.

The second step: Interviews with the purposive sample

The second step in the research process involved interviews with respondents identified from the essay/questionnaires. Fifty-three essays and 25 questionnaires produced 80 respondents and information on farm animals and pets. For example 12 essays (50%) from school 9 were on deworming dogs with cotton bush (*Gossypium* species). The researcher selected twenty-eight respondents from the essay/questionnaires for interviews. Selection was based on whether the essay/questionnaire indicated that a respondent had potentially useful information on farm animals. Interviews are an important part of any action research project as they provide the opportunity for the researcher to investigate further, to solve problems and to gather data which could not have been obtained in other ways (Kreuger, 1988; Etkin, 1993; Cunningham, 1993). The interviews with the key respondents were guided discussions, semi-structured by a mental checklist of relevant points. If these key respondents or the later workshop discussions confirmed the information written in the essays/questionnaires, the information was considered valid. Group and individual interviews were held with officials from the Ministry of Agriculture, Land and Marine Resources: 19 Agricultural Officers (AOs) and Agricultural Health Assistants (AHAs) (50% of all employed in this category in 1995) and 27 Extension officers (EOs) (50% of all those employed in this category in 1995) from one East and two South Regional Offices in Trinidad. These officials were the field-based staff who were considered by their peers and superiors to know about ethnoveterinary practices. No information was obtained from the North administrative zone, or from extension officers in Tobago. A group interview is literally an interview with a group of people who have some common characteristics, for instance residence or occupation. It is likely to be more spontaneous than the focus group workshop described below (Agar and MacDonald, 1995; Etkin, 1993).

The officials interviewed discussed what they knew and indicated which Veterinarians were likely to know ethnoveterinary practices; this type of sampling by referral

is called a stepwise or snowball sample. Thirty veterinarians (50 % of all practising) were then contacted (including both of the Veterinarians located in Tobago), and 19 discussed what they knew.

Seven respondents were identified from this set of interviews with the Ministry of Agriculture staff and the veterinarians, and these seven were also asked about ethnoveterinary practices.

The third step: Focus Group Workshops

The third step of the data collection was the conduction of five focus group workshops with 55 of the respondents, AHAs/AAs, and EOs interviewed, as a form of data validation and verification. An information seminar was also given at the Veterinary school. The four workshops included 12 members of the Tobago Sheep Farmers Association (all literate); one AHA based at the Penal Demonstration station (rural south Trinidad, see Map 2), and two key respondents from the area (both semi-literate); 12 extension officers from the south Trinidad regional office; and 12 extension officers servicing the districts of north-east Trinidad.

The group interaction of a workshop minimises the objectification of the respondents as only 'sources of data' (Oakley, 1981). In the workshops the interviewer asks group members very specific questions in a supportive environment about a topic after considerable research has already been completed (Kreuger, 1988; Etkin, 1993). Participants are invited from a target group with knowledge of the research topic (Etkin, 1993). The purpose is to obtain information of a qualitative nature from a predetermined and limited number of people. The group interaction produces data and insights that would be less accessible without the interaction (Morgan, 1988). Some people need others to be encouraged to talk, to refresh their memories, and some topics are better discussed by a small group of people who know each other (Kreuger, 1988; Etkin, 1993). The group interview recognises that attitudes and perceptions are often developed through interaction with other people and individuals may shift due to the influence of other comments. Alternatively, some opinions may be held with certainty (Kreuger, 1988; Etkin, 1993). Rapport in the group was established since most members knew each other. Some introductions were necessary in the Tobago workshop.

All the workshops were fitted into existing institutional arrangements to ease the process of organisation, reduce costs, and increase participation. For instance all workshops with extension personnel took place on a Wednesday which is their office day. All the workshops were one to two hours long. Prior to the workshops, draft booklets on ethnoveterinary medicine were produced based on the information gained from each set of the previously conducted interviews, meaning that a separate draft booklet was prepared for each workshop, with appropriate drawings taken from (IIRR, 1994). Each participant in the workshops was given a copy of the draft booklet prepared from the previous relevant interviews and encouraged to modify it during the discussion. This draft was then reviewed and corrected in the workshop, and dosages were clarified.

Workshop 1. Wednesday September 13 1995. The Poultry Surveillance Unit (PSU) eight officers (of which two were female) and two poultry farmers.

This meeting took place in a spacious Seminar Room of the National Agricultural Disease Control Centre, (NADC). This Workshop was arranged with Dr. Brown and fitted into his PSU Actor-Network, since they were his staff and the two farmers who were also invited had a collegial relationship with him. The two poultry farmers discussed remedies based on field experience. Farmer 1 had an academic background in animal health and managed an operation with a monthly output of 500,000 broilers and 150,000 breeders, from 18 contract farms. Farmer 2 had an operation of 30,000 broilers, with 4 batches a year. Dr. Brown did not attend. This was the only 'professional' workshop in that a draft booklet was easily produced before the workshop and corrected during the workshop because it involved an already established and effectively working 'bush' information network. None of the other workshops fitted into this category. The draft booklet was based on the Poultry Booklet 2 of the IIRR information kit *'Ethnoveterinary Medicine in Asia'* (1994). This publication has no copyright for non-commercial use and contains many similar practices to those in Trinidad and Tobago. Trinidad and Tobago remedies were inserted into this base. Most of the participants had either used the Trinidad and Tobago ethnoveterinary practices or seen them working. They were able to share details about quantities of the 'bush' to be used and how to use the 'bush' in the context of a 'modern' poultry farm. During the discussion the officers were able to explain information from two student essays, the phenomena of roasting cashews and chicken 'pox' are connected in many people's minds because chickens pick through the roasted shells and a chemical on the shells gives them blisters that resemble chicken pox. Subsequent to the workshop Dr. Brown corrected the draft poultry booklet.

Workshop 2. Tuesday September 19 1995. Tobago Sheep Farmers Association. There were 12 farmers of which 3 were female farmers.

This workshop took place as part of the agenda of a regular meeting, so the date was arranged with the President. This Association was created as part of the CARDI-CIDA Sheep Production and Marketing Project (CSP/M) which was the researcher's former project in Tobago. Only two out of nine sources came. The handout was based only on information from Tobago. A few days later the information in the handout was verified with two of the sources that did not come.

Workshop 3. Friday September 22 1995. Penal Demonstration Station one female AHA, two male farmers/ex-Demonstration workers

This workshop was organised with the help of the AHA who arranged the invitations. The extension officers were invited and were on the compound but did not choose to participate. This was the smallest workshop. The various practices that the three participants and the Penal extension officers had reported in the interviews beforehand were examined in detail. Some needed explaining in terms of Hindi religion and culture.

Workshop 4. Wednesday October 11 1995 Victoria County 12 extension officers of which 3 were females.

This Workshop was arranged through the Head of the Extension Unit. The AHA's are part of a different Unit on the same floor, in the same building, and were also invited but didn't want to stay for the afternoon meeting; [they are usually finished work by lunchtime]. This handout was based on information from two group interviews with the Extension officers and AHA's. Some cultural practices were explained, and the meeting also generated new practices that were not mentioned before.

Seminar 1. Wednesday October 4 1995. Lunchtime seminar at Mt Hope Vet school. 30 Students, 6 Veterinarians, 1 Ministry of Agriculture official and 5 staff members of the UWI Medical Sciences group.

The Mt Hope Seminar fitted into a Series of Seminars that are given at the Vet School. Overheads of both the IIRR Ethnoveterinary booklet on pigs, [because very little information on pigs was collected], and the TRAMIL Ethnopharmacology Book, (Robineau, 1991) were used. Copies of the overheads that reviewed existing scientific work were given as one handout. The second handout gave a general definition of ethnoveterinary medicine, the plants discovered that now have current scientific use, and five of the plants mentioned by the Veterinarians. There was a lively discussion after the Seminar. In this discussion there was a more overt questioning of the legitimacy of 'bush' medicine, which was to be expected, given the audience.

Workshop 5. El Reposo demonstration station, St Andrew/St David counties. Present were 12 extension officers of whom three were females, and one Agricultural officer who led the discussion.

The Veterinarian had a staff meeting with his AHA's at the same time so they did not attend. The handout for the Workshop was prepared based on the interview with the resident Veterinarian and using information from other sources since little information was obtained from this group at the initial visit. At the workshop with a very supportive senior staff member, the staff knew all the practices mentioned and added more.

The fourth step of the data collection was the review of secondary data from the University of the West Indies (UWI) library, and other sources.

Appropriateness of the methods used in the first research phase:

The instrument validity (measuring what it was supposed to measure) of the essay method is demonstrated by two results:

1. the similarity of information on poultry in the essays/questionnaires and from the PSU staff, and,
2. the reports in the essays of practices for backyard chickens that were known to the PSU, but not mentioned by them until asked by the researcher.

During the workshop, the PSU staff and the two ethnoveterinary experts were questioned by the researcher about the poultry ethnoveterinary practices mentioned in the essay/questionnaires. The participants knew of the practices and described 'pip' as a 'gristle like membrane, or cuticle' that sometimes grew over the tongues of backyard chickens and could be removed by putting wood ashes on a couple of the fingers of one hand and then using those fingers to twist it off. The ashes served to improve the grip of the fingers on the 'pip'. Participants also knew of the link between roasting cashew nuts and the chicken 'pox', chickens picked through the roasted cashew shells and subsequently developed pox-like lesions on their beaks.

The research revealed that different sections of the researched population knew of different medicinal plants, this knowledge was linked to their culture and occupation. Since some of the information obtained was thus specialist information, it cannot be extrapolated to the community generally (Etkin, 1993). This implies that using the school essay method to obtain a purposive sample was more appropriate to the research situation than a random sample (Etkin, 1993).

The workshops served to coax some dosages from the respondents and verify that the researcher accurately recorded the information from the previous interviews. The cultural aspects associated with some of the ethnoveterinary practices were also discussed in the workshops. This discussion served to classify the plants into those that are used for strictly medicinal purposes, versus others that are used as part of cultural and religious rituals. Since some of the ethnoveterinary medicines are derived from inter-group borrowing, it cannot be assumed that the knowledge was borrowed in a complete and unadulterated form (Lans, 1996). Incorporating details of cultural aspects into the study of ethnoveterinary medicines ensures that future scientific validation is not wasted on plants that are used for cultural or religious reasons (Waller, 1993; Etkin, 1993). This is important not only because of the waste of resources, but because negative results can lead to the destroy confidence in the field (Eigner and Scholz, 1999).

Conclusion first phase data collection

The school essay method proved to be efficient and affordable and provided 'entrance' to the respondents. The method also provided more respondents in Trinidad than the veterinarians and AHAs/Extension officers. As part of the collaborative approach of the research the school principals' request for questionnaires was agreed to. However the essays proved better than the questionnaires. Questionnaires may have seemed too inflexible for students and for informal oral knowledge like folk medicine. Some schools can be considered to have given their students more choice to collaborate with the research or not. This may account for the high non-response in some schools, and may also explain why one student felt obliged to invent information because he found no respondents. The essay method did yield useful quantitative data. The student responses gave a list of plants, their uses and occasionally their preparation. Thirty diseases, twenty-five plants and eight non-plants were described in the essays. Some responses also indicated whether the moon phase was applicable to the remedy or not. Carapichaima Junior Secondary and its very supportive principal produced the best results. The principals who actively supported this research with their students rather than merely giving permission impacted on the information quality of the essays. Other criteria like geographic location in choosing schools

played a lesser role. Workshops were included in the first phase of the research as a collaborative and a participatory method (IIRR, 1994), which also served to coax dosages from the respondents and verify the collected information. The workshop discussions also included the feasibility of the ethnoveterinary practices and any cultural basis for them.

Second phase data collection

The methods include those associated with data collection, and those linked to non-experimental validation. Time and financial constraints limited the number of sites where data could be collected, and the number of respondents within each study site. The research did not need prior approval or official contacts or a department.

The researcher's status was an insider-observer in some respects. The outsider perspective was based on University studies abroad. As an insider the mother of a friend lent her files of newspaper/clippings on medicinal plants and her pressed samples of medicinal plants. Insiders are more cognisant and accepting of complexity and internal variation, better able to understand nuances of language use and less likely to be duped or mistrusted (Wolf, 1996). The researcher was an insider /outsider to the veterinarians as a friend/acquaintance who had a cat boarding at the school for two years. Three veterinarians were occasional participants in the research, one collected information from 34 clients. Some of the staff of the Veterinary school became co-authors in publications based on the first phase of the research. Little hand-made gift bags were given to most respondents in the second research phase.

In order to gain access to the study population the researcher worked through previously known individuals and from previously existing social networks in building a snowball sample (Naiven, 1987). Known people helped in the creation of some networks, by suggesting people who could be interviewed. When respondents in the horse racing industry were contacted it was discovered that they already knew about the research from the initial contact. The process was facilitated by community-based contacts and occupationally based contacts obtained from newspapers. Snowball sampling led to community members who were well recognised as knowing more than the average person knows. A purposive sample of ethnoveterinary key respondents was obtained. A purposive sample minimises negative outcomes. This networking approach was necessary because there was no sampling frame of persons involved in traditional healing. From 1997 - 1999, the researcher conducted research with one group of seven hunters based in south Trinidad¹¹. Participant observation and in-depth interviewing of key respondents are traditional anthropological approaches.

Interviews

The Medicinal Plant Research Checklist (Fig. 4) and TRAMIL questionnaire (Fig. 5) were used as a guide in the semi-structured interviews to ensure that relatively well delineated disease states or conditions were described. Semi-structured interviews were conducted with 25 new key respondents, six herbalists, personnel associated with sporting animals, veterinarians, and six field staff of the Ministry of Agriculture from September 1996

¹¹ Dr. Elmo Bridgewater is a long-standing member of the hunting group and took the researcher and two female veterinarians on these hunting trips.

to 2000. Three particularly knowledgeable respondents were interviewed five times over the four years. The majority of the interviews (95%) took place in Trinidad. In one swamp-based ethnic-Indian community, a female community member was paid to interview fellow community members. Two of five interviewed female herbalists sold herbs in the market and also to individuals. One male herbalist sold bottled herbal products to individuals.

	PLANT DRUG
PLANT COLLECTION	Scientific name, Family Common name(s). Part of plant collected
EXTRACTION AND PROCESSING	Plants(s) used. Plant part(s) (type, amount), Solvent(s) (type, amount), Heat (type, amount), Dosage form (powder, decoction), Storage
DRUG THERAPY	Dosage (amount, timing). Route of administration and method of use (e.g., external, poultice, internal, infusion, ingested), Disorder(s) treated. Therapeutic activity - information from respondent(s) and personal observations, and the scientific literature. Status of use (past or current use), Adjunct therapy (e.g., diet, sweat baths, prayers)
MEDICAL BELIEFS AND SETTING	Practitioners, range of specialties, selection, training, competence (as judged by the community and researcher(s)), Diagnostic tools, techniques and criteria for illness, Criteria for cure of an illness, Cause(s) of illness (natural, supernatural).
COMMUNITY CHARACTERISTICS	Major causes of death and disease. Nutrition level, Culture and language, Natural environment (major plant and animal communities). Source: Croom, 1983.

Fig. 4. Medicinal plant research checklist

TREATMENTS USED FOR:	(local name of the problem)
-Description of the disease:	-First treatment: traditional plants
Healer, Witch doctor	Medical doctor
-Description and manner medicine was prepared:	-How to take the medicine, its quantity and how many times:
-Where do you find the plants?	Yard— Outside the house.....
-Have you ever used this medicine*? YES / NO *control question	-What were the results :
And for the children? (side effects and dose)	-Precautions taken? (Side effects)
Source: Robineau, 1991	

Fig. 5. Sample of questionnaire used by the TRAMIL project

The Interviews were guided by the following criteria:

1. General therapy
2. Disorder treated
3. Practitioners
4. Dosage
5. Route of administration
6. Response to therapy
7. Status of use
8. Patient
9. Cultural and historical information
10. Botanical identification

Interview guides

1. General therapy

The cultural and therapeutic environments were described, including the groups' beliefs in the causes of disease, its symptoms, proper treatment, and cure. Practices sometimes involve social, psychological, symbolic, and ritual aspects that influence the outcome of the therapy.

2. Disorder treated

What is being interpreted when a folk diagnosis is made? Symptoms? Dimensions of the social field? Aspects of personal history? (Good, 1995). Diseases are most often classified according to clinical signs. A disease concept may translate directly to current western medical terminology on a one-to-one basis; for example, sugar means diabetes mellitus, pressure means high blood pressure (Croom, 1983). More general folk concepts like blood purifier that are used for a range of diseases from skin disorders to arthritis are harder to pin down. Personalistic diseases believed to be caused by spirits are culturally defined and perhaps culturally specific ailments (Croom, 1983).

3. Practitioners

The study included interviews with a few of the specialist healers who sell plants in the markets and on some of the main streets in the towns (Mischel, 1959). The largest category of respondents interviewed fell into the category of specialists in home remedies. These are practitioners who do not consider themselves to be healers, but who give remedies to friends and neighbours if they request one (Heinrich *et al.*, 1992). These practitioners know remedies for common or minor illnesses, whereas specialist groups such as midwives and some of the 'older heads' would have specialist knowledge. Some of the practitioners provided information including:

1. their training and background in the medicinal uses of plants, the type of practices they have, and their reputation in the community
2. people treated (e.g. self, family, surrounding community)
3. type of practice: general or specialist
4. diagnostic procedure (dreams, touch)
5. adjunct therapy (e.g. prayer, curing formulas, massage) (Croom, 1983).

4. Dosage

The safety and efficacy of all drugs are influenced by the amount and timing of the dose. Timing involves the frequency, length of therapy, the relationship of the initiation of therapy to the stage of the disease development, and the relationship to meals (i.e., food in the stomach or intestine may influence absorption of the drug). Variation occurs depending on the practitioner, plant used or disorder treated. Exact dosage information is reported if it was available (Croom, 1983).

5. Route of administration

Taking a medicine internally or applying it externally has obvious therapeutic and toxic consequences. Common routes of administration are poultices, baths, lotions or enema, inhalation, teas and chewing (Croom, 1983). The details of therapy may have a significant pharmacological effect. Increased blood flow from the application of heat or massage will enhance the absorption of many drugs. In addition, the extensiveness of the application to the skin or other large surface areas (intestine, lungs) increases the amount absorbed (Croom, 1983).

6. Response to therapy

The practitioner sometimes described signs that showed the effectiveness of the therapy and described which symptoms disappear, thus indicating recovery from the disorder (Croom, 1983).

7. Status of use

The respondent's source of knowledge of the plant remedy was noted; either direct experience in using the plant or seeing someone else use it, or from more indirect sources, i.e. by hearing or reading of the use. Information was also obtained on whether the plant remedy was used only in the past or if it is still in use. Behavioural details were included such as criteria for selection, mode of preparation, therapeutic, nutritional and other objectives.

8. Patient

Individual patients may vary in their response to a drug due to age, sex, weight or physiological state (Croom, 1983). Previous research (Lans, 1996) and current research indicates that most practitioners are aware of this.

9. Cultural and historical information

Repeat interviews and detailed studies of the secondary historical and cultural literature provided information on the consistency of plant use over generation time and geographic space. Content analysis of oral traditions and of folkloric text, literary and dramatic materials provided the necessary details of medical synchronisation and acculturation processes (Etkin, 1993). Traditional therapies often included non-vegetable material, and psychosocial or psychosomatic aspects (like rites, prayers, massages) (Tarbes, 1989; Mischel, 1959).

10. Botanical identification

This was conducted in collaboration with the Herbarium of the University of the West Indies (Fig. 6). The majority of the plants described in this research were authenticated or identified at the University of the West Indies Herbarium. Specimens were not deposited since some of the plants are common. Non-common plants were also not deposited by the Herbarium, due to that institution's policy.

Voucher Herbarium specimens:
a. Genus/species or family
b. Locality
c. Date of collection
d. Surveyor's institution: National Herbarium

Fig. 6. Protocol for the botanical documentation

Collection of secondary data from the University of the West Indies (UWI) library, and other sources took place from 1996 onwards.

Non-experimental validation

Experts in the field consider that validation is still a weak point in ethnoveterinary medicine. Validation took place throughout the research process. This validation aspect of the research represents the fourth phase or reflecting phase in the research cycle. In knowledge-based action there are four major phrases: planning, acting, observing and reflecting (Masters, 1995). The first step was the validation of the medicinal plants used for poultry by checking with the Poultry Surveillance Unit to see which plants were still being used, writing up the information into an article for the Journal of Preventive Veterinary Medicine which then put the ethnoveterinary knowledge through the peer review-publication process. The feedback from the reviewers and editor then shaped the collection of subsequent information. A similar cycle was repeated for the information on ruminants and pet dogs and for hunting dogs and for the plants used in reproductive health. The cycle will be repeated with the information on horses, game cocks and ethnomedicine.

Traditional validation is very costly. It is claimed that only drug companies with sales of US\$5 billion can engage in drug discovery (Lans, unpublished). One factor leading to high costs is that multiple plant mixtures are sometimes used. Etkin (1993) advises that multiple plant mixtures need be taken into account in validation work since there are complex chemical interactions among constituents of a single plant and with mixtures of plants. Other considerations are whether some plants mixed together increase the availability of bioactive compounds, or if preparations diminish toxicity, while retaining therapeutic actions. Plant screening against microorganisms does not always evaluate a plant on its actual use (Heinrich *et al.*, 1992). This research has evaluated the ethnoveterinary plants used for poultry, game cocks, ruminants, pet dogs, hunting dogs, horses, ethnomedicine and reproductive medicine using a non-experimental method (Browner *et al.*, 1988; Heinrich *et al.*, 1992; Table 6). This method consisted of:

1. obtaining an accurate botanical identification
2. determining the extent to which the folk medicinal data can be understood in terms of bioscientific concepts and methods
3. searching the chemical / pharmaceutical literature for the plant's known chemical constituents
4. searching the pharmacological literature to determine the known physiological effects of either the crude plant, related species, or isolated chemical compounds that the plant is known to contain; and
5. assessing whether the plant use is based on empirically verifiable principles, for instance, if the plant is reputed to cause itching or bleeding, the etic assessment will determine if it contains chemical constituents that are capable of causing itching and bleeding. Or, whether symbolic aspects of healing (or hypnosis, social support, placebo) are of greater relevance (Heinrich *et al.*, 1992; Browner *et al.*, 1988) (see Table 6).

The use of these multiple research methods has ensured that the prevalence of local diseases is linked to the identification of plants, and to any future research that seeks to develop plant based drugs. As such there will be no discrepancy between research objectives, future drug development and local needs. The multiple methods also ensured that medicinal plants are separated from religious and culturally – linked plants and that future clinical trials will be undertaken only on the medicinal plants.

Table 6. Non-experimental validation for poultry: review of the ethnomedical literature

Scientific name	Published literature	Chemical constituents
<i>Allium sativum</i>	Robineau, 1991; Ziegler and Stichler, 1989; Khobragade and Jangde, 1996. Weber <i>et al.</i> , 1992	Allicine has antibacterial and antifungal activity, alliin is an antibiotic precursor, antiinflammatory activity, virucidal activity of fresh garlic
<i>Aloe vera</i>	Karaca <i>et al.</i> , 1995. Chinnah <i>et al.</i> , 1992; Davis <i>et al.</i> , 1994; Lal jawahar <i>et al.</i> , 1990; Afzal <i>et al.</i> , 1991	Acemannan, a polydispersed $\beta(1-4)$ -linked acetylated mannan, enhances the immune response to both Newcastle Disease Virus and Infectious Bursal Disease Virus.

An example of symbolism is the existence of elements in Trinidad of the medieval notion that all plants must be associated either by plant morphology, smell or habit with the disease which it was said to heal, the Doctrine of Signatures. The Cabecar of Central America use various species of *Aristolochia* leaves as snakebite remedies in the belief that plants that share a morphological similarity to a dangerous animal have the power to treat wounds caused by that animal (leaves are similar to the triangular head of the *Bothrops* viper) (Davis and Yost, 1983; Hazlett, 1986). Houghton and Osibogun (1993) reviewed research reporting that an ether extract (root) of *Aristolochia* species inactivated *Naja naja atra* venom (chinese cobra) and reduced the haemorrhage caused by *Trimeresurus mucronata* (pit viper). The medicinal plant use based on a medieval relic (The Doctrine of Signatures) was shown to have a valid scientific basis. In addition, *Aristolochia* species is used worldwide as a snakebite remedy (Houghton and Osibogun, 1993). There are many examples of the Doctrine of Signatures providing false leads (Tyler, 2001).

If ethnobotanical data, phytochemical and pharmacological information supports the folk use of a plant species like the *Aristolochia* species above, it can be grouped into the validation level with the highest degree of confidence. Plants at this level are very likely to be efficacious remedies (Heinrich *et al.*, 1992). Heinrich *et al.* (1992) established four levels of validity:

0. If no information supports the use it indicates that the plant may be inactive.
1. A plant (or closely related species of the same genus) which is used in geographically or temporally distinct areas in the treatment of similar illnesses attains the lowest level of validity, if no further phytochemical or pharmacological information validates the popular use. The use in other areas increases the likelihood that the plant is active against the illness.
2. If in addition to the ethnobotanical data, phytochemical or pharmacological information also validates the use in Trinidad and Tobago, the plant is assigned a higher level of validity. Plants in this category may exert a physiological action on the patient and are more likely to be effective remedies than those at the lowest level of validity.
3. If ethnobotanical, phytochemical and pharmacological data supports the folk use of the plant, it is grouped in the highest level of validity and are most likely to be effective remedies (Heinrich *et al.*, 1992).

Part 2: Case studies

Relationships thinking, a possible new paradigm for anthropology locates the organism or person as a creative agent within a total field of relations (Ingold, 1990).

Introduction to the Case Studies

The results are divided into the following case studies:

- | | | | |
|---|-----------------------|-----------------|--------------|
| 1) Pigs | 2) Commercial Poultry | 3) Game cocks | 4) Ruminants |
| 5) Women and ruminant reproductive health | 6) Pet dogs | 7) Hunting dogs | |
| 8) Horses | 9) Ethnomedicine | | |

Folk Medicinal Terms

The majority of folk medicine involves using the entire plant, or the flowers, leaves and roots of a variety of plants. Sometimes these are combined with drug store components (Inniss, 1910). Some non-plant cures are also called folk medicine. Folk medicine also has what Laguerre (1987) calls symbolic association, i.e. plants with yellow flowers, or yellow stems (*Cuscuta americana*) that are used as cures for jaundice.

Folk medicine is based on tisanes, teas, tinctures and poultices. A tisane is a drink made by the addition of boiling water to fresh or dried unfermented plant material. In Trinidad and Tobago a tisane can also be a mixture of folk medicine and drugstore ingredients. It consists of large amounts of plant parts and is given with sugar or epsom salts, in a specific dose for a specific time (Wong, 1976). A tincture is made by macerating or placing plant parts in alcohol either rum, vermouth or brandy. A decoction is prepared by placing the plant material in cold water and then bringing it to a boil, simmering for a certain period and then allowing the solution to stand for a further period (Sofowora, 1982). Pouring a given quantity of boiling water over a given weight of herbal material and infusing creates a tisane or infusion. This is called 'drawing' in local parlance. The tisane is left to steep covered for 10 – 15 minutes before straining (Wong, 1976). A tea is either a decoction or infusion of plant parts, and is made fresh each time. The separation between decoction and infusion is not clear-cut as was also found by Bonet *et al.* (1992, 1999). Teas are taken for 'cooling'. A loch is a decoction of flowers and a large amount of sugar, a syrup (Wong, 1976). Poultices are the most common means of external treatment. The leaves used are usually heated over a flame, or on a baking utensil, the painful area is rubbed with oil or paraffin (soft candle) and then the heated leaf is applied.

Medicinal plants (folk medicine) are grown in house yards, are easily found in adjacent unutilised house plots, or are begged from neighbours. The most common folk medicine can be bought from women selling in the larger markets or on the streets in the cities. Due to increased urbanisation and spraying of weedkillers, some plants are not as common as they used to be.

Case study 1: Pigs

Precisely among the 'weeds', so called, we often find the strongest curative herbs [they] are greatly influenced by the workings of the Moon (Steiner, 1924)

6. Case study 1: Pigs

Abstract

Eight plants are used in ethnoveterinary medicine for pigs. Immortelle (*Erythrina pallida*, *E. micropteryx*) is used to remove dead piglets from the womb. Bois canôt (*Cecropia peltata*) and Bamboo (*Bambusa vulgaris*) leaf decoctions are used for labour pains. The boiled green papaya (*Carica papaya*) fruit is fed to pigs for milk let down. The leaves and flowers of male (*Carica papaya*) plants is fed to deworm pigs. An un-identified plant named white segene (sea jean ?) is used as an anthelmintic. Sour orange juice (*Citrus aurantium*) is given to pigs before Christmas slaughter to remove fat from the meat. Deer meat (*Centropogon comutus*) is used to feed pigs. Coffee grounds (*Coffee arabica* / *robusta*) are given to scouring pigs.

Introduction

In the 1980s there were 527 pig farms. In October 1997, the number of pig farms was estimated at 262, of which 80% were breeding and fattening, while the remaining 57 were fattening only. Small farms of less than 30 pigs were 82% of the farm population and had 5.7 % of the pig population. Medium sized farms of 31 - 100 comprised 3 % of the population and held 1.4% of the pig population. Large farms of over 101 pigs comprised 15% of the farms and held 92.9% of the pig population. The total breeding stock of the country was put at 5075, which was a decline of 10% from 1996. Weaners and fatteners numbered 22,001, which was an increase of 5.3% from 1996 (CSO, 1997). From July - September 1997, 13,390 pigs were sold, 84% of these, or 11,262, were sold slaughtered. The remaining 16% were sold live (2,128). These sale figures declined by 11.9% from 1996. Pork output was 667,8000 kgs; 538,4000 kgs or 80% were sold to supermarkets, restaurants, butchers and other retail outlets. The average pork output per pig was 49.9 kgs. The value of sales was \$9.4 million. This figure is a decline of 7.8% (CSO, 1997); 43% of all pig farmers said their major problem was the high price of feed; 14% said the disposal of pigs was their major problem and 10% claimed the major problem was the irregular water supply (CSO, 1997). The decline in the number of pig farms is due to the market dominance of a few large private farms that carry out integrated operations from production to processing and marketing and account for 80% of total production (Dindial, 1991).

Adesiyun and Cazabon (1996) found *Coxiella burnetii* and *Toxoplasma gondii* in 11.3% and 5.5% respectively of tested pig sera. Adesiyun and Krishnan (1995) isolated *Listeria monocytogenes* serotype 4, *Campylobacter coli* and *Campylobacter jejuni* from pork carcasses at an abattoir in Trinidad indicating a potential health risk to consumers. Cazabon *et al.* (1978) isolated 19 *Salmonella* serotypes from pig carcass lymph nodes after an outbreak of *Salmonella* gastroenteritis. Kaminjolo *et al.* (1993) found prevalence of

Cryptosporidium oocytes was higher in piglets and lambs, than in calves and goats. Kaminjolo and Adesiyun (1994) found that 91.1% of faecal samples of piglets (2 to 8 weeks old) were positive for rotavirus antigen. Tables 7a and 7b show that no serious diseases were confirmed in pigs.

Table 7a. Notifiable diseases confirmed by species, 1998

Case	Cows	Pigs	Horses	Sheep	Goats	Dogs	Total
Anaplasmosis	3						3
Babesiosis	1		6			2	9
Brucellosis	297					5	302
Rabies	26		1	2	1		29
Salmonellosis		1	2			6	86
Tuberculosis	1						1

Table 7b. Notifiable diseases suspected by species, 1998

Case	Cows	Pigs	Horses	Sheep	Goats	Dogs	Total
Campylobacteriosis		5	2			5	43
<i>C. Fetus</i>							
<i>Venerealis</i>							
Anaplasmosis	14						14
Babesiosis	10		54			113	177
Equine Infectious Anemia			10				10
Leptospirosis		1					1
Salmonellosis	14	49	2	2	8	32	531
Rabies	45	3	1		1	3	130
Tuberculosis	4						4

Source: Ministry of Agriculture, Land and Marine Resources. Veterinary Diagnostic Laboratory. Animal Health Sub-Division. Annual Report 1998.

Methods

Thirty respondents, ten of whom were male were interviewed from September 1996 to September 2000 on ethnomedicinal plants. The thirty respondents were obtained by snowball sampling, and were found in thirteen different sites, 12 in Trinidad and one in Tobago. These interviews provided a little information on ethnoveterinary medicine for pigs. Additional information came from one group of hunters. The majority of the plants were identified at the Herbarium of the University of the West Indies but voucher samples were not deposited.

Results

Very little information was found on ethnoveterinary medicines used for pigs. Pig production has become very intensive, concentrated on a few farms, and based on imported drugs so that there are fewer small farmers than in previous decades. Respondents also claimed that pigs did not get sick and that there were few diseases that affected pigs. The ethnoveterinary usages of locally available plants for pigs in Trinidad are summarised in

Table 8. Eight plants are used for medicinal purposes by farmers. One of these plants (seajeau) has not yet been identified.

Table 8. *Ethnoveterinary medicine used for pigs*

Scientific name	Family	Common name	Plant part used	Use
<i>Erythrina pallida</i> , <i>E. micropteryx</i>	Fabaceae	Immortelle	Leaf	Remove dead piglets from womb
<i>Cecropia peltata</i>	Cecropiaceae	Bois canôt	Leaf	Decoction for labour pains
<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Leaf	Decoction for labour pains
<i>Carica papaya</i>	Caricaceae	Papaya	Green fruit	Decoction for milk let down
not identified	not identified	Sea jean		Anthelmintic
<i>Carica papaya</i>	Caricaceae	Papaya	Leaves, flowers	Fed to deworm pigs
<i>Citrus aurantium</i>	Rutaceae	Sour orange	Juice	Juice included in diet before slaughter to remove fat from meat
<i>Centropogon cornutus</i>	Campanulaceae	Deer meat	Plant	Fed to pigs
<i>Coffee arabica</i> / <i>robusta</i>	Rutaceae	Coffee	Grounds	Given to scouring pigs

Moon phases

Animal health assistants claimed that 80% of traditional farmers timed castration operations for pigs according to the phase of the moon. Key respondents reported that farmers claimed castration wounds bled less if the operation was done in the correct phase of the moon, and said that the wound would swell more if the castration was done in the full moon since there was more tissue reaction.

Symbolic beliefs

The Trinidadian hot/cold system is cathartic in that remedies are taken to remove heat from the system (Littlewood, 1988). Linked to the hot/cold dichotomy is a system of blood beliefs where an excess or lack of cold or heat in the body through exposure or diet causes illness. Blood then becomes 'bad' or 'dirty'. Many factors can produce heat including reproductive processes. For example, one respondent's sow had metritis (expressed by fever and a vaginal discharge) and had farrowed five days before. The farmer cut the pigs' ears with a scissors to let out the 'bad blood'.

Discussion

The farmers' beliefs that the phase of the moon influence aspects of pig husbandry is reflected in the scientific literature. Simko *et al.* 1990 studied the cases of sudden death of 6209 fattening pigs over a 20 year period. Deaths were due to heart and respiratory disease. The authors found two maxima and two minima in the cases of sudden death. The maxima

occurred between days 3 and 7 and between days 15 and 21, or between the new moon and the first quarter, and the full moon and the last quarter. Presented below is the non-experimental validation of the folk medicines used to treat pigs.

Non-experimental validation

A bark decoction of *Erythrina* species is used in India and by Tacanas in Bolivia, the Cabecar and Guaymi in Central America and in Peru for wounds, haemorrhage, dysmenorrhea, uterine haemorrhage and as a purgative (Hazlett, 1986; Kapoor, 1990; Jovel *et al.*, 1996; Bourdy *et al.*, 2000). Similar uses are reported for Argentina, Ghana and Guinea (Oliver Bever, 1986; Filipov, 1994). Leaves, stems and roots contain hydrocyanic acid. The bark contains isoflavones, resins, a fixed oil, fatty acids, betaine and choline. Leaves contain several alkaloids, a lectin and agglutinins (Cambie, 1997). An aqueous extract of *Erythrina senegalensis* stem bark showed analgesic and antiinflammatory activity (Saidu *et al.*, 2000).

A decoction of the leaf bud of *Cecropia polystachya* Trécul is used for kidney and back pain by the Tacanas of the Bolivian Amazon (Bourdy *et al.*, 2000). In Nicaragua *Cecropia peltata* is used for diarrhoea, 'bad belly' and to 'wash out the babies' (Barrett, 1994).

Bambusa species fresh leaf juice had a weak ecobolic¹² action on isolated human and rat uteri. Uterine stimulation was due to its action on cholinergic receptors (Kapoor, 1990).

Carica papaya leaves contain papain, chymopapain and lysozyme proteolytic enzymes that may have anthelmintic effects (Oliver Bever, 1986; Satrija *et al.*, 1995). Latex collected from young papaya fruits had anthelmintic activity against *Ascaridia galli* infections in chickens and against *Heligmosomoides polygyrus* infections in mice (nematode groups) (Satrija *et al.*, 1995). The fruit juice of un-ripened fruit of *Carica papaya* probably contains an antihypertensive agent(s) which exhibit(s) mainly alpha-adrenoceptor activity (Eno *et al.*, 2000). Ripe and unripe *Carica papaya* fruits (epicarp, endocarp) produced significant antibacterial activity against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Shigella flexneri* (Emeruwa, 1982).

Deer feed on *Centropogon cornutus* as its local name 'deer meat' implies. This may explain why the plant is fed to pigs.

Coffee arabica is used in Nicaragua for stomach pain (Barrett, 1994).

Conclusion

There are indications that the majority of the plants described contain chemicals that may explain their popular use.

¹² Ecobolics are agents that stimulate contraction of the gravid uterus and hasten expulsion of its contents (Roper, 1987).

Case studies 2 and 3: Commercial poultry and game cocks

Agriculture should strive for solutions that create a ramifying series of solutions rather than solutions that create new problems to be solved. (Berry, 1981 in Zimdahl, 1998).

7a. Case study 2: Commercial poultry¹³

Abstract

Seventeen medicinal plants are used to treat four categories of health problems common to poultry production. Two previously existing health problems (pox and yaws) were also treated with medicinal plants. *Aloe vera*, *Kalanchoe pinnata*, *Citrus* species and *Momordica charantia* were the main medicinal plants being used in the 'modern' poultry sector. The poultry sector is unique in having the Poultry Surveillance Unit (PSU), which offers technical and veterinary assistance to producers (Ministry of Food Production and Marine Exploitation, 1989). The PSU conducted preliminary on-farm investigation with the medicinal plants Aloe, Caraailli, Citrus and found no harmful effects, so the results were disseminated to farmers.

Introduction

Traditionally the Trinidad and Tobago poultry industry has focussed on chickens for meat and eggs (Brown, 1999a). There are fewer amounts of ducks, guinea fowls (*Numida meleagris*) and turkeys (*Meleagris gallopavo*), of which the most commonly kept is the goose called Muscovy duck (*Carina moschata*) (Brown, 1999a). There are also at least 165 broiler farms with a production of 25,000 tonnes of broiler meat (Brown, 1999a). From January to July 1997, 8,653 thousand-broiler chicks were placed. Small farmers placed 3.7%; medium sized farms, 54.6% and large farmers 41.7%. The majority of Trinidad and Tobago's chicken farmers are contract farmers who rear broilers in an all-in-all-out system for two large poultry processing plants (Table 9a). These contract farmers have broiler capacities ranging from 5,000 to 90,000. Of all the placed broiler chicks, 95% were on contract farms. The processing plants supply government institutions, supermarkets and hotels. In 1996 it was estimated that 350,000 chickens were consumed every week. In the first half of 1997, 8,588,000 broilers were produced of which 99.1% were sold wholesale. The estimated liveweight of broilers sold was 17.2. million kgs. The value of these sales was \$TT118.8 million. There was a price decrease of 8% in 1997 as opposed to 1996. Hired labour represented 57.4% of the workers, and unpaid labour 42.6%. There are also small independent broiler operations that supply live birds to small-scale roadside pluck shops where birds are kept in floor-systems until they are slaughtered and dressed for consumers on demand. There are fewer egg producers than broiler operators in the country. There are at least 55 layer farms with a capacity of 477,500 layers and a total production of 3,583,983 dozen eggs. In 1996 it was expected that 2.5 million chicks would hatch from

¹³ Parts of this case study have been previously published as Lans, C., Brown, G. 1998a. Observations on Ethnoveterinary medicines in Trinidad and Tobago. Preventive Veterinary Medicine 35 (2), 125 - 142.

eggs set in August 1996. In 1997 the number of table eggs produced was 2,333,000 dozen. Most of these (99.4%) were sold wholesale for TT\$13.3 million. The 1997 price increased by 3.2% from the previous year. The chicken industry has been referred to as an assembly-type industry since all the inputs; corn, soya, equipment and the majority of the day-old chicks are imported from the USA.

Table 9a. Number and capacity of productive broiler farms in Trinidad by group size and county (May 1997).

Size of group (sq. ft.)	No. of productive broiler farms	Capacity
< 999	3	2275
1000 - 4999	5	24,830
5000 - 9999	17	207,500
10,000 - 14,999	18	300,550
15,000 - 24,999	44	843,006
25,000 - 49,999	43	1,357,676
50,000 - 99,999	17	1,136,550
>100,000	4	893,000
Total	151	4,775,390

Source: CSO, 1997: Poultry Bulletin.

The Inter-American Institute for Co-operation on Agriculture (IICA) supplies Caribbean-based animal disease information. The Office International des Epizooties (OIE) separates important animal diseases into list A, list B and other diseases, list C. List A diseases are those transmissible diseases which have the potential for very serious and rapid spread, across national borders, which are of serious socio-economic or public health consequence and and impact the international trade of animals and animal products like Newcastle Disease Virus (present in Trinidad and Tobago) and highly pathogenic avian influenza (not present in Trinidad and Tobago) (Brown, 1999b). List B diseases are those transmissible diseases which are considered to be of socio-economic and/or public health importance within countries and which are significant in the international trade of animals and animal products (Brown, 1999b). List B diseases are listed in Table 9b below.

Table 9b. Transmissible diseases of socio-economic and/or public health importance

OIE List B diseases	Disease significance	Present in Trinidad
Infectious bronchitis	Affects poultry health, productivity, trade (APHPT)	Present
Fowl cholera	APHPT	Present
Fowl pox	APHPT	?
Infectious bursal disease	APHPT	Present
Marek's disease	APHPT	Present
Mycoplasmosis	APHPT	Present

Table 9b. Transmissible diseases of socio-economic and/or public health importance (cont.)

Non OIE listed diseases	Disease significance	Reported in the region
Colibacillosis	APHPT	Yes
Infectious coryza	APHPT	Yes
<i>Mycoplasma synoviae</i>	APHPT	Yes
Mycotoxycosis	APHPT	Yes
Coccidiosis	APHPT	Yes
Hypoglycaemia spiking mortality syndrome of broilers (HSMS)	APHPT	Yes, emerging disease

Source: Brown, 1999.

List C diseases are those transmissible disease which are not normally notifiable to the OIE but for which the OIE provides guidelines or other information (Brown, 1999b). Infectious Bursal Disease is under better control than in the past. Infectious Coryza and Fowl Cholera have been reduced due to better water sanitation. Colibacillosis can be a profit reducer when management is suboptimal and/or when immunosuppressive conditions are present (Brown, 1999b). The PSU recommends *Aloe vera* for Cocibacillosis. Infectious coryza can cause large losses in affected flocks. Coccidiosis and HSMS can both negatively influence production parameters. HSMS has been recognised in two Caribbean countries. It is probably infectious, characterised by low morbidity and abrupt onset of high mortality (>0.5%) for at least three consecutive days with simultaneous hypoglycaemia in clinically affected birds (Brown, 1999b). To minimise the impact of Newcastle Disease Virus the PSU recommends management practices such as minimising the stress on the immunological system. Newcastle Disease Virus can affect human health causing conjunctivitis. *Salmonella* species can influence poultry health, productivity and food safety. Mycotoxycosis is an issue since some toxins can be transferred through meat and eggs to the final consumer (Brown, 1999b). Pox and yaws are no longer major disease problems. Vaccines are used for viral diseases such as Mareks, Pox, Gumboro, Avian Reovirus, Avian Cephalomyelitis and Infectious Bronchitis. There has been a resurgence of Gumboro in recent years.

Methods

The information on ethnoveterinary medicine for commercial poultry was originally collected in 1995 using the school essay method. Seven of the 78 essay/questionnaires described ethnoveterinary medicine for backyard poultry: the use of lime juice in ducks drinking water for respiratory illness; the use of a decoction of carailli (*Momordica charantia*) leaves for sick chickens; and the yellow exudate of aloe leaf (*Aloe vera*) used to purge chickens. Three essays described 'pip' as a 'rash on the chickens tongue which could be removed by rubbing or scraping it with wood ashes'. One essay indicated that roasting cashew nuts (*Anacardium occidentale*) in the open air was linked to chicken 'pox'.

The researcher rechecked the collected information with the former PSU head throughout 1997 and 1998. One previously mis-identified plant (*Renealmia alpinia*) was collected and identified at the Herbarium. Nine of the hunters and women interviewed from 1996 – 2000 provided similar and new information on ethnoveterinary medicines used for

poultry. In July 2000 a revisit was made to the PSU. At a meeting with all staff a written paper based on the extension methods used by the PSU was discussed. The opportunity was also taken to establish whether farmers still used the same medicinal plants and if any new plants were used.

Results

Only one plant had been introduced to poultry farmers by the PSU subsequent to the first research phase. The plant Tulsi (*Ocimum sanctum*) was mentioned in a paper by Brown and Lans¹⁴ (1998). One PSU member saw the paper and passed the information on through the PSU network. 'Pip' was theorised as a systematic disease - the dehydrated tissue of the tongue shrivels and dies in some backyard situations with suboptimal management. In most cases the medicinal plants and/or extracts are administered via the drinking water which is changed daily. Only fresh plant parts are used. All intensive poultry operations have an open water system. Bell or trough-type automatic drinkers are gravity fed from overhead storage tanks. Tank sizes range from 45 to 1200 US gallons. The ethnoveterinary usage of locally available plants for commercial poultry in Trinidad are summarised in Table 10. Seventeen medicinal plants are used for medicinal purposes by poultry keepers.

Table 10. Medicinal plants used by poultry farmers and poultry keepers

Scientific name	Family	Common name	Plant part used	Use
<i>Allium sativum</i>	Liliaceae	Garlic	Bulb	Reduced appetite
<i>Kalanchoe pinnata</i>	Crassulaceae	Wonder of the world	Leaves	Reduced appetite
<i>Momordica charantia</i>	Cucurbitaceae	Carailli	Vine	Reduced appetite
<i>Neurolaena lobata</i>	Asteraceae	Z'herbe á pique	Leaves	Reduced appetite
<i>Chrysobalanus icaco</i>	Chrysobalanaceae	Ipecak		Pox
<i>Citrus aurantifolia</i>	Rutaceae	Lime	Juice, pulp	Yaws
<i>Citrus aurantifolia</i> , <i>Citrus limonia</i> , <i>Citrus aurantium</i>	Rutaceae	Citrus species	Juice, peel	Respiratory conditions, heat stress
<i>Coffee arabica</i> / <i>robusta</i>	Rutaceae	Coffee	Grounds	Respiratory conditions
<i>Eryngium foetidum</i>	Apiaceae	Chadron bënëe	Leaves	Respiratory conditions
<i>Momordica charantia</i>	Cucurbitaceae	Carailli	Vine	Respiratory
<i>Pimenta racemosa</i> var. <i>racemosa</i>	Myrtaceae	West Indian Bay	Leaves	Respiratory
<i>Ricinus communis</i>	Euphorbiaceae	Carapate	Leaves	Respiratory

¹⁴ A company called Indian Herbs in Bangalore, India had a product called Zèestress with extracts from *Ocimum sanctum* and *Withania somnifera* which was used as a drinking water additive for immunomodulation and against stress in poultry. The active ingredients were said to be saponosides and steroidal lactones (Brown and Lans, 1998).

Table 10. Medicinal plants used by poultry farmers and poultry keepers (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Aloe vera</i>	Liliaceae	Aloe	Gel	Enhance liveability
<i>Kalanchoe pinnata</i>	Crassulaceae	Wonder of the world	Leaves	Enhance liveability
<i>Ocimum sanctum</i>	Lamiaceae	Tulsi	Leaves	Enhance liveability
<i>Azadirachta indica</i>	Meliaceae	Neem	Leaves	Ectoparasites
<i>Cedrela odorata</i>	Meliaceae	Cedar	Leaves	Ectoparasites
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Ectoparasites
<i>Momordica charantia</i>	Cucurbitaceae	Caraaili	Vine	Ectoparasites
<i>Petiveria alliacea</i>	Phytolaccaceae	Kojo root	Leaves	Ectoparasites
<i>Renealmia alpinia</i>	Zingiberaceae	Mardi gras	Leaves	Ectoparasites
<i>Eryngium foetidum</i>	Apiaceae	Chadron b��n��e	Leaves	Meat quality

Respiratory conditions

Z'herbe    pique (*Neurolaena lobata*) is either boiled and the liquid placed in the drinking water or blended and the resulting liquid put into the drinkers. 1810-2270g of caraaili (*Momordica charantia*) leaves are boiled for one hour in 11.4 liters of water, and the resulting liquid is put in the drinking water. Wonder of the world leaves [70 leaves for 2000 chickens] are simply blended, and the liquid extracted and put into the drinking water. Caraaili has been seen in use by the PSU staff on 60 farms, but wonder of the world, garlic, coconut water and z'herbe    pique are used on approximately nine farms.

For respiratory conditions and heat stress, the juice of lime (*Citrus aurantifolia*), lemon (*Citrus limetta*) or sour orange (*Citrus aurantium*) is put into the drinking water for as long as supplies last, or for as long as the problem persists. Citrus peels, placed in a perforated bag in the water tank, are sometimes used to supplement the juice. PSU staff have seen the use of citrus on 50 farms. Chadron b  n  e leaves (*Eryngium foetidum*) are boiled and added to the drinking water. Boiled caraaili (*Momordica charantia*) stems and leaves are also used for respiratory conditions. For 10,000 chickens, 908g of caraaili and 20 bay leaves (*Pimenta racemosa*) are used in four liters of water. The mixture is put in the drinking water [250 litres], with molasses for improved palatability, for three to five days. This practice is used on 60 farms.

Enhanced liveability

Aloe vera is used in the first two weeks of the chicks' life in an attempt to enhance liveability. This practice was seen on 60 farms, and farmers claim it is effective in giving better performance based on weight/age. Farmers reported peeling and cutting half of one large aloe leaf, [for 4000 chickens] and putting it in a perforated bag in the water tank prior to and after vaccination, or the aloe gel is blended and added directly to the water tank. Another plant used by six farmers to enhance liveability is wonder of the world. The extracted juice of this plant is blended and the resulting liquid is added to the water tank for five days after vaccination.

Reduced appetite

For reduced appetite chickens are given crushed garlic (*Allium sativum*) sprinkled on the food, or coconut water (*Cocos nucifera*) in the drinking water. Other remedies involve the leaves of one of three plants: z'herbe á pique (*Neurolaena lobata*), caraaili or wonder of the world (*Kalanchoe pinnata*).

Ectoparasite control

Forty farmers use the leaves of kojoroot (*Petiveria alliacea*) or the leaves of caraaili (*Momordica charantia*), neem (*Azadirachta indica*), black sage (*Cordia curassavica*), wild balisier (also called mardi gras) (*Renealmia alpinia*) or cedar (*Cedrela odorata*) to repel ectoparasites from chickens and ducks and their environments. The leaves are placed in the nest boxes and/or the litter.

Diet

In backyard systems chickens are kept housed for two to three weeks before being slaughtered and eaten. This is done so that they can be fed commercial feeds instead of picking up anything from the yard. During this housed period chickens can be fed with chadron bënëe (*Eryngium foetidum*) to improve the meat quality and taste.

Farmer-managed medicinal plant research

Holders of indigenous knowledge like ethnoveterinary knowledge, have learnt what they know through a creative discovery process, rather than through a process of passive accumulation (O'Brien and Butler Flora, 1992; Bebbington, 1994). Some farmer-experimenters are less concerned with replication and comparison and more concerned with fitting available resources to the changing circumstances of the farming situation, so that they make it through the season (Richards, 1989). Farmers quasi-experiments may not meet all the validity standards of the objective sciences, but they can give useful results of product performance and produce 'good enough' knowledge over a wide range of environmental conditions (Walter, 1993). Little applied ethnomedicinal research is conducted in the Caribbean (C. Seaforth, Department of Chemistry University of the West Indies, pers. comm., 1995), so Expert 1 conducted his own experiments, and he encouraged his 18 contract farmers to use those plants which proved effective. His managerial position gave him access to the money and flock sizes necessary to experiment. Three of his quasi-experiments are described below:

1. 10,000 chicks were divided into a control, and two treatment groups; one with wonder of the world (*Kalanchoe pinnata*), and a second with commercial vitamins. The treatment groups were better than the control, but showed no difference in combating debeaking stress and vaccination stress. Expert 1 described absence of stress as 'brighter chicks, with increased feed intake', and claimed to have four years of success with this medicinal plant, whose use he claimed was cheaper than commercial vitamins.
2. Caraaili was seen to have reduced the expected mortality of an Aspergillosis-infected flock of 10,000 broiler chickens in 1992. Subsequently, Expert 1 conducted a quasi-experiment with two treatment groups and a control. 130 chickens were divided into three groups: one group of 50 chicks were infected with Aspergillosis at 10 days old, and given a caraaili extract; the second group of 50 chicks, were left uninfected and were given the

caraaili extract; the third group of 30 chicks were left uninfected and were not given the caraaili extract. The source of the Aspergillosis infection was bagasse litter.

Expert 1 claimed that a typical Aspergillosis outbreak resulted in a mortality of 18%. However this expected mortality did not develop in the above quasi-experiment. Instead there was 4% mortality and the survivors gained 1.4 to 1.6 kg in 7 weeks. The uninfected birds with the caraaili achieved a weight gain of 1.82 kg in the seven weeks, while the control birds achieved a market weight of 1.72 to 1.77 kg. From these results Expert 1 concluded that caraaili reduced the severity of the disease and increased appetite. In the workshop with the PSU he recommended 2.3 kg. of caraaili leaves for 10,000 birds, boiled in 18.3 liters of water. One litre of the resulting liquid is added to the barrel of water. Further observations on his part revealed that increasing the amount of caraaili used from 2.3 kg of leaves to 3.7 kg also increased mortality rates.

3. Garlic was tested over time to determine if it could be used to reduce a flock's respiratory reaction to the Newcastle Disease Virus vaccine. Garlic (454 g) blended in water to produce a litre of liquid was tested in combination with one litre of lime juice. Both were put in the drinking water with molasses for increased palatability. This mixture was found to reduce the severity of the respiratory vaccine reaction if given immediately after the vaccine. It was also claimed that this mixture would reduce the severity of a rolling vaccine reaction.

Discussion

Scientist-managed medicinal plant research

In the last decade the PSU conducted preliminary on-farm investigations with aloe, caraaili and citrus (Ministry of Food Production and Marine Exploitation, 1989). These remedies were then disseminated, once they were seen to have had no harmful effects and did not negatively impact on production parameters (Ministry of Food Production and Marine Exploitation, 1989). Chand and Gurung (1991) discuss a methodology of informal research conducted with farmers in Nepal. Gaus and Hogel (1995) make a call for new trial designs and study components that meet both the specific demands of unconventional therapy and keep the high methodological standard of controlled clinical trials.

Mtambo *et al.* (2000) found no prophylactic or therapeutic value of a combination of *Capsicum frutescens* (red pepper), *Citrus limon* (lemon) and *Opuntia vulgaris* (prickly pear) against Newcastle Disease Virus in domestic fowl. The plant extract also showed a negative effect on body weights in domestic birds with Newcastle Disease Virus. Johnson and Pargass (2001) examined whether orally administered doses of *Aloe vera*, *Kalanchoe pinnata* and levamisole™ could produce immunomodulating effects in broiler chickens. There were no significant differences for immunomodulatory activity between the two medicinal plants groups and levamisole (positive control). The titres to the Newcastle Disease vaccine provided some evidence to suggest that *Aloe vera* and levamisole™ were immunostimulatory while wonder of the world (*Kalanchoe pinnata*) was immunosuppressive. The group treated with *Kalanchoe pinnata* had a significantly higher final weight than the negative control (plain water) but not significantly higher than the groups treated with *Aloe vera* and levamisole™. A taste test (of 20 people) indicated that people liked the taste of the *Kalanchoe pinnata* treated chicken the least.

Crude ethanol extracts of the leaves of 43 Jamaican plants produced varying acaricidal effects on the engorged cattle tick (*Boophilus microplus*) (Mansingh and Williams, 1998). Acaricidal indices (AI) for the crude plant extracts ranged from 50 to 100. Among the plants studied were *Momordica charantia* (AI = 71), *Azadirachta indica* (AI = 68) and *Petiveria alliacea* (AI = 66). Hassan *et al.* (1994) found that *Rhipicephalus appendiculatus* tick larvae are attracted to *Acalypha fruticosa* leaves perhaps because an odour from the leaves contained a chemical that mimics pheromones. Mwangi *et al.* (1995) found total repellence of all instars of *R. appendiculatus* on green *Melinis minutiflora* due to the presence of a strong volatile chemical which was repulsive to the ticks (see also Thompson *et al.*, 1978). Certain birds like South American monk parakeets bring green leaves containing volatile compounds to their nests in the breeding season. Indian house sparrows use *Azadirachta indica* leaves (Furlow, 2000). Researchers suggest that this behaviour is linked to ectoparasite control.

Presented below is a selection of biomedical data that specialists can use to assess the merit or demerit of the folk medicinal claims made in the previous section by the poultry farmers.

Aloe vera contains mannose-6-phosphate, phosphatidyl choline and arachidonate, which have wound healing and antiinflammatory properties (Davis *et al.*, 1994; Lal jawahar *et al.*, 1990; Afzal *et al.*, 1991). Acemannan is a polydispersed $\beta(1-4)$ -linked acetylated mannan found in *Aloe vera* (Karaca *et al.*, 1995). Chinnah *et al.* (1992) showed that the immune response of chickens to Newcastle Disease Virus was enhanced by the addition of this acemannan to the vaccine. Nordgren *et al.* (1992) showed that this acemannan enhances the protective efficiency of a Marek's disease vaccine. Karaca *et al.* (1995) used cultures of normal chicken spleen cells and HD 11 cell lines to show that acemannan-induced nitric oxide synthesis may be mediated through macrophage mannose receptors *in vitro*. The authors suggested that macrophage activation may be accountable for some of the immunomodulatory *in vivo* effects of acemannan.

Garlic and its component allicine have antibacterial and antifungal activity (Robineau, 1991). Ziegler and Stichler (1989) found that alliin was an antibiotic precursor. Garlic showed antiinflammatory activity comparable to certain steroid and non-steroid antiinflammatory drugs according to Khobragade and Jangde (1996). Weber *et al.* (1992) found virucidal activity of fresh garlic extract and four garlic compounds against six selected viruses.

Citrus pulp contains citric and malic acids, pectin and flavonoids (Robineau, 1991). Bakhiet and Adam (1995) report that *Citrus* species contain the flavonoids hesperidoside, naringoside and eryodictyoside which play a role in vascular resistance. The essential oils from *Citrus* peels show *in vitro* broad-spectrum antibacterial activity (Robineau, 1991). Aqueous decoctions of citrus species have shown antimycotic, antihæmorrhagic and antibacterial activity (Robineau, 1991). Lime and sour orange have more Vitamin A than the other species. Vitamins A, C and E play a role in immune response (Latshaw, 1991).

Chrysobalanus icaco is used as an astringent in Trinidad and as an antiseptic in Haiti (Wong, 1976; Duke, 2000). *Chrysobalanus icaco* methanol extract had antiangiogenic potential and contains catechin tannins (Verna and Raychaudhuri, 1972; Alves *et al.*, 2000).

Cocos nucifera is used for 'bad belly', diarrhoea and internal parasites in Nicaragua (Barrett, 1994).

Petroleum ether and alcoholic extracts of *Cordia francisci*, *Cordia myxa* and *Cordia serratifolia* leaves had significant analgesic, antiinflammatory and antiarthritic activities in the rat. Four flavonoid glycosides (robinin, rutin, datiscoside, and hesperidin), one flavonoid aglycone (dihydorobinetin), and two phenolic derivatives (chlorogenic and caffeic acid), were present (Ficarra *et al.* (1995).

An infusion of 10 g *Kalanchoe crenata* leaves per litre of water has been shown to prevent avian coccidiosis in domestic poultry (Guèye, 1999). Costa *et al.* (1994) found curative properties of *Kalanchoe* plants associated with action on the immune system. *Kalanchoe pinnata* has *in vitro* antifungal, antibiotic, antibacterial, antiinflammatory, analgesic and immunostimulatory activity (Robineau, 1991; Pal and Nag Chaudhuri, 1989, 1991; Silva *et al.*, 1995; Pal *et al.*, 1999). Almeida *et al.* (2000) demonstrated that *Kalanchoe pinnata* leaf extracts inhibited *in vitro* lymphocyte proliferation and showed *in vivo* immunosuppressive activity. Fatty acids present in *Kalanchoe pinnata* (palmitic acid, stearic acid and traces of arachidic and behenic acids) may be partly responsible for its immunosuppressive effect *in vivo*. The bufadienolide (bryophyllin B) showed antitumour activity (Supratman *et al.*, 2000). Flavonoid rhamnosides found in *Kalanchoe* species showed immunomodulatory activities (Costa *et al.*, 1994). A flavonoid fraction was responsible for antihistamine activity (Nassis *et al.*, 1992).

Momordica charantia contains alpha-eleostearic acid, lineolenic acid and palmitic acid are present, and the plant contains nutritionally useful quantities of iron, calcium, vitamin B, phosphorus and amino acids (Yuwei *et al.*, 1991; Robineau, 1991). Lal jawahar *et al.* (1990) found that the ether insoluble fractions showed dose-related antiinflammatory activity.

Neurolaena lobata hexane and ethanol extracts contain sesquiterpenoid lactones of the neurolenin and furanoheliangolide type (Passreiter *et al.*, 1995; François *et al.*, 1996; Borges-del-Castillo *et al.*, 1982; Berger *et al.*, 1998). *Neurolaena lobata* sesquiterpenes had antimicrobial, antimalarial, antinociceptive and antibacterial effects (Scholz *et al.*, 1994; Gracioso *et al.*, 1998; Passreiter and Medinilla Aldana, 1998; Cáceres *et al.*, 1998; Lentz *et al.*, 1998; Gracioso *et al.*, 2000).

Tulsi (*Ocimum sanctum*) ethanol extract showed a stress alleviating effect and antiinflammatory activity. It also showed CNS activity in rats that may involve dopaminergic neurones (Sakina *et al.*, 1990; Singh and Majumdar, 1999; Archana and Namasivayam, 2000). *Ocimum sanctum* contains monoterpenes in the essential oil and apigenin, apigenin-7-O-glucuronide, luteolin, luteolin-7-O-glucuronide, molludistin, orientin and ursolic acid in the leaves (Archana and Namasivayam, 2000; Ahmad and Beg, 2001). *Ocimum sanctum* dry leaves in rations may provide limited protection for chicks from immunosuppressive effects of Infectious Bursal Disease (Sadekar *et al.*, 1998). An *Ocimum gratissimum* extract at a 1:10 dilution inhibited the growth of pathogenic fungi *Basidiobolus haptosporus* and *B. ranarum* but did not inhibit that of *Aspergillus fumigatus*, *Geotrichum candidum* and *Candida albicans*. *Ocimum gratissimum* extract inhibited the growth of *Trichophyton rubrum* and *T. mentagrophytes* at 1:10 dilution (Nwosu and Okafor, 1995). Aqueous extracts of *Ocimum gratissimum* showed analgesic and spasmolytic activities (Aziba *et al.*, 1999).

Petiveria alliacea has a strong smell of onions or garlic due to the presence of isoarborinol, isoarborinol-cinnamate and sulphide compounds (Morton, 1981; Duke, 2000). This strong smell was claimed to drive away ectoparasites and snakes. A similar belief that leaves of a strongly smelling plant (*Thamnosma rhodesica*) repels ectoparasites exists in Botswana (Guèye, 1999).

Eugenol, methyl chavicol, 1,8-cineole, caryophyllene, chavicol, copaene, geranial, geraniol and neryl acetate among others are found in *Pimenta racemosa* (Duke, 2000). Eugenol has antibacterial properties and is also a local anaesthetic (Duke, 2000).

Ricinus communis ethanolic leaf extract showed activity against herpes simplex type-1 virus and vesicular stomatitis virus (Ali *et al.*, 1996). Plants contain an alkaloid (ricinine), a diterpene (casbene), as well as ascorbic and other acids (Cambie, 1997).

Azadirachta indica contains triterpenoids (limonoids), all of which are active against more than 200 insect species (Berger and Mugoya, 1995; BOSTID, 1992; Robbers *et al.*, 1996).

The use of cedar bark (*Cedrela odorata*) for poultices is documented in Morton (1981), while fresh or powdered Neem leaves are used in Asia, and cotton wool ashes are used in India (IIIR, 1994). *Cedrela* species contain tetranortriterpenoids in the leaves which may act as insect deterrents (Marcelle and Mootoo, 1981; Veitch *et al.*, 1999).

Renealmia alpinia plant contains diterpenes and proanthocyanins and a labdadienol in the seed oil (Wilbert, 1996; Zhou *et al.*, 1997).

Eryngium foetidum is used for respiratory problems in the Caribbean and in Nicaragua (Honychurch, 1986; Barrett, 1994). Chadron b  n  e (*Eryngium foetidum*) leaves are rich in calcium, iron, riboflavin and carotene (Robineau, 1991). The hexane extract is rich in phytosterols (stigmasterol, the main component 95%), alpha-cholesterol, brassicasterol, campesterol, beta-sitosterol, delta 5-avenasterol, delta (5)24-stigmastadienol and delta 7-avenasterol (Garc  a *et al.*, 1999a). Simon and Singh (1986) found antimalarial activity against *Plasmodium gallinaceum*. The antiinflammatory effects of the leaves were confirmed (Garc  a *et al.*, 1999a). *Eryngium foetidum* has been categorised in TRAMIL Category B, for the folk uses diarrhoea, gastralgia, hypertension and respiratory problems.

A possible explanation for the link between roasting cashew nuts (*Anacardium occidentale*) and the 'chicken pox' mentioned in the student essays is the presence of cardol and anacardic acid in the oil of the fruit pericarp. This oil produces poisonous fumes when seeds are burnt in the open. The oil can cause blister formation (Tan, 1981).

Conclusion

Chicken farmers have rediscovered ethnomedicine because of economic constraints (Lans, 1996; Ministry of Food Production and Marine Exploitation, 1989). Rapid turnover of flocks enables speedy replication of ethnoveterinary experiments on various farms. The results of this informal research are then shared in a knowledge network of colleague-farmers and PSU staff (Lans, 1996). It is not known whether the mode of action of garlic in reducing the severity of the respiratory reaction to the Newcastle disease vaccine, is in fact a positive one.

7b. Case Study 3. Game cocks

Abstract

This case study documents ethnoveterinary medicines used to treat game cocks in Trinidad and Tobago. The data was collected from July to September, 2000. Seven trainer/owners were visited and interviewed. *Citrus aurantium* juice and pulp are used to clean and toughen the birds' skin. Eyebright (not yet identified) and plantain (*Plantago major*) leaves are used for injuries to the eyes. Plant tips of worm grass (*Chenopodium ambrosioides*) and *Gossypium* spp. are used as anthelmintics. Aloe (*Aloe vera*) gel is used for internal injuries. The yellow sap from the cut *Aloe vera* leaf or the juice of *Citrus limonia* is used to purge the birds. Gru gru boeuf (probably *Acrocomia ierensis*) kernel oil was used in the past for cheating during cockfights. The ethnoveterinary uses of the plants are similar to their human folk medicinal use in other countries.

Introduction

The early Spanish and/or French colonists probably introduced cock fighting to Trinidad (Moodie-Kublalsingh, 1994). It is presently an illegal sport and has been an illegal activity for at least the last century. It should be noted that keeping game cocks is not an illegal activity in Trinidad. Cock fighting previously took place at community gayelles in rural areas distant from official scrutiny. Nowadays cockfighting takes place at one urban gayelle. Trainers supervise game cock training and the birds are kept in stables. The term's 'trainer' and 'stable' are borrowed from horse racing and many participants (especially in earlier times) participate in both sports. Although illegal, the 'sport' still attracts a few hundred participants. The cockfighting season lasts from December to July (primarily the dry season). The birds start moulting in August. Birds are imported from Spain, Cuba and Venezuela. Local birds are also exported to St. Lucia and were previously exported to Venezuela. Moodie-Kublalsingh (1994) recorded some of the folk medicine associated with cock fighting. There are references to a big wasp called 'cojón de toro', and a plant called 'matapuelco' that were used to make cocks fearless (Moodie-Kublalsingh, 1994). Except for a description of a small corn at the base of the plant that had a milky juice, the plant was not botanically identified. The pulverised fresh plant or the juice of *Eupatorium ayapana* was applied to the wounds of fighting cocks in Puerto Rico in the 1800s (Ewen, 1896).

Data collection

The data was collected from July to September, 2000. A veterinarian who had clients with game cocks was contacted and he provided the names and phone numbers of six owner/trainers. Telephone contact was made with those individuals, but only one knew about plants other than aloe (*Aloe vera*) and worm grass (*Chenopodium ambrosioides*). That owner was visited and interviewed. Snowball sampling (Nalven, 1987) was used to identify three trainer/owners, and two well-known cock fighters who also owned race horses. These five were visited and interviewed. A stable observed on a field trip was also visited and the owner interviewed. During these interviews the plants and their uses were described

by the owner/trainer, the birds were displayed and the preparations for fights were described.

Results

The ethnoveterinary usages of locally available plants for game cocks in Trinidad are summarised in Table 11. Nine plants are used for medicinal purposes by owner/trainers. One of these plants (*gru gru boeuf*) was tentatively identified from the literature but eyebright has not yet been identified.

Table 11. Medicinal plants used by trainers and owners for game cocks

Scientific name	Family	Common Name	Plant part used	Use
<i>Citrus aurantium</i>	Rutaceae	Sour orange	Juice, pulp	Toughen and clean skin, respiratory problems
Not yet identified	-	Eyebright	Leaves	Ocular injuries
<i>Plantago major</i>	Plantaginaceae	Planten	Leaf juice	Ocular injuries
<i>Chenopodium ambrosioides</i>	Chenopodiaceae	Worm grass	Plant tops	Anthelmintic
<i>Gossypium</i> sp.	Malvaceae	Cotton bush	Leaves	Anthelmintic
<i>Aloe vera</i>	Liliaceae	Aloes	Gel	Internal injuries, 'thinning the blood'
<i>Aloe vera</i>	Liliaceae	Aloes	Yellow sap from cut leaf	Purgative agent
<i>Citrus limonia</i>	Rutaceae	Lemon	Juice	Purgative agent, respiratory problems
<i>Acrocomia aculeata</i> * <i>A. ierensis</i> *	Arecaceae	Gru gru boeuf*	Kernel oil	Cheating by making skin greasy

* Tentative identification

Role of the trainers

The birds are considered to be strong tempered with a natural fighting instinct. At nine months they are considered to be the equivalent of 17 human years and they start to 'tread'. 'Tread' in this context means challenging the other males and trying to control territory and females. The trainer uses various exercises to strengthen the birds' wings, build up their thighs and increase their stamina. Practice fights (sparring) also take place in training gayelles that contain sand or sawdust. During these sparring sessions a protective covering is tied on the spurs to minimise serious injury to the other cock. However their beaks can still cause injuries. The cocks are allowed to spar for five to ten minutes. These practice fights are also used as a test to determine the cock's best fighting weight. The spurs are also checked to ensure that they are normal in shape and size. The leg feathers are trimmed for competition so that the physical development of the leags and injuries can be

seen. The comb is removed because it is an impediment when it falls over the eyes and both comab and wattle are very susceptible to injuries during fighting. The operation is done three days before or after the waxing (first quarter) or waning moon (last quarter). No medication is put on the sites after removal of the comb and wattle. The bird is said to become more aggressive if no medication is applied.

Diet

Game cocks are fed a diet consisting of orange juice, plenty of fruit, wheat germ and root crops (e.g. yam, cassava and sweet potatoes). Some individuals allegedly spend US\$1600 - 3200 to maintain thirty birds in the training season. The diet also includes brandy and raw eggs, which are used to increase the size and weight of the birds. Corn and chickpea (*Cicer arietinum*) together with fresh ghee are added to the diet during the fighting season.

Massage

Trainers/owners use bay rum to massage the birds. Bay rum is a mixture of bay oil that is extracted from leaves of *Pimenta racemosa*, alcohol and water. To clean and toughen the skin of the cock and prepare it for battle, birds are bathed with the juice and pulp of sour orange (*Citrus aurantium*) and bay rum.

Injuries

Eye injuries are treated with the juice squeezed from planten leaves (*Plantago major*) and a plant called eyebright that has not yet been identified. The gel from the Aloe (*Aloe vera*) leaf (2 ounces over 3 days) is pushed down the bird's throat for internal injuries / bleeding.

Respiratory problems

Respiratory problems are treated with a combination of honey and sour orange or lemon (*Citrus* species).

Deworming

Worm grass (*Chenopodium ambrosioides*) is used by all the respondents in the off-season, but in the fighting season anthelmintics (developed for humans and dogs) were used for convenience. Most respondents give the birds an undiluted infusion of *Chenopodium ambrosioides* to drink and claimed to have no fixed dose. One respondent combined the worm grass with Epsom salts and soft candle (whale oil). The ingredients were mixed and made into a little ball and pushed down the throat of the bird. The worm grass infusion or anthelmintic was given when the respondents saw worms in the faeces or brown-coloured stool. A decoction of *Gossypium* sp. is given as the drinking water. Caution about the dosage (6 plant-tops with young leaves for 10 birds) was expressed. The yellow sap under the green epidermis of the *Aloe vera* leaf is used to purge birds after deworming. Some respondents remove the green skin from the *Aloe vera* leaf, others just cut off the end and collect the sap. Birds are also purged with salt, lemon juice or raw egg whites. Additionally one trainer with a large stable of 300 birds gives aloes (*Aloe vera*) in the drinking water to the birds when a fight is at hand. This is done five days before a fight to "thin down the blood". This stable fights birds every week during the fighting season.

Cheating

In the past some cock fighters / trainers put grease or oily plant products on the birds' spurs and/or body. These products (including gru gru boeuf (*Acrocomia ierensis*) kernel oil made the bird's body very slippery so that the 'greasy' bird would be less susceptible to injury.

Other plant products placed on the spurs also allegedly affected the nerves of the competitors cock when they were wounded by the 'coated' spur. This practice ceased when judges became stricter and requested that trainers suck the spurs of the cock before a fight.

Review of the ethnomedicinal literature

This section reviews the available literature based on the method developed by Heinrich *et al.* (1992).

Aqueous decoctions of *Citrus* species have shown antimycotic, antihæmorrhagic and antibacterial activity (Robineau, 1991). Vitamins A and C act as antioxidants. Vitamin A is important for the health of epithelial, respiratory and ocular tissues. Vitamin C also helps poultry combat stressful conditions (Latshaw, 1991).

Plantago major fresh leaf juice or bath is used for ophthalmic injuries in Venezuela, France, Madeira and Mauritius (Morton, 1975; Novaretti and Lemordant, 1990; Rivera and Obón, 1995; Gurib-Fakim *et al.*, 1993; Jelager *et al.*, 1998). *Plantago major* contained 25 mg ascorbic acid, 31mg dehydroascorbic acid and 8.5mg carotenoids/100 g young leaves (Samuelsen, 2000). Samuelsen (2000) reviewed the compounds in *Plantago major* that aid in wound healing. Plantamajoside and acteoside have antibacterial activities. Compounds with antioxidant and free radical scavenging activities are flavonoids and caffeic acid derivatives (plantamajoside and acteoside). Pectic polysaccharides are immunostimulants. The long chained saturated primary alcohols present in the leaf wax aid the healing of superficial wounds. Compounds with antiinflammatory activity are baicalein, hispidulin, aucubin, ursolic acid and oleanolic acid (Samuelsen, 2000; Ringborn *et al.*, 1998).

The monocyclic terpene ascaridol found in *Chenopodium ambrosioides* kills and paralyses *Ascaris* and hookworms (*Ancylostoma*) and to a lesser extent oxyurides (Oliver Bever, 1986).

Gossypium species plant leaves, seeds and stems contain several insecticidal and pesticidal compounds (Duke, 2000). Although these compounds have insecticidal activity they are not listed as having vermifuge activity by Duke (2000).

Fresh *Aloe vera* leaves are used to obtain two components: (1) a bitter yellow juice (exudate) with high content of 1,8 dihydroxyanthraquinone derivatives (aloe emodin, chrysophanol) and their glycosides (aloins), which are used for their cathartic effects and (2) a mucilaginous gel from the parenchymatous tissue, which has been used for topical treatment of skin burns and wounds (Vázquez *et al.*, 1996). *Aloe vera* has a significant influence on the proteoglycans, and glycosaminoglycans in healing wounds and this healing may be related to mannose-6-phosphate and acemannan (Chithra *et al.*, 1998). Cinnamoyl-C-glucosylchromone in *Aloe barbadensis* contributes to its topical antiinflammatory activity (Hutter *et al.*, 1996).

Conclusion

There are indications that the majority of the plants described contain chemicals that may explain their popular use.

Case studies 4 and 5: Ruminants and Reproductive health

"...sheep are only economical as lawnmowers. It makes no sense at all to buy dewormers, this will lead to a more depressed situation, a downward spiral, since these wormers are a major cost [TT\$150.00] and farmers are already not making money on sheep. Some dewormers don't work, but you only find out after you buy it, after the dealers said it was going to work. The dealers always say it was the farmers fault, the farmer did something wrong". (Respondent Interview, July 1995)

8a. Case Study 4. Ruminants¹⁶

Abstract

Twenty-one medicinal plants are used to treat ruminants. The main plants used were *Azadirachta indica* and *Curcuma longa*. Medicinal plants are used predominantly for endoparasites, internal and external injuries and pregnancy-related conditions.

Introduction

Some research has been conducted on ruminant health in the Caribbean. Rawlins (1983, 1985) conducted studies of screwworm myiasis in the Caribbean. The author recommended eradication of *Cochliomyia hominivorax*. Gibbs *et al.* (1983) conducted a serological survey of 6250 serum samples from cattle, sheep and goats in Latin America. The authors found that the antibody to bluetongue was widely distributed. Gumm *et al.* (1984) discuss the difficulty of interpreting the epidemiological significance of the findings generated by the survey reported by Gibbs *et al.* (1983). Adesiyun and Cazabon (1996) found *Toxoplasma gondii* in 42.9% of tested goat sera. Kaminjolo and Adesiyun (1994) found that faecal samples of 27.7% of calves (1 to 6 weeks old), 48.6% of lambs (1 to 8 weeks old) and 28.6% of goat kids tested positive for rotavirus antigen. Holder and Reece (1998) have documented some of the most recent animal health data available. They compiled data from the small animal clinics of the School of Veterinary Medicine (SVM) (4258 cases); from the SVM large animal ambulatory clinics (1879 cases); and from necropsy data (442 cases). They also collected pioneering data from the private sector, a private clinic in San Fernando, (900 cases). Their final source of data was the Government Veterinary Diagnostic Laboratory in Curepe, 1545 cases. The most common reproductive diseases / conditions diagnosed in the SVM large animal ambulatory clinics "B" 1994 - 1996 were : 1. metritis, 2. retained foetal membranes, 3. cystic follicle, 4. abortion, 5. mastitis and 6. cystic corpus luteum (Holder and Reece, 1998). These findings correspond to those being treated by farmers using ethnoveterinary remedies.

¹⁶ Parts of this case study have been published in Lans, C., Brown, G. 1998b. Ethnoveterinary medicines used for ruminants in Trinidad and Tobago. Preventive Veterinary Medicine. 35 (3), 149 - 163.

Methods

Fourteen new respondents interviewed between September 1996 and September 2000 revealed the same or similar information as that collected in 1995.

Results

All of the plant species mentioned below are common in Trinidad and Tobago and occur in naturally vegetated areas or are found growing on abandoned properties, roadsides or other clearings. Some have also been transplanted to house gardens. Some plants can be bought from older women in the larger markets or on the streets of the cities (Lans, 1996). Twenty-five percent of the key respondents explained that some plants worked better for some individuals than others. Dosages were also altered to fit the condition and size of the animal and the availability of the plant.

All respondents claim that they 'boil' the plants, which is then a decoction. When questioned further, however, they admitted that some of the plants are administered as teas (an infusion). Numbers of plant leaves to use and the number of days in the dosing regime were typically odd numbers. The ethnoveterinary usages of locally available plants for ruminants in Trinidad and Tobago are summarised in Table 12. Twenty-one plants are used for medicinal purposes by those who keep ruminants.

Table 12. Medicinal plants used for ruminants

Scientific name	Family	Common name	Plant part used	Use
<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Leafy branches	Retained placenta
<i>Curcuma longa</i>	Zingiberaceae	Turmeric	Rhizome	R/ placenta
<i>Oryza sativa</i>	Poaceae	Rice paddy	Grain	R/ placenta
<i>Senna occidentalis</i>	Caesalpinaceae	Wild coffee	Leaves, roots	R/placenta
<i>Spondias mombin</i>	Anacardiaceae	Hogplum	Leafy branches	Retained placenta
<i>Achryanthos indica</i>	Amaranthaceae	Man better man	Leaves, roots	Oestrus induction
<i>Aloe vera</i>	Liliaceae	Aloes	Leaves	O/ induction
<i>Mimosa pudica</i>	Fabaceae	Ti marie	Roots	O/ induction
<i>Petiveria alliacea</i>	Phytolaccaceae	Gullyroot	Roots	O/ induction
<i>Ruellia tuberosa</i>	Acanthaceae	Minny root	Roots	O/ induction
<i>Senna occidentalis</i>	Caesalpinaceae	Wild coffee	Leaves, roots	Oestrus induction
<i>Laportea aestuans</i>	Urticaceae	Stinging nettle	Leaves	Urinary problems

Table 12. Medicinal plants used for ruminants (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Anacardium occidentale</i>	Anacardiaceae	Cashew	Bark	Diarrhoea
<i>Psidium guajava</i>	Myrtaceae	Guava	Buds	Diarrhoea
<i>Aloe vera</i>	Liliaceae	Aloes	Leaves	Poultice
<i>Asclepias curassavica</i>	Asclepiadaceae	Red head	Flower	Poultice
<i>Curcuma longa</i>	Zingiberaceae	Turmeric	Rhizome	Poultice
<i>Kalanchoe pinnata</i>	Crassulaceae	Wonder of the world	Leaf	Poultice
<i>Musa species</i>	Musaceae	Banana	Stem	Poultice
<i>Nopalea cochenillifera</i>	Cactaceae	Rachette	Joint	Poultice
<i>Theobroma cacao</i>	Sterculiaceae	Cocoa	Pods	Poultice
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf	Wounds
<i>Curcuma longa</i>	Zingiberaceae	Turmeric	Rhizome	Wounds
<i>Azadirachta indica</i>	Meliaceae	Neem	Leaves	Anthelmintic
<i>Petiveria alliacea</i>	Phytolaccaceae	Gullyroot	Roots	Anthelmintic
<i>Ruellia tuberosa</i>	Acanthaceae	Minny root	Roots	Anthelmintic
<i>Stachytarpheta jamaicensis</i>	Verbenaceae	Vervine	Leaves	Anthelmintic, Milk production
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Ectoparasites

The term 'leaves' can sometimes include the leaves and stems of the upper part of the plant, and sometimes the entire plant except the roots. Animals were drenched with bamboo joints, old shoes, or thin-necked olive oil bottles (125 ml.). Only three respondents administered plants by pushing the fresh leaves down the throat of the animal.

Plants used for Reproduction

Six plants are used for retained placenta. An infusion or decoction of wild coffee (*Cassia occidentalis*) leaves is drenched, but 'a few branches' of hogplum (*Spondias mombin*), or a 'reasonable handful' of bamboo leaves (*Bambusa vulgaris*) or three pounds of rice paddy, are simply fed to ruminants for retained placenta or to remove what the key respondents call the 'bruised blood' (clotted blood and haematomas) associated with birth. Turmeric (called Saffran¹⁶ in Trinidad; *Curcuma longa*, syn. *Curcuma domestica*) is also given as a drench for retained placenta. The turmeric rhizome (five, 9-cm pieces for a cow) is grated and given as an infusion, both to 'bring down the bruised blood', and to increase milk production.

The plants used in an attempt to induce oestrus by 'cleaning out the womb' are used singly or in combinations.

Three roots of minny root (*Ruellia tuberosa*) or gullyroot (*Petiveria alliacea*) were boiled in water. The dose for a goat was given as three-quarters of a beer bottle (275 ml). A dose for

¹⁶ Curcuma is the Latin form of the Arabic word Kourkour and means saffron (Scartezzini and Speroni, 2000).

two or three cows consisted of five roots and 'some' leaves of gullyroot (*Petiveria alliacea*), three roots and 'some' leaves of wild coffee (*Senna occidentalis*), five roots and 'some' leaves of man better man (*Achyranthes indica*), and five roots of ti marie (*Mimosa pudica*) with garlic, five 9-cm pieces of turmeric root (*Curcuma longa*) and salt added. *Aloe vera* gel is also used to 'clean out the womb', and as a laxative.

Other ailments

Leaves of the red stinging nettle (*Laportea aestuans*) are used as an infusion for urinary problems.

Diarrhoea

Cashew bark (*Anacardium occidentale*) and guava bud or young leaves (*Psidium guajava*) are used for diarrhoea. The cashew bark (2 or 3 pieces, 11 cm square) was either boiled and then strained and given to the animal as drinking water, or it was mixed with charcoal and then drenched twice a day. The young guava leaves or guava bud were boiled in water. For large animals, the leaves were ground and mixed with coconut oil (*Cocos nucifera*) before drenching for diarrhoea or colic.

Wounds

Poultices were the most common means of external treatment. The flowers and/or leaves of the poisonous plant red head (*Asclepias curassavica*) were crushed or ground, the juice was squeezed into the wound and then the residue was used to fill and cover wounds to prevent myiasis. All the respondents knew the plant was toxic to grazing animals. Poultices were made of warmed joints (flattened branches) of the cactus called rchette (*Nopalea cochenillifera*; syn. *Opuntia cochenillifera*), and the sap from the pseudostem of the banana (*Musa* species). Rchette joints were sliced and mixed with sugar or flour for abscesses. The banana stem is cut, and the exudate collected on a piece of cotton, which is then placed on the wound for two days. Two plants are used as emollients on burns and inflamed tissues. Wonder of the world leaves (*Kalanchoe pinnata*; syn. *Bryophyllum pinnatum*) are 'rolled' with a bottle to burst the plant veins, but rchette is sliced. Then, the leaves of either plant are warmed over a flame or on a baking utensil, the painful area is rubbed with paraffin or whale oil (called soft candle) and then the heated leaf is applied. Turmeric rhizome (*Curcuma longa*) is grated and warmed in oil and applied to wounds. Scrapings from young cocoa pods (*Theobroma cacao*) are also used externally, especially on burns and cuts. *Aloe vera* gel is also placed on wounds. Turmeric rhizome is grated and an infusion is drenched for internal injuries. *Aloe vera* gel is also given for internal injuries.

Helminth infections

Three roots each of minny root (*Ruellia tuberosa*) or gullyroot (*Petiveria alliacea*) are used as a decoction for deworming ruminants. Three of the respondents also tied their ruminants in the environment of gullyroot so that they could self-medicate. The dose for small ruminants was described as 18 leaves boiled in two bottles of water until the liquid was reduced to approximately 284 ml. The dose for a cow was approximately 141 ml of this liquid, less was given for sheep. An infusion of neem leaves was drenched. For cows, three or four, one-metre branches were stripped of their leaves which were then ground, strained and given to the cow to drink in a pint bottle, every three months.

Vervine leaves (*Stachytarpheta jamaicensis*) were also blended fresh or given as an infusion in place of the drinking water, or it was drenched. If the anthelmintic was given to ruminants

as the drinking water, molasses and or salt was added for palatability. Anti-parasitical plants were picked and administered when the moon was waning, or in the full moon.

Enhanced production

Vervine (*Stachytarpheta jamaicensis*) is given as an infusion in an attempt to increase milk production.

Ectoparasite control

Cordia curassavica is used to control ticks by grooming the animal with a 'brush' made of a bunch of leafy branches.

Moon phases

The explanations for deworming by the phase of the moon were two-fold, either that the parasites were weak in the new moon and thus more susceptible to the medicines or that animals were infected during the full moon (Lans, 1996). Moon phases are also a factor in controlled mating times. Ten key respondents indicated that farmers believed there was a link between breeding cows in the full moon and the new moon phases and the future strength and vitality of the offspring. These respondents also claimed that there were more requests for Artificial Insemination (AI) services in the full moon. More research is necessary in this area.

Medico-religious practices

Medico-religious practices exist. Ibrahim (1996) includes non-physical or supernatural agents such as spirits, curses, hexes and the evil eye (*mal yeux/maljo*) under the category ethno-toxicology, with the emic definition of ethno-toxicology as 'poisons that are believed to act at a distance'. *Mal yeux* is described as the discomfort caused to a person or animal by people who project negative thoughts and energies towards them (Lans, 1996). In Trinidad and Tobago a red string is tied around the neck of young sheep and goats to protect them from the evil eye, or a blue spot is painted on the animal with indigo blue or wound spray. In Trinidad, farmers will ask Hindu pundits (priests) or other curers to say 'prayers' over sick animals, usually cows which are valuable. Hindu prayers are part of a ritual called 'jharay' (Lans, 1996). Trinidad also has Indo-cultural specialists such as 'vein pullers' and masseurs who may be consulted for sick animals (Lans, 1996). Perezgrovas (1996) found a similar treatment for evil eye in Mexico to that used in Trinidad and Tobago.

Discussion

Ethnoveterinary dosages could be described as 'vague' as was also found by Longuefosse and Nossin (1996) or - more favourably - as case and context specific, and thus difficult for key respondents to describe to researchers as a specific set of guidelines (Lans, 1996; Ibrahim, 1996). Ibrahim (1996) described the 'apparent disregard for western scientific dosages in traditional medicine as rational given that crude botanicals have pharmacological actions that vary according to place and time of plant collection, storage methods and season of the year'. In addition Ibrahim (1996) claimed that crude botanicals are biotransformed more readily *in vivo* than are commercial drugs. It may be that drugs are given 'to effect' (Ibrahim, 1996), to achieve clinical improvement rather than complete elimination of the causative agent. However, for anti-parasitics, key respondents expected

to see the parasites voided in the faeces (Lans, 1996; Heinrich *et al.*, 1992). Longuefosse and Nossin (1996) recorded the administration of anti-parasitical medicinal plants when the moon is waning. Herskovits and Herskovits (1947) have also recorded the use of the moon in Caribbean ethnomedicine, while some of the research published in McCorkle *et al.* (1996) have documented husbandry practices linked to moon phases in ethnoveterinary medicine.

The cultural aspects and related terms linked to the use of medicinal plants for reproductive reasons are documented in Laguerre (1987), Longuefosse *et al.* (1996), Browner *et al.* (1988), IIRR (1994), Ortiz de Montellano (1975), Herskovits and Herskovits (1947), Bourdy and Walter (1992), Bhat *et al.* (1990), Ajao *et al.* (1985) and Morton (1981). The cultural aspects associated with the use of *Stachytarpheta jamaicensis* as a lactagogue are documented in Hodge and Taylor (1957), Eldridge (1975) and Morton (1981).

Ethnoveterinary knowledge

Traditional therapies often combine various medications, some of non-plant origin, and other exogenous factors such as prayers, massage, etc. This complexity needs to be taken into account in the validation of these therapies (Mathias *et al.*, 1996). This section evaluates the symbolic aspects of the ethnoveterinary knowledge to ascertain whether these account for the plant use rather than the chemical constituents of the plant.

Phases of the moon are used to pick the plants or treat the animals (see also McCorkle and Bazalar, 1996). This is due to ancient beliefs in which lunar cycles are associated with earthly phenomena such as tides, presence of fish, growth and harvesting of plants and care of animals (Herskovits and Herskovits, 1947). Ayurvedic medical principles state that plants harvested at the time of the full moon are the most potent as drug materials (Karnick, 1978). The concentration of compounds has been found to vary in plants according to the moon phase or time of the day (Rounds, 1982; Bello *et al.*, 1991; Vasconcelos Silva *et al.*, 1999).

In Trinidad records were collected from a farm over a four-year period (G. Bidhesi, pers. comm., 1996). A.I. services for which conception occurred, calving dates and sex of calves (from 104 calvings) were classified according to phases of the moon when these fell 3 days before or after a particular phase. The author found no significant difference ($P > 0.05$) in any of the factors studied between the different moon phases. Muraleedharan *et al.* (1990) found that a significantly higher number of animals are inseminated on the 3 days of full and new moon (-1 day 0 day +1 day). The authors also observed that neither season nor lunar phases between seasons influenced oestrus cycle. Subramaniam *et al.* (1989) studied 13, 943 and 10, 947 inseminations in cattle and buffalo, respectively. The effect of season on A.I. % during full moon and new moon was significant for buffaloes but not for cattle. The average conception rate was higher in new moon and full moon in cattle but not for buffaloes.

Scientist-managed medicinal plant research

Some of the mechanisms by which natural medicines produce their effect may be ignored if a narrow assessment of therapeutic action is used (Mathias *et al.*, 1996). For instance Michael Huffman of the University of Kyoto in Japan found that the chimpanzees in

Tanzania were swallowing the hairy leaves of the *Aspilia* plant to remove the parasitic nematode *Oestophagostomum stephanostomum* from their guts with a physical rather than chemical action (quoted by Black, 1996).

Presented below is a non-experimental method of evaluating the efficacy of Trinidad and Tobago's ethnoveterinary medicines (Browner *et al.*, 1988; Heinrich *et al.*, 1992).

Bambusa vulgaris leaves are used in Jamaica for malaria and other fevers (Asprey and Thornton, 1953-1955). *Bambusa* species leaf decoctions are used as emmenagogues, to induce the lochia after childbirth and as abortifacients in India (Kapoor, 1990). *Bambusa* species were one component of two multi-plant herbal preparations evaluated for their effects on fertility in rats and buffaloes (Shyamala and Kshama, 1999; Deshpande *et al.*, 1999).

Dry *Curcuma longa* rhizome showed an antiimplantation effect in the rat uterus intraperitoneally at an unspecified dose (Robineau, 1991). The aqueous and alcoholic extracts isolated from turmeric are as effective as butylated hydroxy anisole in their anti-oxidative activity (Selvam *et al.*, 1995). There is a strong correlation between antioxidant activity and antiinflammatory activities of curcuminoids (Anto *et al.*, 1998). Curcumin was also found to possess antiviral potential (Roth *et al.*, 1998).

Oryza sativa contains oestrone and has been shown to induce ovulation (Oliver Bever, 1986).

Senna species contain sennosides and minor amounts of rhein, aloe-emodin, chrysophanol, and physcion (anthraquinone aglycones), and kaempferol (flavonoid), a xanthone and 3 α -sitosterol (Robineau, 1991; Bakhet and Adam, 1995). The leaves and stem have hypotensive properties (Robineau, 1991). The anthraquinone glycosides of the plant are reputed to be oxytocic and to act as ecbolics (Brander *et al.*, 1993; Robineau, 1991).

In Venezuela the stem bark of *Spondias mombin* is used as an infusion for treating different types of muscular ailment, but it has not been shown to have any antiinflammatory activity (Abad *et al.*, 1996). The leaves and stems of *Spondias mombin* contain several compounds including 3-hexanol, the sesquiterpene β -caryophyllene, and an anarcadic acid derivative which had weak activity against *Staphylococcus* species (Offiah and Anyanwu, 1989; Corthout *et al.*, 1990 a & b; Wilbert and Haiek, 1991; Corthout *et al.*, 1994; Coates *et al.*, 1994; Lemos *et al.*, 1995). Extracts of *Spondias mombin* showed relaxant activity on smooth muscle and uterine stimulant activity (Robineau, 1991).

In Nepal and Pakistan and in the Bihar State in India, *Achyranthes aspera* is used to facilitate parturition and for abdominal pain (Bhattarai, 1994; Shinwari and Khan, 2000). The benzene extract of the stem bark shows abortifacient activity in the rat (Bhattarai, 1994; Tripathi *et al.*, 2000).

Aloe-emodin from the *Aloe vera* plant contributes to the laxative activity of the plant. The anthraquinone and anthrone glycosides of the plant are reputed to be oxytocic. This oxytocic activity may be related to their laxative properties since all purgatives are ecbolics¹⁷ (Brander *et al.*, 1993; Robineau, 1991).

¹⁷ Abortifacients (ecbolics, oxytocics, emmenagogues) terminate pregnancy (Riddle, 1991).

Mimosa pudica leaves were used for lassitude and depression by the Maya and for pains in Jamaica (Asprey and Thornton, 1953-1955). *Mimosa pudica* contains ascorbic acid, minerals, ash, beta-carotene, crocetin-dimethyl-ether, crocetin, mimosine, norepinephrine (Duke, 2000).

Petiveria alliacea contains triterpenes, free sulphur and sulphur derivatives (trithiolaniacin and benzylhydroxyethyltrisulphide), benzaldehyde, benzoic acid and a trans-stilbene (Robineau, 1991; Hegnauer, 1990). Active compounds in the root extract are reported to be coumarins (Rocha and Silva, 1969). Some of these compounds can act as antioxidants, antiseptics, antibacterials, fungicides, immunostimulants, antispasmodics or as mild sedatives (Robineau, 1991; Duke *et al.*, 1998; Duke, 2000). *In vitro* the plant has antibacterial and antifungal properties and induces contraction of the smooth muscle (uterus, ileum, trachea, aorta, gastric fundus) (Robineau, 1991). Clinical trials have demonstrated analgesic effects and the plant has been shown to have anti-convulsant and abortive properties (Morton, 1980; Elisabetsky and Wannmacher, 1993; Souza Brito and Souza Brito, 1993).

Ruellia tuberosa contains flavonoids, phytosterols (beta-sitosterol, stigmasterol, campesterol), alkanes (hentriacontane, nonacosane) (Hegnauer, 1989; Duke, 2000).

The use of *Laportea aestuans* in Trinidad for oliguria and venereal diseases has been previously reported (Wong, 1976). *Laportea aestuans* contains acetylcholine, histamine and 5-hydroxytryptamine (Hegnauer, 1973).

Anacardium occidentale contains phenols, cardanols, cardols, catechin (flavonoid) and tannins (Wagner, 1993; Bakht and Adam, 1995; Souza Brito and Souza Brito, 1993). The tannins and catechin (flavonoid) have anti-inflammatory effects (Souza Brito and Souza Brito, 1993). Morton (1981) gives the dimension of the cashew bark for treatment of diarrhoea as 10 cm by 5 cm, boiled in 1 litre of water, drenched twice a day for 7 days.

The treatment of diarrhoea with *Psidium guajava* leaves has been documented across Asia and Central and South America (Morton, 1981). A methanol extract of the leaves demonstrated anti-diarrhoeal effects by inhibiting intestinal motility and preventing castor oil-induced diarrhoea (Olajide *et al.*, 1999). The anti-diarrhoeal activity of *Psidium guajava* is thought to be due to the inhibition of the increased watery secretions that occur commonly in all acute diarrhoeal diseases and cholera (Lutterodt, 1992). The plant contains cineol, three flavonoids with strong antibacterial action: quercetin, its 3-L-4-arabinofuranoside (avicularin) and its 3-L-4-pyranoside (Oliver Bever, 1986; Morales *et al.*, 1994). It also contains beta-sitosterol, triterpenoids (oleanolic, ursolic, crataegolic and guayavolic acids) and 10% ellagic tannins (Robineau, 1991). Crataegolic, ursolic and oleanic acids and quercetin have anti-inflammatory properties (Duke, 1989; Wagner, 1990; Jie, 1995).

Aloe vera has a significant influence on the proteoglycans, and glycosaminoglycans in healing wounds and this healing may be related to mannose-6-phosphate and acemannan (Chithra *et al.*, 1998). *Aloe vera* gel also increased the amount of hyaluronic acid and dermatan sulphate in the wound which may result in the formation of a more stable scar and faster healing (Chithra *et al.*, 1998).

Asclepias curassavica is toxic to grazing animals, and ingested flowers cause vomiting (Morton, 1981). The latex of *Asclepias curassavica* contains cardiotoxic cardenolides (asclepin, 3-O-acetyl-calotropin and calotropin), esterified triterpenes and beta-sitosterol (Morton, 1981; Seiber *et al.*, 1982; Duke, 1989).

Kalanchoe pinnata leaves are used in India and Brazil for treatment of bruises, wounds, boils and insect bites (Nassis *et al.*, 1992; Muñoz *et al.*, 2000a). *Kalanchoe pinnata* has *in vitro* antifungal, antibiotic, antibacterial and antiinflammatory activity (Robineau, 1991). In the treatment of 50 trophic ulcers in the leg with *Kalanchoe pinnata* leaf juice applied externally, 46 cases resulted in healing (Robineau, 1991). Phenols (coumaric, ferulic, syringic, caffeic and *p*-hydroxybenzoic acids) are found in *Kalanchoe pinnata* (Robineau, 1991). Ferulic and caffeic acids have antitumour, choleric and hepatotropic properties (Duke, 1989). Also found are the flavonoids (quercetol-3-diarabinoside and kaempferol-3-glucoside), and the steroid bryophyllin b which is cytotoxic (Robineau, 1991).

Musa paradisiaca plant shows antibiotic activity (Robineau, 1991). The high tannin content gives it astringent properties. Tannins have anti-diarrhoeic, bactericidal and viricidal properties (Duke, 1989). Banana plant fresh sap put on fresh wounds, in Tanzania and is said to protect against tetanus.

In India, Italy and the Canary Islands the mucilaginous joints of *Nopalea cochenillifera* and the related *Opuntia* species are split open and applied as poultices to relieve burns and skin diseases (Morton, 1990; Uncini Manganelli, Tomei, 1999; Loro *et al.*, 1999).

Theobroma cacao contains a proanthocyanidin which has analgesic effects (Souza Brito and Souza Brito, 1993). The seeds and fruit contain benzenoids, alkaloids, flavonoids, lignans, proteins and non-alkaloid N-heterocycles (Gupta *et al.*, 1993). Complex polysaccharides have been found in the fruit with arabinose, rhamnose, glucose, mannose, galactose or galacturonic acid as building units (Hegnauer, 1973).

Azadirachta indica is reported to have a variety of biological activities (van der Nat *et al.*, 1991). A 75% methanol extract of the bark and leaves was shown to have an antiinflammatory and antipyretic effect (Labadie *et al.*, 1989). Most of the effects can be attributed to compounds representing the structural classes of the limonoids, nortriterpenoids, phenolics and macromolecules (van der Nat *et al.*, 1991).

Stachytarpheta jamaicensis (syn. *Stachytarpheta indica*) was used in Jamaica and New Caledonia as an emmenagogue (Asprey and Thornton, 1953-1955; Cambie, 1997). Roots are used in Vietnam as an abortifacient and in India they are said to have anti-fertility properties. The plant contains saponins with friedelin and ursolic acid as aglycones (sapogenins) (Cambie, 1997). An aqueous methanol extract of *Stachytarpheta jamaicensis* took 81.5 hours to inactivate filariform larvae of *Strongyloides stercoralis* as opposed to the commercially available drugs levamisole (less than 1 hour), albendazole (35 hours), and thiabendazole (74 hours) (Robinson, 1990). In feverish rats the effect of *Stachytarpheta jamaicensis* was compared with aspirin and dypiron and found to be similar to that of other febrifuges. The analgesic effect was evaluated in rats and showed a lesser effect than morphine (Robineau, 1991). Vela *et al.* (1997) confirmed the effectiveness of *Stachytarpheta cayennensis* as a plant with antiacid/antiulcer and laxative properties.

Smith (1974) reported that weekly grooming of cattle with leaves of *Cordia curassavica* reduced tick populations. *Cordia* species contain phenolic compounds (Ficarra *et al.*, 1995) and terpenoid quinones (Lachman-White *et al.*, 1992). Branches are reported to be resinous and leaves are aromatic and have stiff hairs on their upper sides (Morton, 1981). The flavonoid kaempferol has been found (Hegnauer, 1964).

Conclusion

Medicinal plant dosages for ruminants tended to be case and context specific. Phases of the moon were taken into consideration in farmers' decision making. If the ethnoveterinary use of the medicinal plants is supported by phytochemical and pharmacological information, and if these plants are used in Caribbean-based human folk medicines as well as in other countries for similar reasons as suggested in the discussion above, then it is likely that they are efficacious remedies (Heinrich *et al.*, 1992).

8b. Case study 5. Ethnomedicinal and ethnoveterinary knowledge used for Reproductive health problems¹⁸

Abstract

A methodology for the non-experimental validation of herbal medicines was used to evaluate nine (9) plants: *Spondias mombin*, *Senna occidentalis*, *Petiveria alliacea*, *Ruellia tuberosa*, *Curcuma longa*, *Abelmochus esculentus*, *Bambusa vulgaris*, *Oryza sativa* and *Stachytarpheta jamaicensis*. These nine plants are used in both ethnomedicine and ethnoveterinary medicine for reproductive health conditions and are a subset of over seventy (70) plants derived from ethnoveterinary research conducted in Trinidad and Tobago in 1995. The purpose of this non-experimental validation is to provide a guide to laboratory researchers as to which of these plants merit further investigation. The first step of the methodology involved a review of the published historical, social science and ethnomedicinal literature to gain an understanding of Caribbean, Asian, African and Latin American concepts of the reproductive process in humans. This step served to separate the plants used for cultural reasons from those with specific medicinal properties. The second step involved searching the published literature for information on the plants' known chemical constituents and pharmacological effects. The third step built on the first two and was an evaluation of whether there is a plausible biological mechanism by which the plant chemicals and known or possible physiological effects could achieve the results described by the respondents.

Introduction

Ethnomedicinal research was conducted in 1995 and throughout 1997 and 1998 into ethnoveterinary practices that are used for domestic ruminants' reproductive health. These reproductive uses are derived from similar uses in ethnomedicine. Nine plants are commonly used for reproductive purposes. These are *Spondias mombin*, *Senna occidentalis*, *Petiveria alliacea*, *Ruellia tuberosa*, *Curcuma longa*, *Abelmochus esculentus*, *Oryza sativa*, *Bambusa vulgaris* and *Stachytarpheta jamaicensis*. The chapter evaluates these nine plants using a non-experimental validation based on that developed by Heinrich *et al.* (1992). This method involves three steps. Firstly, how the plants are used and the cultural practices associated with them are described. Additionally, links to similar cultural practices in Asia, Africa and Latin America are traced. Secondly, the published phytochemical and pharmacological information is reviewed and the chemical components of the plants are presented. Thirdly, an indication is given as to whether these components support the reproductive uses made of the plants.

Methods

The initial ethnoveterinary research was conducted from April - October 1995 and is described briefly in the following section. Follow-up interviews were held with six older

¹⁸ Part of this case study has been published in Lans, C., Röling, N. 1998c. Feminist methods, women's traditional health knowledge and ethnoveterinary knowledge. Working Paper No.3. Centre for Gender and Development Studies, University of the West Indies, St. Augustine. It was also submitted to a Journal for review.

women (>50) in 1997 about the plants that they used for reproductive problems. One of these women was a farmer, two were herbalists and three were housewives who knew the common remedies or core traditions. This was a purposive sample chosen from the previous ethnoveterinary research and from on-going medicinal plant research. The six women were located in Mason Hall, Tobago, Paramin in North Trinidad, San Fernando in South Trinidad and Talparo in Central Trinidad. In these interviews, the six women were asked specifically about the plants and cultural practices used during childbirth. The following information about each plant was collected: popular name, uses, part(s) used, mode of preparation, time and duration of application, doses and expected action of the plant.

These interviews were necessary since it was realised that male farmers were using the reproductive knowledge of their female relatives to assist in the health care of their animals. Female farmers were using the same plants for their animals that they used for themselves. All of the respondents indicated that they gave the plants used for retained placenta to their animals as soon as possible after parturition. Plants were collected on 25% of these interviews to verify that the common names used by each respondent were the same as those recorded in the literature. Additional plant collection was not possible at homes in which the plant was not grown. This research on plants used for reproductive purposes was presented to two groups of women in 1998. Firstly to a group of thirty-five rural women in Todd's Road (Central Trinidad) who confirmed the plants and uses during the question period. It was presented four months later to fifteen rural women in Biche (South-eastern Trinidad), who confirmed both the uses in humans and in animals. This indicates that the plants and reproductive uses are widely known. The main reason to present this work was to clarify how the plants are used. In previous times women were attended by midwives who put these plants in a tub of steaming water and the women would then sit over it on a stool for up to nine days. Whereas farmers gave the same plants to animals as a decoction. Very few of the women spoken to said that they utilised the plants as decoctions.

The plants described in chapter were authenticated at the University of the West Indies Herbarium. The plants were compared to existing collections (Hogplum TRIN# 31573,28045; Minny root TRIN# 19343; Vervine TRIN# 19347; Kojo root 32379#; Wild coffee 32787# and Bamboo 31914#). Specimens were not deposited since the plants are common.

Results

Forms of administration

Respondents used decoctions and infusions. Additionally, women used the leafy branches of hogplum, a decoction of roots of wild coffee or leafy branches of bamboo. These plants were put in the 'tensil (utensil) or tub of boiling water and the women then sat over the tub on a stool. Women made a decoction of ground turmeric with massala, ginger and salted butter, to "bring down everything" after parturition. A decoction of turmeric with vervine was used to "clean out" the body. Dosages were non-standard; the most common dose described was "some".

Emic descriptions

During the ethnoveterinary research in Trinidad, rice paddy was called a “heated substance” that was good for retained placenta but not recommended for pregnant animals. The logic of the term heated substance was explained by one respondent who claimed that the “heat” of the rice paddy would help break down the uterine lining and therefore assist in cases of retained placenta.

Ethnopharmacological evaluation of the plants

The link between medicinal plants used for both human and animal health was most clearly seen in the plants that are used for retained placenta, or to remove what the respondents called the “clot blood” associated with birth (the blood clots and haematomas). This connection is demonstrated in Table 13a.

Table 13a. Comparison of ethnoveterinary and ethnomedicinal plant use

Scientific name Common name (Family)	Ethnoveterinary use, parts used, administration	Ethnomedicinal use (including respondents quotations)
<i>Abelmoschus esculentus</i> Okra (Malvaceae)	Green pods and leaves fed for retained placenta.	Used as a vegetable. It has historical linkages to female reproduction.
<i>Bambusa vulgaris</i> Bamboo (Poaceae)	Leaves fed to ruminants for fever, after parturition, for milk let down and for retained placenta	Decoction of leaves used for fever
<i>Curcuma longa</i> Turmeric (Zingiberaceae)	Decoction or infusion of grated rhizome given to increase milk production and for retained placenta.	To “bring down everything” after parturition and to “clean out” the body. Turmeric is called “tambric” in Tobago.
<i>Oryza sativa</i> Rice (Poaceae)	3 lbs. of Paddy is fed to ruminants for retained placenta.	
<i>Petiveria alliacea</i> Gullyroot (Phytolaccaceae)	Decoction of leaves and roots given in an attempt to induce oestrous.	Used for dysmenorrhoea/amenorrhea.
<i>Ruellia tuberosa</i> Minny root (Acanthaceae)	Decoction of roots given in an attempt to induce oestrous.	Used for dysmenorrhoea/amenorrhea.
<i>Senna occidentalis</i> Wild coffee (Caesalpinaceae)	Decoction of leaves and roots given in an attempt to induce oestrus.	a) Used to bring down the “clot blood”.
	Leaf infusion/decoction drenched for retained placenta.	b) Midwives used to boil leaves and roots for their clients as a tisane

Table 13a. Comparison of ethnoveterinary and ethnomedicinal plant use (cont.)

Scientific name Common name (Family)	Ethnoveterinary use, parts used, administration	Ethnomedicinal use (including respondents quotations)
<i>Spondias mombin</i> Hog plum (Anacardiaceae)	Leafy branches are fed for retained placenta.	Used to bring down the "clot blood".
<i>Stachytarpheta jamaicensis</i> Vervine (Verbenaceae)	Decoction of plant tops given to animals. Used to increase milk production.	Used for milk let down and insufficient milk.

All the plants show the lowest level of validity established by Heinrich *et al.* (1992). This means that the plants (or a closely related species of the same genus) are used in geographically similar or different places for the treatment of similar illnesses. In order to achieve the highest level of validity the ethnobotanical, phytochemical and pharmacological literature has to support the ethnomedicinal use of the plant (Heinrich *et al.*, 1992). The role that culture and religion play in farmer decision making may explain the similarity between the ethnoveterinary practices found in Trinidad and Tobago and ethnomedicines used by women in the Caribbean, India, Africa and South America (Morton, 1981; IIRR, 1994). These parallels are shown in Table 13b.

Table 13b. Comparison of plant use for female reproductive problems in different geographical locations

Scientific name and (Ethnovet use)	Ethnomedicinal use	Location
<i>Abelmoschus esculentus</i> (retained placenta)	A decoction of young Okra is used as a demulcent to soothe genito-urinary complaints. Wild okra (<i>Abelmoschus moschatus</i>) is used to treat stomach pains.	The Philippines (Morton, 1990) Trinidad (Morton, 1980, 1981)
<i>Bambusa vulgaris</i> (retained placenta)	a) The leaf decoction is used as a remedy for fever, stomach upsets and nervous conditions. Root decoction is an abortifacient.	Caribbean and Latin America (Morton, 1980, 1981)
	b) Leaves used as emmenagogues and as a febrifuge. The fresh juice of the leaves of the plant has a weak ecboic action, and leaves are also used for diarrhoea, fever, infections, skin rashes and sores.	India (Kapoor, 1990) Nicaragua (Coe and Anderson, 1996a)
<i>Curcuma longa</i> Turmeric (retained placenta)	a) Used with <i>Trianthema portulacastrum</i> for wounds and vaginal discharges.	India (Nagaraju and Rao, 1990)
	b) Dried root powder mixed with water or rhizome juice is drunk as a postpartum medication	Indonesia, Malaysia (Grosvenor, 1995; Ong and Norzalina, 1999)

Table 13b. Comparison of plant use for female reproductive problems in different geographical locations (cont.)

Scientific name and (Ethnovet use)	Ethnomedicinal use	Location
<i>Oryza sativa</i> (retained placenta)	Rice water is drunk to relieve leukorrhea and vaginitis in Nepal	Bhattarai (1994)
<i>Petiveria alliacea</i> (oestrous induction)	a) Leaves boiled with <i>Phyllanthus amarus</i> bark of <i>Swietenia mahogoni</i> and the pulp and seeds of <i>Crescentia cujete</i> for abortions.	Latin America and the Caribbean (Morton, 1980, 1981)
	b) Gully root plant parts are used as emmenagogues, for menstrual difficulty, womb inflammation and as abortifacients.	Latin America and the Caribbean (LAC) (Morton 1980, 1981)
	c) Slaves used a decoction of the roots of <i>Petiveria alliacea</i> in order to abort after eating large amounts of Okra	LAC (Morton, 1980, 1981; Duke, 2000)
<i>Senna occidentalis</i> (oestrous induction)	a) Large handful of ground leaves is mixed in water and drunk to induce birth, to "cleanse" the insides, prevent haemorrhaging, expel the lochia and "draw organs back to normal".	Vanuatu (Bourdy and Walter, 1992), Nicaragua (Coe and Anderson, 1996a)
	b) Decoctions and infusions of leaves, leafy stems and flower spikes or roots used for womb inflammation, abortifacients, emmenagogues, purgatives, for menstrual pain and as postpartum depurants. Use of 5 g of roots in 300g of water can cause abortion.	Caribbean (Morton, 1980, 1981) Nicaragua (Coe and Anderson, 1996a)
<i>Spondias mombin</i> (retained placenta)	a) Leaves are boiled with <i>Cordia cylindrostachya</i> , <i>Mangifera indica</i> and <i>Anacardium occidentale</i> . The decoction is taken for 9 days after confinement.	Caribbean (Morton, 1980, 1981).
	b) An aqueous extract of leaves with leaves of <i>Alchornea cordifolia</i> is used to clean cuts, sores and burns. An aqueous extract of the <i>Spondias mombin</i> bark is used as a vaginal wash for treating infections and haemorrhages.	Nigeria (Ajao <i>et al.</i> , 1985), Latin America (Hazlett, 1986; Ayala Flores, 1984; Coe and Anderson, 1996a).
<i>Stachytarpheta jamaicensis</i> (milk production)	a) Plant decoction as a lactagogue, and emmenagogue, to clean the system and relieve painful menstruation. The root decoction is used as an abortifacient.	Middle America and the Caribbean (Morton, 1980, 1981)
	A "bitter plant" used to treat gastrointestinal pain. Used for childbirth and pregnancy, fever, respiratory conditions, worms, VD, as a purgative or a laxative.	Mexico and Haiti (Heinrich <i>et al.</i> , 1992) Nicaragua (Coe and Anderson, 1996a)

Discussion

Since farmers derive some ethnoveterinary remedies from ethnomedicinal knowledge it needs to be asked why these plants are used for reproductive reasons. Are the plants used for cultural, religious or ethnomedicinal reasons? In Jamaica of 125 pregnant women in a study, 82 percent reported drinking bush teas during their pregnancy (Landman and Hall, 1983). Mint and *Momordica charantia* were the most commonly used because they did not cause nausea. Reasons for use were gastrointestinal problems, colds, hunger,

faintness or for the general health of themselves and their babies (Landman and Hall, 1983). One-quarter of the women reported customs directed toward facilitating delivery. Okro (*Abelmoschus esculentus*), thyme tea, cobweb tea, ginger tea, or raw egg was said to speed up delivery, or induce labour or ease the pain of delivery (Landman and Hall, 1983).

Ethnoveterinary links to cultural traditions

It is difficult to distinguish between amenorrhoea (absence or suppression of menstruation due to illness, depression or malnutrition) and early pregnancy (Riddle, 1991). Knowing this difficulty, women in some Latin American and Caribbean countries deliberately or unconsciously blur the differences between abortifacient and menses-stimulating effects. This gives them some control over reproduction in Christian countries that have strict social or legal restriction against abortion (Conway and Slocumb, 1979; Brody, 1981; Browner *et al.*, 1988; Sobo, 1996; Nations, 1997). Etkin (1988) claims that the Native American literature contains similar obfuscation. There is also historical information that slave women and Creoles used bitter herbs to produce abortions (Moreno Fragnals, 1976; Brereton, 1995); some of this knowledge may have been passed on to the current generation. Plants used before the 1950s were *lignum vitae* (*Guaiacum officinale*), seed under leaf (*Phyllanthus niruri*), gully root (*Petiveria alliacea*) and more poisonous purges like oleander (*Nerium oleander*) and mudar (*Calotropis procera*) (Bayley, 1949). Native Americans may have been the first to use *lignum vitae* as antiseptics, for syphilis and as stimulants (Lawrence, 1998).

Traditional human health care for reproductive purposes focuses equally on the pregnancy, parturition and the postpartum period (Browner, 1985). Sobo's (1996) research in Jamaica shows that birth, defecation and menstruation are defined traditionally as cleansing processes. After births or miscarriages, mild purgatives are given to induce the quick delivery of the placenta and pregnancy-related waste matter through the vagina (Sobo, 1996). Squatting over a pot of hot water, as seen with the utensil ('tencil) in Tobago ensures the ejection of all waste. The steam enters the body and "melts" all recalcitrant matter, which then slides out (Herskovits and Herskovits, 1947; Weniger *et al.*, 1982; Sobo, 1996).

Abortifacients "make baby turn into blood and wash out" (Sobo, 1996). Emmenagogues are used to restore the menses, to "clean out" the womb, and to restore vitality after pregnancy (Sobo, 1996). All purgatives are classified as a "washout" and many women use "washout" ingredients as emmenagogues (Browner, 1988; Morton, 1980; Sobo, 1996). For example, senna (*Senna occidentalis* and *Cassia obovata*) is sold in Jamaica as a powerful laxative for men and horses that should not be taken by pregnant women (Sobo, 1996). While Mexican Americans recommend purging with senna to promote conception (Kay, 1996). A similar blurring of the boundaries is seen with vervine. Sobo (1996) records that *Stachytarpheta jamaicensis* is included in abortifacient recipes though its traditional use is to "wash out" worms and "cold" (mucous). The Amerindians used *Stachytarpheta* species as one of eight plants in a special bath given eight or nine days after childbirth to the mother and in another to the newborn infant (Hodge and Taylor, 1957). While in this research vervine was being used for milk let down in women and livestock.

Latin American and Caribbean women choose plants for reproductive conditions based on the properties that correspond to the hot-cold valence, irritating action, emmenagogic, oxytocic, anti-implantation and / or abortifacient effects (Browner, 1985; Etkin, 1988). Activities, food and medicines are classified in various ethnomedicinal systems

as hot or cold. The hot-cold valence in this context refers to the traditional belief that heat opens the body and facilitates the blood's free flow, whereas cold causes the blood to stop flowing and clog the arteries, veins and womb (Coe and Anderson, 1996a). One cause of infertility is described as "cold in the uterus" and fertility enhancers are considered to be "hot" (Browner, 1985; Kay, 1996).

In Mexico infertility in women is considered a "cold" illness and "hot" remedies are prescribed (Ankli *et al.*, 1999). Uteroactive plants used in Mexico are described in metaphorical terms of "warming" or "irritating" (Browner *et al.*, 1988). "Warming" the body, blood and womb, causes the womb to "open" to release detained menstrual flow or expel a full - term foetus or unwanted conceptus (Browner *et al.*, 1988). "Irritating" plants "open" the uterus and stimulate contractions that will release blocked menstrual blood or push out a full - term foetus or unwanted conceptus (Browner *et al.*, 1988).

Using rice paddy as a "heated substance" for retained placenta is a similar practice to what IIRR (1994) recommends as a uterine tonic. This tonic is composed of five types of grains including rice, mixed with six ingredients like black pepper and fennel seeds. This tonic was reputed to help cleanse the uterus, expel the placenta and dispel gas from the rumen of the dam (IIRR, 1994). Another "hot" preparation is described by Harrell (1981) who documented that Taiwanese villagers fed women nothing but chicken, sesame oil, wine and rice for a month after childbirth. This "hot" combination was thought to replace the energy lost with the mother's blood at delivery.

Evaluating plant components to assess the validity of the ethnoveterinary uses

The plants listed above, three of which are used for retained placenta, can be evaluated according to the terms discussed in the last section, i.e. on their "irritating" chemical constituents. This evaluation is presented in Table 13c. Chemical constituents that correspond to the term "warming" are perhaps those that cause *in vivo* or *in vitro* uterine contractions. Uterine stimulants are ergometrine, oxytocin, serotonin (5-hydroxytryptamine), acetylcholine and prostaglandins (PGE₂ and PGF_{2α}) (Uguru *et al.*, 1998). Linoleic and eicosapentaenoic acids play a positive role in ovarian and uterine function (Staples *et al.*, 1998). Arachidonic acid, di-homo- α -linolenic acid and eicosapentaenoic acid are direct precursors of prostaglandins (Groenwald and van der Westhuizen, 1997). Irritating chemical constituents according to Duke (2000) are 1,8-cineole, alpha-pinene, borneol, eugenol, oleic acid and vanillin.

Chemicals with spasmogenic activity are 1,8-cineole, serotonin (5-hydroxytryptamine), alpha-pinene and beta-pinene. Plants that induce smooth muscle contractions or have oxytocic effects may improve sperm transport and conception (Gustave Borde, Department of Clinical Sciences, University of the West Indies, pers. comm., 2000). The table presents a preliminary evaluation of the efficacy of Trinidad and Tobago's ethnoveterinary medicines based on the criteria established by Browner *et al.*, 1988 and Heinrich *et al.*, 1992. More details on the phytochemical properties of each plant are given in the phytochemical section. Phytochemical and pharmacological information for each plant are reviewed to assess whether the plant can exert the desired physiological action.

Table 13c. Evaluation of the plant remedies for reproductive purposes

Scientific name	Irritating chemicals	Oxytotic /Uteroactive chemicals and properties, maintenance of reproductive health	Useful medicinal properties
<i>Abelmoschus esculentus</i>			Active against <i>Staphylococcus aureus</i>
<i>Bambusa vulgaris</i>	-	Acts on cholinergic receptors. Leaves have weak ecobolic action	-
<i>Curcuma longa</i>	-	Camphor, terpenene, borneol	Antiinflammatory, Antioxidative, Anti-tumour, Antifungal
<i>Oryza sativa</i>	-	Oestrone, Vitamin E	-
<i>Petiveria alliacea</i>	-	Induces smooth muscle contractions	Anti-convulsant, Analgesic, Antibacterial, Antifungal
<i>Senna occidentalis</i>	-	Anthraquinone glycosides	Fungicidal, Antiinflammatory, Antibiotic, Anti-hepatotoxic
<i>Spondias mombin</i>	Tannins	Saponins	Antibacterial, Antiviral, Antiinflammatory, Antifungal
<i>Ruellia tuberosa</i>	-	beta-sitosterol, stigmasterol, purgative action	-
<i>Stachytarpheta jamaicensis</i>	Tannins		Febrifuge, Analgesic, Antinociceptive (relaxation may help milk let down)

Phytochemical section

Abelmoschus esculentus contains antioxidants (alpha-tocopherol, gamma-tocopherol, methionine and threonine) tryptophan (analgesic, serotonergic) arginine (anti-fertility, spermogenic, pituitary stimulant), several minerals, linoleic and oleic acids (antiinflammatory, immunostimulant), niacin (antihistaminic, serotonergic), pectin (antibacterial, fungicide), thiamin (analgesic) and amino acids (Duke, 2000). *Abelmoschus esculentus* was active against *Staphylococcus aureus* (Verpoorte and Dihal, 1987)

Bambusa bambos (syn. *B. arundinacea* Willd.) a similar species to *Bambusa vulgaris* contains cholin, betain, nuclease, urease, proteolytic enzymes, diastatic and emulsifying enzymes, and a cyanogenic glucoside (Kapoor, 1990). Fresh juice of the leaves produced uterine stimulation due to interference with cholinergic receptors (Kapoor, 1990). *Bambusa vulgaris* plant extract possesses hypoglycaemic activity which peaks at +3 hr and was better than that of tolbutamide (Fernando *et al.*, 1990).

Curcuma longa has an anti-thrombotic effect in mice (Olajide, 1999). The petroleum ether extract of the rhizome and two of its fractions, had significant antiinflammatory activity in rats which compared favourably with hydrocortisone acetate and phenylbutazone (Oliver Bever, 1986; Kapoor, 1990). Antiinflammatory components in *Curcuma longa* are azulene, borneol, caryophyllene, cinnamic acid, curcumin, eugenol, alpha-pinene, beta-sitosterol, vanillic acid and cineol (Duke *et al.*, 1998). Cineol is a CNS stimulant and speeds up transdermal

absorption of other compounds (Duke *et al.*, 1998). Borneol, curcumin, p-cymene and eugenol are analgesic components (Duke *et al.*, 1998). Curcumin is an antioxidative compound that inhibits all branches of the arachidonic acid cascade (Ammon *et al.*, 1993). Duke (2000) lists camphor, borneol and terpenene as irritating compounds. Extracts of the rhizome of *Curcuma longa* showed an anti-fertility activity in rats by an anti-implantation effect (Oliver Bever, 1986; Robineau, 1991). The extract may act on the adrenal-hypophysial axis of dams/foetuses. Curcuma essential oil has an anti-histamine effect, the essential oil inhibits hyaluronidase (Oliver Bever, 1986). Curcumin was found to cause a sharp but transient fall in blood pressure (Kapoor, 1990).

Oryza sativa seed contains allantoin, alpha-tocopherol, ascorbic acid, beta-carotene, calcium, gamma-tocopherol, glucose, guanine, iron, linolenic acid, niacin, oleic acid, palmitic acid, pyridoxine, riboflavin, squalene and thiamin, sterols (including oestrone) (Duke, 2000). Oestrone may explain the fact that *Oryza sativa* induces ovulation (Oliver Bever, 1986).

Decoctions of various parts of *Petiveria alliacea* have been widely used in different countries for many purposes, including treatment of dysmenorrhoea and as an abortifacient and emmenagogue¹⁹ (Oluwole and Bolarinwa, 1998). *Petiveria alliacea* has been reported to cause abortions in cattle (Morton, 1980). The seed methanolic extract (MEPA) causes contraction of the rat uterus and also induces contraction of the smooth muscle (uterus, ileum, trachea, aorta, gastric fundus) (Robineau, 1991; Oluwole and Bolarinwa, 1998). The contractile effect of MEPA may involve prostaglandin synthesis since indomethacin reduced the frequency and amplitude of uterine contraction (Oluwole and Bolarinwa, 1998).

Senna occidentalis leaves and roots contain several compounds including flavonoid glucosides and anthraquinones (Lai and Gupta, 1973; Kapoor, 1990; Robineau, 1991). Studies reviewed by Robineau (1991) reported antiinflammatory and antibiotic properties. Leaf extracts showed laxative activity (Robineau, 1991). Some purgatives are ecboolics, especially the "drastics", the anthracenes, and the neuromuscular purgatives (Brander *et al.*, 1993). The anthraquinone glycosides of the plant are reputed to be oxytocic and should not be given to pregnant women, unless it is to help delivery (Robineau, 1991).

The leaves and stems of *Spondias mombin* contained 3-hexanol and β -caryophyllene compounds, tannins, saponins, resins, unsaturated sterols, glycosides, triterpenes, long-chain phenolic acids, caffeoyl esters and ellagitannins (geraniin and galloyl-geraniin) with antiviral properties, a long-chain phenol, and five, 6-alkenylsalicylic acids and an anarcadic acid derivative which had weak activity against *Staphylococcus* species (Offiah and Anyanwu, 1989; Corthout *et al.*, 1990 a & b; Wilbert and Haiek, 1991; Corthout *et al.*, 1994; Coates *et al.*, 1994; Lemos *et al.*, 1995). Extracts of *Spondias mombin* showed relaxant activity on smooth muscle and uterine stimulant activity (Robineau, 1991). Some saponins have been shown to be uteroactive (Browner *et al.*, 1988). Offiah and Anyanwu (1989) found that the aqueous extract of *Spondias mombin* leaves induced abortion *in vivo* in rats and mice, but *in vitro* the extract did not produce contraction of either primed or gravid uteri from these animals. Aqueous and ethanolic extracts of *Spondias mombin* leaves were found to be antibacterial *in vitro* with a broader spectrum and greater effectiveness than streptomycin and penicillin G (Ajao *et al.*, 1985).

¹⁹ An agent that stimulates menstrual function or aborts if there is a pregnancy (Riddle, 1991).

Ruellia tuberosa root decoction is used in Venezuela for purifying the blood (Morton, 1975). *Ruellia tuberosa* root infusion was used for gonorrhea and venereal diseases and was considered emetic and depurative (Chiossone, 1938). Duke (2000) and Kay (1996) documented the following compounds in *Ruellia tuberosa*: campesterol, hentricontane, nonacosane (antiviral) and stigmasterol (estrogenic, ovulant, sedative and antiinflammatory), apigenin, luteolin, and beta-sitosterol. Apigenin has sedative, anti-histaminic, anti-platelet, antiaggregant, spasmolytic and antiinflammatory properties. Luteolin is antiinflammatory. Beta-sitosterol is estrogenic and androgenic (Duke *et al.*, 1998; Duke, 2000). Some *Ruellia* species have demonstrated antibacterial activity. Luteolin, apigenin and iridoid glucosides might be partly responsible for the purgative action of *Ruellia praetermissa* (Salah, 2000).

Stachytarpheta jamaicensis leaves contain choline, iridoids (lamiide, ipolamiide), phenolic acids (chlorogenic acid), the hypotensive gamma-amino-butyric acid, flavones and catechic tannins (Robineau, 1991; Heinrich *et al.*, 1992). An aqueous extract showed spasmogenic activity on the ileum of guinea pigs (Robineau, 1991). Ipolamiid (an iridoid) and the phenylethanoid glycoside (acteoside) may have antiinflammatory and antinociceptive properties (Schapoval *et al.*, 1998). Iridoids are reported to be mildly laxative and antiinflammatory (Duke, 1989). Research conducted in 1990 did not find the anti-lactagogue compound dopamine (Robineau, 1991).

Ruminant reproductive disorders

The plants can also be evaluated on how their varied properties could affect the physiological conditions associated with reproductive disorders. In polyoestrous animals like ruminants a subnormal number of offspring, in addition to failure to produce any offspring, constitutes infertility. In the female, infertility may be due to failure to cycle, to aberrations of the oestrous cycle and period (based on ovarian dysfunction, dysfunction of the hypothalamus-pituitary axis), or to failure to conceive, and to prenatal and perinatal death (Merck, 1986). Reduced dietary intake can lead to ovulation failure since there is an insufficient amount of circulating LH to stimulate maturation of the ovulatory follicle (Rhodes *et al.*, 1996). Three basic physiological functions must be maintained during the peri parturient period if metabolic diseases like retained placenta (retained foetal membranes) are to be avoided. The rumen needs to adapt to the high energy lactation diet, normocalcemia needs to be maintained and the immune system needs to be strong (Goff and Horst, 1997).

The causes of retained placenta have been well documented; however the particular roles and effects of the multiplicity of causes are still unclear (Laven and Peters, 1996). Retained placenta is defined in this case study as the presence of foetal membranes 24 hours or more post partum (Laven and Peters, 1996). The delivery of the placenta post partum is a physiological process, involving the loss of feto-maternal adherence in combination with uterine muscular contractions (Laven and Peters, 1996). There is inconclusive evidence that infection of the genital tract with pathogenic organisms or the build-up of virulence in organisms which are normally present in ruminant housing such as Group C *Streptococcus*, *Escherichia coli*, *Pseudomonas* and *Corynebacterium pyogenes* may lead to retained placenta (Arthur *et al.* 1989; Laven and Peters, 1996). An increase in blood selenium is associated with a decrease in all infections especially those caused by *Corynebacterium* species (Jukola *et al.*, 1996).

There is an apparent negative relationship between maternal plasma oestrone sulphate (E₁S) concentrations and placental expulsion (Zhang *et al.*, 1999). This implies that increased oestrogen has a positive effect on uneventful placental delivery in cattle since oestrogens play an important role in the maturation of placentomes and in uterine contractility (Zhang *et al.*, 1999). Statistical differences were found in the activities of various enzymes (superoxide dismutase (SOD), phospholipase A₂ (PLA₂), alkaline phosphatase (AKP), lactic dehydrogenase (LDH) and glutathione peroxidase) in cows with retained foetal membranes and cows without the condition. (Brzezinska-Siebodzinska *et al.*, 1994; Mahfooz *et al.*, 1994; Kanofer *et al.*, 1996).

Dietary deficiencies result in increased oxidative stress and production of lipid peroxides (Michal *et al.*, 1994; Brzezinska-Siebodzinska *et al.*, 1994; Laven and Peters, 1996). Phospholipase A₂ (PLA₂) plays a role in the release of free fatty acids from the cell membrane. These are converted into arachidonic acid. Cows with retained foetal membranes had lower fatty acid content except for linoleic acid. The arachidonic acid pathway is altered in cases of retained foetal membranes (Kanofer *et al.*, 1996a&b). Dietary polyunsaturated fatty acids and their role in the synthesis of prostaglandin and provision of energy before calving may be related to retained placenta (Chassagne and Barnouin, 1992). Various studies indicate that retained placenta could be due to a PgF_{2α} or an energy deficiency at calving (Chassagne and Barnouin, 1992), or reduced blood glucose levels (Choudhury *et al.*, 1993).

Retained placenta and problems with onset of postpartum cyclicity (days to first oestrus, days to first service and conception rate) may result from inadequate dietary antioxidants including beta-carotene/ Vit A, Vit E and deficiencies in selenium, iodine, magnesium, copper, zinc and iron. Serum values for glucose and protein were significantly lower in cows with retained placenta (Choudhury *et al.*, 1993; Mahfooz *et al.*, 1994). The metabolism of amino acids may be altered in cows with retained foetal membranes and there may be an imbalance in free radical generation and neutralisation and lower fast-acting antioxidants in plasma in cows with this condition (Brzezinska-Siebodzinska *et al.*, 1994; Kanofer and Maj, 1997). Nakao *et al.* (1997) concluded that a large amount of PgF_{2α} is released for a relatively shorter period in cows after dystocia and / or retained placenta and the elevation of plasma PgF_{2α} metabolite (PGFM) is not responsible for the uterine involution.

The previous discussion and the chemical constituents of the traditional plants used for reproductive conditions may provide a rational basis for their use. For example *Curcuma longa* is reported to contain 6.3% protein, 5.1% fat, 69.4% carbohydrates and carotene calculated as Vitamin A (50 IU/100g) on a fresh weight basis (Kapoor, 1990). When farmers feed ruminants turmeric after parturition they may add to the Vitamin A, protein and glucose in the diet. The plant also has antiinflammatory and uteroactive effects that may also be effective for retained placenta.

Bambusa vulgaris and *Senna occidentalis* are fed to animals within hours after birth. This practice matches claims in the literature that ecobolics are only effective for retained placenta if given immediately after parturition (Peters and Laven, 1996). *Spondias mombin* is also fed within hours. This plant has uteroactive effects (see Phytochemical section) and its antibacterial, antifungal and antiinflammatory properties may play a limited role in controlling the genital tract infections that may lead to retained placenta (Arthur *et al.* 1989; Laven and Peters, 1996). The vitamin E and oestrone in rice paddy may play a role in reducing retained placenta since increased oestrogen has a positive effect on uneventful placental delivery in

cattle (Zhang *et al.*, 1999). Deficiency in tocopherols (Vit E) is associated with gestation problems (Oliver Bever, 1986). Rice paddy would also increase the animals' energy levels.

Stachytarpheta jamaicensis may play a role in milk let down due to its antiinflammatory, analgesic and antinociceptive properties. The plant also acts as a febrifuge. These plant properties may reduce fear, stress and pain and help alleviate painful conditions like udder oedema. *Senna occidentalis*, *Petiveria alliacea* and *Ruellia tuberosa* are used to induce oestrus. These plants have antiinflammatory, oxytocic and abortive properties. Infections are common causes of female infertility (conception failure, early embryonic death and anoestrous). The antibacterial and antifungal properties of these plants may alleviate any infections present and the affected animal may then return to a fertile oestrus.

Conclusion

A non-experimental validation was used to evaluate nine plants used by humans and for animals in reproductive folk medicine. The method used was a modification of that developed by Browner *et al.* (1988) and Heinrich *et al.* (1992). Although cultural forces influence the use of all the plants for reproductive conditions, the data presented suggests that they are used for what western scientists would agree are rational reasons.

Case studies 6 and 7: Pet dogs and hunting dogs

How do you allow for situations in which both veterinarians and farmers claim to know about folk medicine and are wrong ? (Prof. Paul Richards, Group Technology and Agrarian Development, WUR, pers. comm., 1996).

9a. Case study 6. Pet dogs²⁰

Abstract

This case study documents ethnoveterinary medicines used to treat pet dogs in Trinidad and Tobago. Nuts of *Areca catechu*, seeds of *Carica papaya*, and leaves of *Cassia alata*, *Azadirachta indica*, *Gossypium* species, *Cajanus cajan* and *Chenopodium ambrosioides* are used as anthelmintics. *Crescentia cujete* pulp, *Musa* species stem juice, the inside of the pods of *Bixa orellana*, and *Eclipta prostrata* plant tops are used for skin diseases. Seeds of *Manilkara zapota*, *Pouteria sapota* and *Mammea americana* and leaves of *Cordia curassavica* and *Nicotiana tabacum* are used to control ectoparasites. Dogs are groomed with the leaves of *Cordia curassavica* and *Scoparia dulcis*. *Psidium guajava* buds and leaves and the bark of *Anacardium occidentale* are used for diarrhoea. Owners attempt to achieve milk let down with a decoction of the leaves of *Stachytarpheta jamaicensis*.

Methods

The initial ethnoveterinary research was conducted from April - October 1995. Follow-up interviews were held with forty-three respondents throughout 1997 and 1998, to obtain more details on and more instances of the plant-based remedies. Plants were collected on 25% of these interviews to verify that the common names used by each respondent were the same as those recorded in the literature.

A brief review of the literature on canine health indicates the following: One hundred and thirty dogs presented to the Small Animal Clinic of the School of Veterinary Medicine were divided into two groups of 65 diarrhoeic and 65 non-diarrhoeic (Adesiyun *et al.*, 1997). Rectal swabs taken from both groups were positive for *Escherichia coli* (76.2%), *Salmonella* (4.6%) and *Campylobacter* (13.8%). The study also reported resistance to tetracycline (59.6%) and ampicillin (50.5%) (Adesiyun *et al.*, 1997). Everard *et al.* (1979) found that a high percentage of dogs in Trinidad were infected with *Leptospira* serogroups. Rawlins *et al.* (1983) conducted a general study of screwworm myiasis in Trinidad and Tobago, Guyana, and Suriname.

Annual estimates of losses ranged from \$4.82 to \$10.71 US dollars per animal (dairy, beef, pigs, dogs, cats, sheep, goats, horses and jaguars). Of all the respondents in Trinidad and Tobago, 47% said that their dogs were infected with myiasis. Cuts, tick-bite wounds, umbilicus of neonates, bites from vampire bats and castration wounds were the main sites of

²⁰ Parts of this case study has been published as Lans, C., Harper, T., Georges, K., Bridgewater, E. 2000. Medicinal plants used for dogs in Trinidad and Tobago. *Preventive Veterinary Medicine* 45 (), 201 – 220.

the infection in Trinidad and Tobago. The fly species that cause screwworm myiasis were considered a distant second in importance to the *Boophilus* species tick as animal pests. Musai (1997) reported 107 positive cases of canine spirocercosis during the period 1980 - 1995. The period 1991 - 1995 showed a two-fold increase in the number of positive cases as opposed to the 1980 - 1990 period (Musai, 1997).

In 1996 there were three cases of Salmonellosis, eleven cases of suspected Campylobacteriosis *C. Fetus Venerealis*, 25 cases of suspected salmonellosis and one case of suspected dermatophilosis in dogs (MALMR, 1996). *S. scabiei* var. *canis* can transfer from its primary canine host to its accidental host (man) (Haynes, 1985), therefore it is of interest that there were reports in the human population of epidemic levels of scabies infestation in Trinidad of 410 - 709/100,000 from 1986 to 1988, and 1124/100,000 in Tobago in 1988 (Reid *et al.*, 1990). A study of 200 canine serum samples suggested a seroprevalence of *Brucella canis* in dogs of five percent in the area studied (Georges, 1995).

List of anthelmintics used in Trinidad for dogs

Trade name	Active ingredient
Zentel	Albendazole
Coopane/Canoids	Piperazine, Adipate
Scolaban	Bunamidine
Vermiplex	Dichlorophene, Toluene
Ketrax	Levamisole
Telmin KH	Mebendazole
Nemocid/Combattrin	Pyrantel pamoate
Lopatol	Nitroscanate

There is no comprehensive published information available on the number of dogs in the country. There are pets, pet/watch dogs, watchdogs, security dogs and hunting dogs receiving various levels of care. Three studies give an indication of the population of stray dogs. One Trinidad-based study reported that 820 dogs were taken in by the Trinidad and Tobago Society for the Prevention of Cruelty to Animals (TTSPCA) from November 1995 to February 1996 and only 1.3% were reclaimed (Pyke, 1996). Of the 152 dogs captured by the Port of Spain dog pound in the same period 14.1% were reclaimed. There was an intake of 101 dogs at the Tobago branch of the TTSPCA from June 1996 - February 1997, of which 55% were adopted (Caruth, 1997).

In 1997 and 1998, interviews were held with forty-three new respondents to obtain more details on and more instances of the plant-based remedies. Nine key respondents were concentrated in Paramin, the area designated A (Map 2). One key respondent in area A was recognised and consulted by her community as a specialist in folk medicine and also sold medicinal plants. The other respondents in this area had dogs and used some of the plants mentioned in this case study to treat their pets. Group and individual interviews were held with the respondents in Area A. Area A is a part of Trinidad with a higher density of descendants of French and Spanish speaking people than the areas covered by the school-essay method conducted in 1995. Area A was not part of the research area covered in 1995. Area A was visited five times over the two-year period, 1997-1998. The sample from Area A was obtained by referral and so is a snowball sample. Thirty-four respondents were resident in area B (Map 2). Information from these respondents was obtained when they presented

their dogs to a clinic in Arima²¹. These respondents came from Arima, Sangre Grande, Guanapo, Aripo, Talparo, Valencia and Tamana, and supplemented the two respondents obtained from this area in 1995. This sample is best described as a convenience sample. Area B is of interest because it has remnants of the original native Amerindian inhabitants of Trinidad, and their knowledge. Plants were collected on 25% of the visits to Area A to verify that the common names used by each respondent were the same as those recorded in the literature. The plants described in this case study are common and well-known.

Results

Respondents used decoctions and infusions. 'Leaves' means that the top piece of the plant was used in the case of large plants. The respondents demonstrated to the authors that the entire plant minus the roots was used if it was a small plant. These demonstrations imply that plant-stem material was used in addition to the leaves. The most-common dose described was "some". Even the population of the convenience sample at the Arima clinic was reluctant to give details of dosages.

The term "grooming" as used in Trinidad and Tobago is broad enough to cover the use of fly repellents applied to the coat. However, in this case study the term is confined to "making the coat shiny and removing the loose hairs". Aqueous solutions of plant leaves used as fly repellents are categorised in this case study as ectoparasite prevention as opposed to treatment. When talking about the efficacy of the plants, three respondents claimed that what worked for one dog might not work for all, and also that the effective dose depended on the individual dog. The ethnoveterinary usage of locally available plants for dogs in Trinidad and Tobago are presented in Table 14. Twenty plants are used.

Table 14. Medicinal plants used for pet dogs

Scientific name	Family	Common name	Plant part used	Use
<i>Anacardium occidentale</i>	Anacardiaceae	Cashew	Bark	Diarrhoea
<i>Psidium guajava</i>	Myrtaceae	Guava	Buds, leaves	Diarrhoea
<i>S. jamaicensis</i>	Verbenaceae	Vervine	Leaves	Milk let down
<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Leaves	Grooming
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Grooming
<i>Scoparia dulcis</i>	Scrophulariaceae	Sweet broom	Plant tops	Grooming
<i>Bixa orellana</i>	Bixaceae	Roukou	Inside pods	Mange
<i>Crescentia cujete</i>	Bignoniaceae	Calabash	Pulp	Mange
<i>Eclipta prostrata</i>	Asteraceae	Congo lala	Plant tops	Mange, Fungal skin infections

²¹ This information was collected by clinic veterinarian Dr. Tisha Harper and is considered separate from the interviews documented in Chapter 5 on methods.

Table 14. Medicinal plants used for pet dogs (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Musa species</i>	Musaceae	Moko, Banana	Stem	Mange
<i>Manilkara zapota</i>	Sapotaceae	Sapodilla	Seeds	Myiasis
<i>Cajanus cajan</i>	Fabaceae	Pigeon pea	Leaves	Ectoparasite
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Ectoparasite
<i>Mammea americana</i>	Guttiferae	Mammee apple	Seeds	Ectoparasite
<i>Nicotiana tabacum</i>	Solanaceae	Tobacco	Leaves	Ectoparasite
<i>Pouteria sapota</i>	Sapotaceae	Mamey sapote	Seeds	Ectoparasite
<i>Areca catechu</i>	Arecaceae	Betel nut	Fruit/nut	Anthelmintic
<i>A. indica</i>	Meliaceae	Neem	Leaves	Anthelmintic
<i>Cajanus cajan</i>	Fabaceae	Pigeon pea	Leaves	Anthelmintic
<i>Carica papaya</i>	Caricaceae	Papaya	Seeds	Anthelmintic
<i>Cassia alata</i>	Caesalpiniaceae	Senna	Leaves	Anthelmintic
<i>C. ambrosioides</i>	Chenopodiaceae	Worm grass	Leaves	Anthelmintic
<i>Cocos nucifera</i>	Arecaceae	Coconut	Jelly	Anthelmintic
<i>Gossypium species</i>	Malvaceae	Cotton bush	Leaves	Anthelmintic

Plants used for diarrhoea

The bark of the cashew tree is boiled for 15 - 20 minutes, until it is reddish brown in colour; then, the decoction is given to the dog to drink. Guava leaves are boiled and the resulting decoction is given to the dog as the drinking water.

Milk let-down

A decoction of "some" leaves of the vervine plant is given to dogs to achieve milk let-down.

Plants used for skin diseases and mange

Four plants used to treat mange are administered via baths. Bamboo leaves are combined with black sage and congo lala leaves to bathe dogs. This combination is used if the dog is being bathed in a river. The bamboo leaves are taken from the river bottom and are only used if they are available. Black sage and sweet broom are used to bathe animals with skin problems. A "bundle" of leaves (judged sufficient for the size of the animal) is used. The leaves are pulverised in water, and the resulting solution is used to bathe the animal. During the bath, the leaf residue is used to scrub the dog. In this bundle, the black sage is seen as the essential component and the leaves of the plant were reported to have fine hairs and oils. It is claimed that when black sage is used the loose hairs in the coat fall off and new ones grow. Black sage is used before dog shows to make the dog's coat shiny.

Two tree fruits are used to treat mange. One of these tree fruits is called roukou locally but is known commercially as Annatto. The roukou pod is broken open and the inside of the pod with its small seeds is rubbed on the area of the dog that shows signs of mange. One pod is used per affected site and the application is done once or twice while the dog is being treated. Some respondents bathe their dogs first with various products, then apply the roukou. Because roukou is a plant dye, a dog with a severe case of mange can have up to 60% of its skin dyed red. The second tree fruit used to treat mange is calabash. The pulp of the calabash fruit is applied externally on the affected dogs. One respondent claimed that the calabash pulp was in a decayed condition when used.

Mange is also treated with the "water" from banana stems. The trunk or stem of the banana plant is cut diagonally with a machete. The stem juice or exudate that oozes out is collected and then applied to dogs with minor cases of mange. The respondents described the stem used as "rotten moko" (meaning that the banana plant chosen had been previously harvested and cut to knee height). This cut surface had therefore been exposed to the elements, which may have altered the amount and quality of the stem juice collected. Dogs are bathed with leaves of Congo lala crushed in water to treat mange and fungal skin infections.

Plants used for ectoparasites

Sapodilla is a tree fruit. The seeds of the fruit are dried and pounded until fine. The resulting powder is put on cuts to prevent myiasis. The exudate from the cut stem of the banana trunk is collected on a piece of cotton, and the cotton is then placed in a deep wound to cure myiasis. When the fly larvae have died, the wound is covered to prevent further infections. The exudate-soaked cotton is also used in wounds to prevent infection.

Dogs are bathed with black sage, congo lala, or pounded sweet-broom leaves to repel flies and ticks. The method of administration used for these three plants is similar. A "bundle" of leaves and stems (judged sufficient for the size of the animal) is rolled and placed in a bucket of water. The resulting solution is then rubbed into the coat. Sweet-broom leaves are reported to produce lather. Seeds of the tree fruits mammy-apple or mammy-sepote are sun-dried, grated and mixed with coconut oil (*Cocos nucifera*). The resulting paste is rubbed on the dog to keep away flies and ectoparasites.

Hunting dogs and dogs that are allowed to stray are reported to get parasites in their noses from drinking in puddles. The parasite is possibly an unidentified species of leech (Prof. P.R. Bacon, Department of Life Sciences, University of the West Indies, pers. comm., 1999). Pounded tobacco leaves are steeped in alcohol and kept until needed. If the dog appears to have a parasite in its nostrils, some of this solution is placed in the dog's nose. Alternatively leaves of pigeon pea are pounded with a pinch of salt, olive oil and honey and this is given to the dog when it starts coughing.

Plants used as anthelmintics

The leaves/plant tops of three plants and three trees are used as anthelmintics. A handful of the leaves of the neem tree is ground and the solution put into the food or water. Pigeon-pea leaves are used infrequently as an anthelmintic. "Some" pigeon pea leaves are ground, the juice squeezed out, and this liquid is mixed with salt and honey and administered for internal

parasites. Alternatively, a decoction of the tip of a pigeon-pea branch is given to the dog to drink. One respondent specified a decoction of 15 - 20 leaves for two dogs which was given as the drinking water. Seeds from the papaya fruit and leaves from the senna tree are also used to deworm dogs.

Worm grass is a commonly used anthelmintic. Two respondents pounded "some" worm grass leaves with olive oil and with salt and gave the resulting liquid to the dog. More often, a decoction of the leaves made with water or milk is given to the animal. Milk is favoured for puppies. The most commonly used remedy is a decoction of cotton-bush leaves which is given to dogs as the drinking water, with milk or in food. The most-frequently described dose given was "some", followed by "1 or 2 leaves." Three respondents suggested two leaves as a dose for a small dog (< 16 kg), four or five leaves was considered by four respondents to be the dose for a large dog (> 25 kg). Only three respondents pounded four or five leaves to make a dose of half of a teaspoon or 2.5 ml that was then administered.

Dogs are sometimes tied for several hours after administration of the plant-based anthelmintics. There were respondents who followed up the administration of the anthelmintic plants with a purgative. These anthelmintic plants are often administered when the moon is waning. The parasites are said to be more susceptible to the medication when the moon is waning or in the full-moon phase. Other respondents felt that dogs are more likely to become infected during the full-moon phase.

There were some concerns expressed by the veterinarians interviewed about the plant-based anthelmintics. Veterinarians reported that they had cases of weak pups dying after being given *Gossypium barbadense* or *G. hirsutum*. Two veterinarians felt that the plant-based anthelmintics paralysed and eliminated roundworms, but three others reported that after clients had used the plant-based anthelmintics to deworm their animals, stool-sample analyses conducted at the clinics still showed positive values for hookworms and roundworms. The veterinarians also claimed that the dewormed puppies were still in poor condition when brought in, and that the client or the veterinarian saw roundworms after the puppies had been dewormed with the plant-based anthelmintics.

Informant-managed medicinal plant research²²

One woman used betel nut (*Areca catechu*) as an ethnoveterinary anthelmintic for her pet dogs. Ms. R. was concerned about the chronic diarrhoea of her son's 34-kg. mixed breed dog. Ms. R. associated the diarrhoea with an endoparasite infection and tried conventional dewormers for the dog. However she was dissatisfied with their efficacy. She had read of the use of *Areca catechu* as an anthelmintic in a published work (Mahabir, 1991). She decided to try this remedy on the dog. Ms. R. bought some betel nuts from the village (Hindu) puja shop. She experimented with a dose that was split in two and given in her son's dog's food for two successive nights. The dog was observed after the initial feeding for any side effects; none were seen. This initial dose was considered successful since the diarrhoea stopped within 48 hours. This initial dose has been used subsequently for the 34-kg. Dog and a fraction of this dose is given to her 7-kg. dog. The dogs are treated

²² Brown and Lans, 2000. Poster presentation 3rd International Symposium on Herbal Medicines in the Caribbean, University of the West Indies, Mona, July 7th - 9th, 2000.

each time they are observed to have diarrhoea and / or seen to be eating grass. Ms. R. has also recommended this ethnoveterinary remedy to neighbours and friends since it appears to be efficient and at TT\$0.25 / nut is cost-effective relative to the TT\$6.00 cost of deworming a 34-kg. dog with the commercial anthelmintic Nemocid (Pyrantel pamoate). Stool samples from the dogs given the betel nut powder were examined for parasite eggs but the results were inconclusive.

Discussion

There was no indication of overlap of respondents and key respondents. The emphasis on obtaining many respondents from as wide a cross-section as possible was to increase the possibility of meeting key respondents who would be willing to discuss dosages and techniques and would be able to show researchers a sample of the medicinal plant. The research methods used partially achieved this objective.

Dosages

Lanusse and Prichard (1993) consider that a major disadvantage of self-administration systems is the wide variation in consumption between individual animals. Dosages given in tropical countries and in the Caribbean are usually imprecise or non-standardised (Bakhiet and Adam, 1995; Eldridge, 1975; Longuefosse and Nossin, 1996) and veterinarians sometimes criticise this characteristic of ethnoveterinary medicine (Lans, 1996). The work of Niwa *et al.* (1991) revealed that establishing an ethnomedicinal dose is more complex than anticipated by Lanusse and Prichard (1993). Niwa *et al.* (1991) recorded that natural plant-medicinal products were more effective in some patients than others because patients who respond well have larger amounts of acid and pepsin in their gastric juices. These more effective gastric juices degraded the medicinal-plant extract into bioactive low-molecular weight compounds with antioxidant activity from repeating polymers (such as alpha-tocopherol, beta-carotene and flavoprotein). While discussing the efficacy of their plant-based remedies, several key respondents claimed that "what works for some, does not work for others, and each individual has to work out their own dose". According to Strobel (1985), the idea that each individual (in collaboration or not with a healer) has to determine which plant and which dosage is effective for the complaint being treated, comes from the Hippocratic tradition.

The administration of anthelmintic plants during the waning phase of the moon has been previously reported (Lans and Brown, 1998b; Longuefosse and Nossin, 1996). The respondents frequent description of "boiling" the plant parts is confirmed by Morton (1980) who claims that decoctions are more commonly used than infusions. Morton (1980) and Eldridge (1975) emphasise that it is an error to think that the word "leaves" as used by respondents is literal, unless respondents are referring to individual leaves of large trees. Both Eldridge (1975) and Morton (1980) claim that the whole above-ground herb, or leafy stems or branch tips are the most common translations of the respondent term "leaves".

Scientific testing of natural remedies

Various studies have shown immunosuppression in dogs with demodectic mange and other infectious or parasitic skin diseases (Toman *et al.*, 1998), however it is not known if immunostimulation plays a role in the mange remedies based on *Bixa orellana*, *Crescentia cujete* or *Musa* species. The use of "rotten moko" by the respondents for mange and myiasis is borne out by experiments conducted by Haynes (1985). Haynes (1985) studied various ways of treating sarcoptic and demodectic mange in dogs in Trinidad such as sulphur in molasses; kerosene and sevin powder; kerosene and coconut oil (*Cocos nucifera*); and banana stems. Experiments of the effects of banana-stem extracts on ticks were also conducted. The complete study on mange treatments included forty dogs of both sexes and various ages and breeds (both pets and strays). Mange mites were identified from all dogs: 26 dogs had *S. scabiei* var. *canis*, nine had *D. canis* and five had dual infections. Haynes' (1985) research is best described as exploratory and responsive to the conditions of the dogs.

Haynes' (1985) experiments on the use of the sap of the banana stem will be briefly reviewed. Eight dogs were used: one with demodectic mange, five with sarcoptic mange and two with dual infections. Their weights ranged from 3 to 9 kg. Five dogs were treated at the University, while three were treated at their homes. Two methods of testing the banana stems for mange were used. In method 1, a bath was prepared by soaking sections of banana stem in water for 30 minutes. The banana stem was squeezed to remove the fluid and the residue discarded. The formula used was 1 kg banana stem to 4 litres water/ 3 kg body weight. The resulting banana-stem extract was applied with a cloth to the dog. Method 2 involved the direct rubbing of pieces of decomposed banana stem directly onto the dog (avoiding all sensitive areas). The Binomial and Fisher Exact non-parametric tests were applied to the results. Results were that 1 to 3 kg of very decomposed banana stem applied directly to the dogs twice weekly, cured one dog with demodectic mange in 15 weeks, two dogs with sarcoptic mange were cured in 6 weeks, and two dogs with dual infections were cured in 7 weeks (Haynes, 1985).

A series of experiments was conducted to determine the effect of the water-soluble components of decomposed banana stems on the larvae of the *R. sanguineus* (dog tick) and *Boophilus microplus* (cattle tick). The weight of the extracted material from one stem was 8.6 kg and the volume 5.8 litres. Two methods were used in the testing: the Fielder (1968; cited by Haynes (1985)) tea-bag method used by Wright and Riner (1979; cited by Haynes (1985)) and the filter-paper method of Granett and Sacktor (1947; cited by Haynes (1985)). Haynes (1985) used the results of the tick-larvae experiments to suggest that the banana-stem extract contained compounds that controlled mange— rather than the mange mites being killed by mechanical injury.

Review of the ethnomedicinal literature

The following section reviews the medicinal plants used for dogs with the non-experimental method based on Heinrich *et al.* (1992).

The ethnoveterinary uses of *Psidium guajava* and *Anacardium occidentale* for diarrhoea have transferred directly from the human use.

Anacardium occidentale bark decoction is drunk for diarrhoea in Curaçao, Suriname and Trinidad (Morton, 1981). The human dose in Suriname is a 10× 5-cm² piece of bark boiled in 1 litre of water (Morton, 1981). The bark contains phenols (cardanols, cardols, and anacardol) which have bactericidal, antifungal, antiinflammatory, analgesic, vermifugal, protozoicidal, parasiticidal and anti-enzymatic properties (Bakhiet and Adam, 1995; Oliver Bever, 1986; Wagner, 1993). The active compound in the bark is tannin (Tan, 1981).

Psidium guajava has been so well studied that it is recommended for human use in diarrhoeal cases (Robineau, 1991; Lozoya *et al.*, 1994).

6-hydroxyluteolol-7-glucuronide, apigenol-7-glucuronide and luteolol-7-glucuronide have been identified in *Stachytarpheta jamaicensis* (Duke, 2000). The plant has febrifuge and analgesic effects (Robineau, 1991), which might help alleviate the signs associated with mastitis. Another reason for its use as a lactagogue might be that ipolamide (a bitter iridoid glycoside) acts as a mild stomachic (Heinrich *et al.*, 1992) and this compound may have antiinflammatory properties (Schapoval *et al.*, 1998). Research conducted in 1990 did not find the antilactagogue compound dopamine (Robineau, 1991).

Little information was obtained on *Bambusa vulgaris*, however the undersides of the leaves are hirsute (Kapoor, 1990). This physical property of the leaves might have a positive effect on the dog's coat.

Scoparia dulcis is used for burns, skin rashes and irritations in Martinique, Trinidad, Brazil and Colombia (Wong, 1976; Hirschmann and Rojas de Arias, 1990; Laferriere, 1994; Longuefosse and Nossin, 1996). *Scoparia dulcis* is said to kill lice and fleas and is used against vermin in Paraguay (Morton, 1981). *Scoparia dulcis* whole plant soaked in water releases mucilage and the resulting liquid is claimed to be cool and refreshing (Morton, 1990). Polysaccharides in the plant might be protective of normal cells and stimulate regeneration of these and might have bactericidal and immunostimulant properties (Morton, 1990; Wagner, 1990, 1993; Oryan and Zaker, 1998).

Bixa orellana seeds applied locally are widely used against burns and skin diseases (Tan, 1981; Morton, 1981; Robineau, 1991), and these uses are recommended by Robineau (1991). The tannin content in the seeds would make it useful for external wounds (Tan, 1981). Wax-like substances from the seed coat of *Bixa orellana* paralyse intestinal parasites (Oliver Bever, 1986) and could possibly suffocate mange mites. The seed coat contains norbixin, a volatile oil, a fixed oil, and apocarotenoids (mainly bixin) (Harborne, 1975; Tan, 1981; Weniger *et al.*, 1993; Mercadante *et al.*, 1996), these oils might also suffocate mange mites. Four C₄₀-carotenes were tentatively identified in the seeds (Mercadante *et al.*, 1996). The seeds contain a volatile oil, saponin, tannin, carotenoids, bixin and traces of alkaloids (Mercadante *et al.*, 1996; Tan, 1981). Many saponins are toxic to insects (Robbers *et al.*, 1996). One of the seed alkaloids is reported to be toxic (Morton, 1981).

Research published in 1987 suggested that an extract of *Bixa orellana* experimentally produced hyperglycaemia in dogs (Morrison *et al.*, 1987). Weniger *et al.* (1993) quoted Morrison *et al.* (1987) but found no cytotoxic substances. *Bixa orellana* is traditionally used in the Caribbean and South America as a food colouring, aphrodisiac and spice in cooked food (Duke, 1970; Kainer and Duryea, 1992; Weniger *et al.*, 1993). *Bixa orellana* has been used by pre-Columbian natives to the West Indies, Central and South Americas as body paint, to

repel insects, for protection against sunburn and for what Morton (1981) calls "social reasons".

The pulp of *Crescentia cujete* is applied on dermatitis, coral cuts, sunburn, itchy skin conditions of dogs and cattle and has flea repellent properties (Morton, 1981). The cut open calabash fruit and the seeds are used to treat dogs with mange (Morton, 1968a&b; Duke, 1970). Tree cutters rub the pulp on their skin as a protection against the caustic sap from *Hippomane mancinella* (Morton, 1968a, 1981). Hydroalcoholic maceration of the fruit pulp inhibits *Streptococcus pneumoniae* and is considered emetic, purgative and toxic (Morton, 1981; Robineau, 1991). *Crescentia alata* chloroform and hexane extracts were active against *Candida albicans*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Streptococcus pneumoniae*, *Streptococcus pyogenes* and *Escherichia coli* possibly due to tannins, flavonoids and alkaloids (Binutu and Lajubutu, 1994; Rojas *et al.*, 2001). Other relevant compounds are quinones and saponins.

Eclipta prostrata (syn. *Eclipta alba*) entire plant is used externally in India, Suriname and the Philippines to treat swelling of ears on cattle, wounds, bruises and sores on the shoulders of draft animals, for skin diseases and to stop bleeding (Morton, 1981; Tan, 1981; Kapoor, 1990; Lachman-White *et al.*, 1992; Pal, 1997). The plant was used during the Vietnam war as an antiseptic and haemostatic (Tan, 1981). The plant improves hair growth and colour (black) (Kapoor, 1990; Pal, 1997). Constituents of the plant include large amounts of resin, sulphur-containing peptides, coumestans, triterpenoids (which have insecticidal activity), flavonoids, polyacetylenes, luteolin, antiviral ingredients including thiophenes, steroidal alkaloids, phenols, tannins, polypeptides and the insecticidal compound nicotine (Oliver Bever, 1986; Wagner *et al.*, 1986; Kapoor, 1990; Saxena *et al.*, 1993; Abdel-Kader *et al.*, 1998).

A triterpenoid glucoside (ecliptasaponin C), daucosterol and stigmasterol-3-O-glucoside were isolated from *Eclipta prostrata* (Zhang and Chen, 1996). The polyacetylenes have strong UV-mediated toxicity to bacteria and *Candida albicans* and are also toxic to insects and larvae (Oliver Bever, 1986) and may have antiinflammatory properties (Wagner, 1993). One of the steroidal alkaloids also showed good activity against *Candida albicans* (Abdel-Kader *et al.*, 1998). This would imply usefulness against secondary fungal infections in dogs with mange. Perrucci *et al.* (1995) claimed that natural monoterpenes with free alcoholic or phenolic functional groups have the best miticidal activity.

The trunk sap of various *Musa* species is used for burns in eastern Nicaragua (Coe and Anderson, 1996a), in India (Pal and Jain, 1989), and in Rodrigues (the Republic of Mauritius in the Indian Ocean) (Gurib-Fakim *et al.*, 1996). The sap has antibiotic activity (Morton, 1981; Robineau, 1991). In the Philippines and India, the juice of the pseudostem is used on wounds (including to bring about clotting in bleeding wounds) and might contain tannin and mucilage (Tan, 1981; Borthakur, 1997). In Thailand, "water" from the rotting stem is rubbed on ruminant fungal skin infections (IIRR, 1994). The sap/stem juice contains dopamine, noradrenaline, leucodelphinidin, leucocyanidin, deoxyxanthocyanidin, potassium nitrate, magnesium nitrate, tannins, and three amino phenols (which are sympathomimetic and might have vasoconstrictive properties) (Oliver Bever, 1986; Singh *et al.*, 1993). The plant contains 5-hydroxytryptamine (with insecticidal and vasoconstrictive properties), caprylic acid (with fungicidal and pesticidal properties) and kaempferol (with antibacterial properties) (Duke, 2000). The pith contains calcium and iron and the hull husk contains alpha-tocopherol, ascorbic acid, beta-carotene, carbohydrates, chlorophyll, fat, fiber, niacin and

norepinephrine (Duke, 2000). It would seem that banana stems have some of the properties of natural remedies that promote the healing of skin tissue. These are reported to be antibacterial action, acidic pH, and high carbohydrate levels (to provide nutrients and energy for healing tissue) (Oryan and Zaker, 1998). Amino acids and iron play a role in collagen formation and maturation (Oryan and Zaker, 1998). Action of an extract from the banana trunk resembled that of a potent local anaesthetic (Singh and Dryden, 1985, 1990).

Manilkara zapota seeds are poisonous and contain HCN, sapotin and saponin (Morton, 1981; Duke, 2000). Some triterpenoids including saponins are poisonous to insects (Robbers *et al.*, 1996).

Cordia curassavica may have acaricidal properties (Smith, 1974). *Cordia* species contain phenolic compounds and terpenoid quinones (Lachman-White *et al.*, 1992; Ficarra *et al.*, 1995).

The use of the seeds of *Pouteria sapota*, *Manilkara zapota* and *Mammea americana* for ectoparasite control in dogs is possibly derived from the human folk use against the chigger flea (*Tunga penetrans* Linn.) (Lans, 1996). This practice is also reported for *Mammea americana* seeds in Suriname (Morton, 1981) and by the Chocó Indians (Duke, 1970). Tungiasis is still present in south-western Trinidad (Chadee, 1998). Morton (1981) and Alvarado-Panameno *et al.* (1994) reported on the insecticidal and ectoparasitocidal properties of *Mammea americana* seeds.

After conducting a controlled study using hexane plant extracts of *Mammea americana*, Greenspan Gallo *et al.* (1996) claimed that components in the extracts of seeds, leaves and roots were insecticidal. The seed extracts contained the largest amount of mammein (a derivative of coumarin; Morton, 1981) and were the most insecticidal (Greenspan Gallo *et al.*, 1996).

Areca catechu nut contains five alkaloids (arecoline, arecaidine, guvaoline, guvacine and arecolidine) (Kapoor, 1990). Arecoline preparations were the active ingredients in some older commercial canine anthelmintics (eg. CanoidsTM). Arecoline is a cholinergic agonist/antagonist and this drug relies on the host to expel the paralysed parasite from the gastrointestinal tract (Comley, 1990).

Azadirachta indica contains triterpenoids called limonoids, all of which are active against more than 200 insect species (Berger and Mugoya, 1995; BOSTID, 1992; Robbers *et al.*, 1996). Neem compounds (including azadirachtin, salannin, deacetylazadirachtinol and meliantriol) act as metamorphosis disruptants, feeding deterrents, pesticide and toxicants (Berger and Mugoya, 1995; BOSTID, 1992). Trials in Germany showed that neem preparations with high concentrations of azadirachtin were effective against intestinal nematodes in animals (BOSTID, 1992).

The use of *Cajanus cajan* as an anthelmintic could be attributed to the influence of the Chinese immigrants to Trinidad (Duke, 2000). A decoction of seven to nine leaves is used against intestinal parasites in humans in Rodrigues (Gurib-Fakim *et al.*, 1996). The leaves contain tannins, phytosterols and triterpenes (Robineau, 1991). Triterpenes are found in some anthelmintic plants (Oliver Bever, 1986).

Carica papaya is considered an effective and well-known anti-parasitic remedy (Heinrich *et al.*, 1992). A decoction of papaya seeds or the powdered seeds are used as anthelmintics in Africa, and Watt and Breyer-Brandwijk (1962) claimed that these preparations are not purgatives. The seeds contain carpaine which has anthelmintic activity (Duke, 1989; Kapoor, 1990). A benzylthiourea compound isolated from the seeds (the author did not indicate whether this compound is carpasemine) showed anthelmintic activity when tested against *Ascaris lumbricoides* (Kapoor, 1990).

Comley (1990) claimed that some plant anthelmintics are primarily purgatives that eject some of the intestinal worm burden. One example of this might be the use of the leaves of *Cassia alata* as an anthelmintic (as leaves are purgative) (Koch, 1993; Oliver Bever, 1986; Ortiz de Montellano, 1975; Watt and Breyer-Brandwijk, 1962). A decoction of leaves of *Cassia alata* is used as a human vermifuge in Trinidad (Morton, 1981), and this use has been transferred to ethnoveterinary medicine. Relevant compounds are the cathartic anthraquinone glycosides: chrysophanic acid; rhein and its glucoside; aloë-emodol; aloë-emodin and sitosterol (Ortiz de Montellano, 1975; Morton, 1981; Tan, 1981; Oliver Bever, 1986; Hemlata and Kalidhar 1993).

Chenopodium ambrosioides is considered an effective and well-known anti-parasitic remedy (Duke, 1989; Heinrich *et al.*, 1992). The essential oil of *Chenopodium ambrosioides* contains ascaridol as its main component (Oliver Bever, 1986). Five grams of the plant is reportedly equivalent to 17.5 µg of ascaridol (Robineau, 1991). The more-effective treatments of dogs by the respondents perhaps combined the anthelmintic plant with a purgative after administration (Oliver Bever, 1986).

Cocos nucifera milk of the green fruit contains amino acids. The oil contains lauric, myristic and fatty acids, glycerides, phytosterol and squalene (Kapoor, 1990).

Gossypium species plant leaves and stems contain several insecticidal and pesticidal compounds such as alpha-phellandrene, alpha-pinene, camphene, chlorine, cyanidin, delphinidin, myrcene, catechin, rutin, quercetin, *p*-coumaric acid, palmitic acid and tannin (Duke, 2000).

The crushed leaves of Tobacco in a decoction was recommended as an insecticidal spray by Tan (1981), and is used as a parasiticide and ascaricide in the Netherlands Indies, Vietnam and Mauritius (Watt and Breyer-Brandwijk, 1962). Tincture of tobacco is used in Latin America to remove ticks (Duke, 1989).

Seeds of *Pouteria sapota* contain amygdalin, sinaptose, tannin, glucose, albumin and casein (Morton, 1981). Enzymatic hydrolysis of amygdalin yields hydrocyanic acid and benzaldehyde (Robbers *et al.*, 1996).

Conclusion

This review of the ethnomedicinal literature indicates that ethnobotanical, phytochemical and/or pharmacological information provides some support of the ethnoveterinary use of the plants discussed in this case study.

9b. Case Study 7: Hunting dogs²³

Abstract

Ethnoveterinary medicines are used by hunters for themselves and their hunting dogs in Trinidad. Plants are used for snakebites, scorpion stings, for injuries and mange of dogs and to facilitate hunting success. Plants used are *Piper hispidum*, *Pithecelobium unguis-cati*, *Bauhinia excisa*, *Bauhinia cumanensis*, *Cecropia peltata*, *Aframomum melegueta*, *Aristolochia rugosa*, *Aristolochia trilobata*, *Jatropha curcas*, *Jatropha gossypifolia*, *Nicotiana tabacum*, *Vernonia scorpioides*, *Petiveria alliacea*, *Renealmia alpinia*, *Justicia secunda*, *Phyllanthus urinaria*, *Phyllanthus niruri*, *Momordica charantia*, *Xiphidium caeruleum*, *Ottonia ovata*, *Lepianthes peltata*, *Capsicum frutescens*, *Costus scaber*, *Dendropanax arboreus*, *Siparuma guianensis*, *Syngonium podophyllum*, *Monstera dubia*, *Solanum* species, *Eclipta prostrata*, *Spiranthes acaulis*, *Croton gossypifolius*, *Barleria lupulina*, *Cola nitida*, *Acrocomia ierensis* (tentative ID).

Introduction

The aim of this case study is to evaluate the ethnoveterinary remedies used by certain hunters in Trinidad. Plants are used to treat snake bites and scorpion stings and for hunting success. During the research some hunters claimed that their dogs either started hunting or hunted better after they had treated them in various ways with medicinal plants. This study has evolved out of an interest in a non-experimental evaluation of Trinidad and Tobago's ethnopharmacopoeia. This evaluation establishes whether the plant use is based on empirically verifiable principles or whether symbolic aspects of healing are more important (Heinrich *et al.*, 1992). Hunters are principally interested in the following game animals: agouti (*Dasyprocta agouti*), matte (*Tupinambis negropunctatus*), tatou (*Dasyprocta novemcinctus*), deer (*Mazama americana trinitatis*), lappe (*Agouti paca*), manicoú (*Didelphis marsupialis insularis*), wild hog/quenk (*Tayassu tajacu*). The hunting season lasts from October 1st to February 28/29, then there is a closed season for the rest of the year. There is no comprehensive published information available on the number of hunting dogs in the country. Hunting dogs are typically foxhounds, 13 inch and 9 inch beagles, coonhounds (all original stock imported) and mixed breeds. These dogs are usually scent and not sight hounds.

Background and Methods

Data collection

The research area is located in Guayaguayare on private land belonging to a State-owned oil company. This area also has a protected animal reserve where in theory no hunting is allowed. From 1997 - 1999, the author conducted research with one group of seven hunters based in south Trinidad on private land belonging to a State-owned oil company (not in the protected animal reserve). This research included participant observation (Etkin, 1993), which involved taking part in five hunts over the three years (going into the forest, observing the chase and capture, sharing a meal and sharing of take home

²³ This case study was submitted a Journal for review.

game). One veterinarian²⁴ served as the linkage who provided entrance to this group and facilitated the participation in the hunting activities. The ethnoveterinary remedies were written up into a handout. The author joined in two social occasions in which each hunter in turn sat with the researcher and added details to information already documented in the handout and confirmed his remedies. Each trip and social occasion involved listening to each hunters stories, which usually involved complicated trails, how far each hunter had to walk to find dogs, which animals were being chased, where they were shot and how, coping strategies when lost, which hunter coped better with sleeping 'out', and killing of snakes or ocelots (*Felis pardalis*). While a story was being told others listened in silence or sometimes interjected with their own story.

Unstructured interviews were also held with four individual hunters in North Trinidad (Paramin) and two in Central Trinidad (Talparo) and four in Mayaro (South Trinidad). Paramin and Talparo retain Hispanic traditions either from the original Spanish colonists or from continuous small-scale immigration from Venezuela (Moodie-Kublasingh, 1994). The following information was collected from all respondents, the popular name, uses, part(s) used, mode of preparation and application. The ethnoveterinary handout was given to two hunters. These two hunters then used the documented information to provide 50% of the plants. A third hunter provided the plants that he used to bathe dogs for quenk hunting. The author collected the other forty percent of the documented plants. All the plants were identified at the University of the West Indies Herbarium.

Results

Environmental hazards

The following section outlines environmental hazards to hunters (and researchers), which may explain some of their bush medicine remedies. One research hazard was the presence of a mite infestation *Trombicula* species, in the area. These mites are called 'bête rouge' locally because of the orange colour of the larval cluster seen on the skin. The mites affect game animals like Agouti and can attack man since they attach themselves to all mammals and vertebrates. The author can confirm that depending on the sensitivity of the individual a larval infection produces slight or extreme irritation. Lesions may persist after the larvae have left to begin their adult stage however the dermatitis disappears. The adult mites are free living on vegetation and are found in fruit- growing areas on chalky soil (Wall and Shearer, 1997).

Yellow fever outbreaks in the past have affected howler monkeys (*Alouatta seniculus insularis*) and can spread to any mammals, since these monkeys are susceptible to sylvan forms of the human disease (Alkins, 1979). Another occupational and research hazard is the presence of constricting and venomous snakes. 'Belle chemin' (*Liophis melanotus nesos*) is a constrictor. The 'huile' (*Boa murina*) eats all vertebrates. There are two families of venomous snakes. Within the Elapidae family in Trinidad there are two poisonous coral snakes (*Micrurus lemniscatus*, *Micrurus psypes*) which rarely bite dogs or humans since they are small, rare, and have retracted fangs. *Micrurus* venom has moderate effects on blood coagulation and tissue integrity, however, victims rarely survive because the potent neurotoxin in the venom causes a postsynaptic blockade of neuromuscular transmission.

²⁴ Dr. Elmo Bridgewater is a long-standing member of the hunting group.

The neurotoxin can cause cranial nerve paralysis leading to neurotoxic facies or respiratory paralysis and death (Nishioka *et al.*, 1993).

Some harmless snakes from various families like *Leptodeira annulata ashmeadi*, *Leptophis ahaetulla coeruleodorsus*, *Clelia clelia cleia*, *Helicops angulatus*, *Liophis* species, *Oxybelis aenus*, *Pseudoboa newwiedii*, *Thamnodynastes* species, and *Tripanurgos compressus*, *Erythrolamprus* species, *Siphlophis cervinus*, *Oxyrhopus petola petola*, may bite and cause a reaction or mild envenomation (Murphy, 1997). The last three are called false corals since they mimic true coral snakes for protection. Bites from false corals are more common than those of true corals (Nishioka *et al.*, 1993).

Snakes in the Crotalidae family are locally called 'mapipire'. These snakes are pit vipers with long, hollow fangs. The mapipire 'z'ananna' or 'bushmaster' (*Lachesis muta muta*) and 'mapipire balsain' or 'fer-de-lance' (*Bothrops atrox atrox*) are large and poisonous. *Lachesis muta* can inject a large dose of venom in a single bite (Jorge *et al.*, 1997). These snakes have front fangs and bitten areas show severe swelling and necrosis of tissue due to haemorrhagic, myotoxic, necrotizing, defibrinogenating, coagulant, caseinolytic, proteolytic, oedema-inducing, coagulant and neurotoxic venom activities (Jorge *et al.*, 1997).

Hunting dogs may be stung by scorpions of the Buthidae family (*Tityus trinitatis*). The effects of the sting can be severe. *Tityus trinitatis* accounts for 90% of the scorpion population, but there are six other species which are all venomous (Kenny *et al.*, 1997; George Angus *et al.*, 1995). Signs would be swelling, pain and limping in dogs. There are approximately 175 stings by *Tityus trinitatis* and eight human deaths annually (Hutt and Houghton, 1998). In humans acute symptoms are convulsions, nausea, vomiting, drowsiness, sweating, dyspnoea and localised burning (George Angus *et al.*, 1995). Of all scorpion sting victims, 80% developed acute pancreatitis and in 38% of these cases there was no abdominal pain (George Angus *et al.*, 1995).

Conventional treatment in Trinidad for snake bites and scorpion stings in dogs makes use of steroids, antibiotics and the ananase enzyme (from the Pineapple *Ananas comosus*) and needs to take place within 2 hours of the bite. The snake bite site typically is a necrotic area, the skin sloughs off due to the proteases in the venom and the area looks dark and bruised (Melo *et al.*, 1994). The ananase enzyme reduces the inflammatory response; and helps the breakdown of necrotic tissue. It is felt that dogs bitten on the head have a better chance of survival since there is less vascular absorption of the venom.

Hunter's ethnoveterinary medicines

Several plants are used in an attempt to improve hunting success²⁵. For this purpose the odour and other physical characteristics of the plant are very important. Plant use for hunting success has been divided into four categories. The first is called "steaming" and these plants are usually administered in baths and are considered mental and/or physical stimulants. Steaming is also carried out with one type of insect (an unidentified solitary wasp that hunts spiders²⁶). Both the wasp and its spider prey are put into rum with

²⁵ One hunter claimed he used 'no compelling' implying that the plants used 'compelled' dogs to hunt.

²⁶ Butt Colson and de Armellada have done research on the tribes of the Akawaio and northern Pemón, Carib-speaking Amerindians in the Guiana Highlands of the border areas of Venezuela, Brazil and Guyana. They claim that the qualities and

guinea pepper (*Aframomum melegueta*) on a Friday. This solution is then given to the dog, or included in the bath water, and it was claimed to have a stimulant effect on the dog.

The second category comprises plants placed in the dog's nose. Here it is expected that this action will act as a nasal and chest decongestant and the dog will subsequently have a better sense of smell and improve its ability to follow a scent.

The third category is based partly on the Doctrine of Signatures in which a plant characteristic is considered to have a desirable quality or to have a physical property that resembles the desired game. This desirable quality is claimed to be transferred to the dog after the plant is used in a bath. The plant's used in this category are also chosen in recognition of animal behaviour. For example one respondent claimed that after the hole of an agouti was dug out *Piper marginatum* was found in the hole and it was claimed that it was being used as a bed. Therefore hunting dogs bathed with this plant would recognise the smell of the agouti, which would carry traces of the strong smell of *Piper marginatum*.

The fourth category is called "cross". In this situation the hunters complain that the dog goes in the opposite direction from the game. The dog is faced upstream and bathed in a river and rubbed with the crushed leaves of seven different plants (sometimes the plants used have no other distinguishing characteristic). The dog is then turned to face downstream. One hunter who hunts quenk claimed that dogs are trained to hunt small game first. For example the dog is bathed with congo lala (*Eclipta prostrata*) and it will start hunting matte (*Tupinambis nigropunctatus*), then it is bathed with carailli leaf (*Momordica charantia*) and barbadine leaf (*Passiflora quadrangularis*) so that it will hunt larger game. Eventually the dog is bathed with the plants for quenk.

Plants are also used for emergencies such as snake bites. Plants used for snake bites are typically made into tinctures with alcohol or sweet oil (olive oil) and kept in 150 ml flasks called snake bottles. Snake bottles contain one or more plants and/ or insects. These tinctures are also used against scorpion stings (*Tityus trinitatis*). Plants used in snake medicines are often collected during Lent or specifically on Good Friday. In normal years this period corresponds to the Dry season and the concentration of plant chemicals may differ from other times of the year. Tref (*Aristolochia trilobata*) has to be rewarded with silver coins as a symbolic payment before removing some of its parts, or the respondents claim that the entire plant or clump of plants will die. This payment was supposed to be placed in the hole from which the root was dug. The only explanation given for the payment was that the plant was not a "simple plant". Several of the plants have one local name for several closely related species. For example Candlestick is the name of *Piper hispidum*, *Piper marginatum* (species collected), *Piper amalago* and *Piper dilatatum*. Monkey step refers to either *Bauhinia exilis* or the more commonly found *Bauhinia cumanensis*. All closely related species will be dealt with in the ethnomedicinal literature review.

The ethnoveterinary uses of the plants for hunting dogs are presented below in Tables 15a and 15b.

habits of animals and insects are also called on by the shaman in his tasks. One insect is the Wanawanari or excavating sand wasp *Ammophila*. The insect after preparing the nest, flies off and soon returns with an immobilised grub or insect. This is placed in the nest with the egg as a fresh source of food for when the young wasp hatches. Pemon say the Wanawanari is a great shaman that brings life and vitality by causing a metamorphosis from a cold, inert grub/insect to another Wanawanari (Butt Colson and de Armellada, 1983).

Table 15a. Plants used for successful hunting (steaming, "crossed", dog's nose)

Scientific name	Common name	Use
Zingiberaceae <i>Aframomum melegueta</i>	Guinea pepper	Dry seeds are ground to a powder, and sprinkled on the dog's food
Aristolochiaceae <i>Aristolochia rugosa</i>	Mat root	Considered "hot". Used to bathe lazy dogs (also crossed dogs)
Solanaceae <i>Capsicum frutescens</i>	Bird pepper	Put in dog's nose so it can find trail or to improve its ability to follow a scent
Cecropiaceae <i>Cecropia peltata</i>	Bois canôt	Dry leaf is put in water with red Physic nut (<i>Jatropha gossypifolia</i>). The water is left in the open for nine days until larvae are seen. The water is then used to bathe the dog
Euphorbiaceae <i>Croton gossypifolius</i>	Blood bush/ Bois sang	Bathe dog with leaves of bois sang and kojo root plant and mardi gras leaves and berries if the dog is not performing as well as in the past
Not yet identified	Turpentine bush	Bathe dogs with crushed leaves
Euphorbiaceae <i>Jatropha curcas</i> , <i>Jatropha gossypifolia</i>	White/Red Physic Nut	Three leaves each of white and red bushes are crushed and put into bath water. The water is then used to bathe the dog
Piperaceae <i>Lepianthes peltata</i>	Sun bush	Use crushed leaves to bathe dog for "cross"
Solanaceae <i>Nicotiana tabacum</i>	Tobacco	Cleans dog's nose to improve its ability to follow a scent
Piperaceae <i>Ottonia ovata</i>	Pot bush	Crush a piece of stem and leaves or roots and put it in the dog's nose or wash the dog's nose with decoction
Phytolaccaceae <i>Petiveria alliacea</i>	Kojo root	Bathe dogs with ground root so they are more alert
Euphorbiaceae <i>Phyllanthus urinaria</i>	Seed under leaf	Plant tops used to bathe dogs for "cross"
Piperaceae <i>Piper hispidum</i>	Candle bush	Leaves are used to bathe dogs
Asteraceae <i>Vernonia scorpioides</i>	Ruckshun	Bathe dogs with leaves so that they are more alert

Table 15b. Plants used for successful hunting (Doctrine of Signatures)

Scientific name	Common name	Useful plant quality	Use
Araliaceae <i>Dendropanax arboreus</i>	Fei jein		Combine with leaves of the plants below to bathe dogs "steam" to catch quenks
Araceae <i>Monstera dubia</i>	Sei jein		Ditto
Monimiaceae <i>Siparuma guianensis</i>	Dead man's bush		Ditto
Solanaceae <i>Solanum</i> species	Devil pepper		Ditto
Araceae <i>Syngonium podophyllum</i>	Matapal-kit		Combine with leaves of the plants above to bathe dogs "steam" to catch quenks
Cucurbitaceae <i>Momordica charantia</i>	Caraalli	Used to bathe dogs so that it will catch agouti	
Piperaceae <i>Piper marginatum</i>	Agouti bush / Lani bois	Plant used so the dogs will catch Agouti	Leaves used to bathe dogs. Some hunters combine the lani bois with leaves of guatacare (<i>Eschweilera subglandulosa</i> Lecythidaceae)
Mimosaceae <i>Pithecelobium unguis-cati</i>	Cat's claw	The vine clings to any tree with "claws", therefore the dog will closely pursue Agouti	5 - 7 shoots of the whole vine are pounded and put into water and this is used to bathe the dog
Zingiberaceae <i>Renealmia alpinia</i>	Mardi gras	Berries on plant attract lice, which get trapped in the leaves and die. Dog will closely pursue the game	Plant berries and leaves are used to bathe the dog
Poaceae <i>Saccharum officinarum</i>	Sugar cane	Deer eat these leaves	Leaves are used to bathe dog so it will track deer
Orchidaceae <i>Spiranthes acaulis</i>	Lappe bush	Plant has markings similar to lappe so the dog will track lappe	Vine is used to bathe the dog
Araceae <i>Xanthosoma brasiliense</i> , <i>Xanthosoma undipes</i>	Hog tannia	The leaf has needles similar to the bristle-like hairs on the back and neck of the wild hog/quenk. The quenks also eat these tubers.	The root (or tannia) is ground and sprinkled on the dog's food
Haemodoraceae <i>Xiphidium caeruleum</i>	Walk fast	Ethnomedical belief is that use of the plant helps children walk	Leaves used to keep dogs walking straight

Plants used for snake bites

If dogs are bitten by snakes, the injury is usually on the nostrils, forehead or front shoulder. For snake bites of hunters and their dogs a piece of the woody flexible vine called Monkey ladder (*Bauhinia cumanensis* or *Bauhinia excisa*, Fabaceae) is pounded and put on the bite. It is claimed that this stops the flesh around the bitten area from dropping off. Alternatively a tincture is made with a piece of the vine and kept in a snake bottle. Tinctures are also made with single or multiple ingredients and plant parts of the following: caterpillars (*Battus polydamus*, Papilionidae: identified by Boos, 1987) that eat the tref leaves (*Aristolochia trilobata*) are put into alcohol) with mat root (*Aristolochia rugosa*), cat's claw (*Pithecellobium unguis-cati*), tobacco (*Nicotiana tabacum*), snake bush (*Barleria lupulina*), obie seed (*Cola nitida*), and wild gri gri root (*Acrocomia ierensis* (tentative ID)). The leaf juice of *Eclipta prostrata* is used for scorpion stings. Emergency snake medicines are obtained by chewing the roots of Bois canôt (*Cecropia peltata*) taken from the east part of the tree and administering this chewed-root solution to the dog. Alternatively four or five berries of mardigras (*Renealmia alpinia*), are crushed with the juice of wild cane (*Costus scaber*) and the dog is given the resulting solution. All the respondents claimed that their snake medicines were effective against bites/stings of Mapepire. One respondent who used mardigras (*Renealmia alpinia*) for his dog claimed that the dog's throat became swollen after the snake bite. After he gave the dog the medicine it stood up and it was completely recovered hours later.

Plants used for mange and other skin conditions

The leaves and vine stem of wild caraalli (*Momordica charantia*) are crushed in water and used to bathe dogs with mange. The pulp of the fruit of the cannonball tree (*Couroupita guianensis*) is rubbed on the infected skin of many dogs. A frothy solution is obtained by crushing the leaves of syrio (*Sambucus simpsonii*) in water. This is used to rub dogs with mange. It is claimed that when the dog licks its skin, this medicine will also work internally. Dogs with rashes are bathed with St. John's bush (*Justicia secunda*, Acanthaceae). It is claimed that this plant imparts a red colour to the bath water.

Plants used for injuries

Dogs may get trauma damage during the hunt but may have insufficient contact with game animals to pick up any diseases directly from them. Mardigras (*Renealmia alpinia*) is used to bathe dogs who have strained a limb. Leaves of Physic nut (*Jatropha curcas/gossypifolia*) are boiled and the decoction used to clean sores. Other injuries that hunting dogs are susceptible to would be nail breakage, lameness and shoulder injuries, injuries caused by running into an object or the dog may be kicked by a deer.

Dosages

Dosages were imprecise but hunters claimed to know what would happen with some cases of overdosing. For example an overdose of Ruckshun (*Vernonia scorpioides*) would over-excite the dog to the point where it would even bark at snakes. If a dog is given a tincture made with Punccheon Rum (80% proof), it is claimed that the dog may become temporarily crazy. Based on experiences like these, some hunters have switched from alcohol to olive oil for their tincture solution. Additionally alcohol tends to evaporate. However lipophilic compounds are extracted in alcohol that would not be extracted by olive oil.

One respondent claimed that Pot bush (*Ottonia ovata*) gave his dog a headache (it shook its head continuously and there is no sign of anything in its ear), and it made two respondent's tongues numb. This respondent then put Vicks™ in his dog's nose as an alternative. Another used vinegar as an alternative to the 'scratchy' pot. Another respondent claimed that dogs had a stronger constitution than humans and should be given the equivalent of twice the human dose.

Discussion

The following sections examine the plant used by hunters in a holistic manner, however, It is difficult to judge hunting success. Cultural factors are examined first and then the 'efficacy' of all the plants used is evaluated using a non-experimental method.

Cultural factors

Solanum americanum was used in Trinidad to ward off evil (Moodie-Kublalsingh, fieldnotes). It was claimed by one respondent that when dogs are "crossed" and seem to be "climbing trees" they are really chasing spirits in the forest. The Tacana in Bolivia believe that malevolent spirits dwell in canopy trees such as *Dipteryx odorata* and *Ceiba samauma* (Bourdy *et al.*, 2000).

Hell (1996) developed a folk taxonomy of European hunters that distinguishes between red beasts (deer), black beasts (boar), and stinking beasts (fox). A longer fieldwork period would be necessary to know how closely the Trinidad system fits this scale (See Fig. 7 below). The first non-Amerindian hunters in Trinidad were probably the Spanish, followed by the French. French (Creole) terms are used to describe the landscape, but these terms were not recorded. However there is literature establishing that native Amerindians participated in hunts with Creole hunters (Carr, 1893) proving the point that indigenous knowledge is constructed through people's daily practical experiences as situated agents like hunters (Bebbington, 1994). The game animals are called beasts, and white meat (chicken) is classed at the bottom of the hierarchy, similarly to the European system (Hell, 1996). Collective hunting is deemed more socially acceptable than individual hunting, however the skill and landscape knowledge of the individual hunters who live off wild meat sales is acknowledged. Women do not hunt.

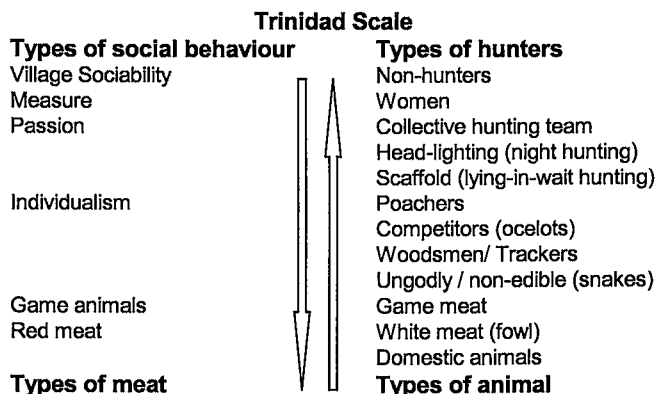


Fig. 7. Trinidad taxonomy of hunting

Amerindian conceptualisations of nature

The following section attempts to reframe the folk medicinal data in terms of bioscientific concepts and methods. Or establish whether symbolic aspects of healing (social support, belief systems) are of greater relevance (Heinrich *et al.*, 1992; Browner *et al.*, 1988). Amerindian conceptualisations of nature were a part of a complete belief system and arose through historical contingency, linguistic constraints, everyday experiences, metaphorical extension, ritual prohibitions and so on (Ellen, 1996b). There are indications that modern hunters are copying the traditions of the original Amerindian inhabitants of Trinidad and Tobago. In turn, these Amerindian traditions are related to those previously practices in South America. For example the Caribs in Dominica used leaf baths against bad luck (Hodge and Taylor, 1957). From the Venezuelan/Spanish/Amerindian? tradition comes the beliefs in plants called "turals" in Venezuela and in Spanish-speaking Trinidad. These plants bring good fortune and have silver coins planted at their roots (Moodie-Kubalsingh, 1994). The belief that plants can bring luck may explain their use for hunting dogs. These beliefs may have originated in the Amazon where baths are a frequent way to utilise traditional remedies (Nunes, 1996). Absorption routes of active compounds are the respiratory tract (volatile substances carried by water vapour) and the skin (Nunes, 1996). It is also practical to use baths if the intention is to disguise the smell of the hunting dog so that the game animal does not recognise it (Serpell, 1995).

The use of hallucinogenic and other plants to improve hunting success is recorded in Russo (1992), Muñoz *et al.* (2000) and Hodge and Taylor (1957). Waorani in the Ecuadorian Amazon feel that the characteristics of one entity or object may pass to another (Russo, 1992). These beliefs may lie behind the use of plants for hunting success. Im Thurn (1883) has recorded the various rituals that Amerindians in Guyana perform before a hunt. They used plants called 'beenas', which acted as charms to entice any object or desire wanted, including making the capture of game certain. Each beena usually had a specific purpose. Beenas were used for dogs, which were made to swallow specific pieces of roots and leaves for specific game animals (Im Thurn, 1883).

According to Roth (1915), beenas were used because there was an ancient almost forgotten belief that plants possessed associated spirits. In addition to the plant use of the Guyanese Amerindians, ants and other insects were made to bite the nostrils of the hunting dog. Plant leaves and other plant parts including peppers were then rubbed into the wounds on the noses of the dogs. This was done on the assumption that the power of scent in dogs was improved by these practices since the nasal mucous membranes were cleaned, the perceptions were sharpened, and the dog would keep its nose to the ground when hunting (Im Thurn, 1883; Roth, 1915). There seemed to be a mental connection of success in acquisition of game with pain previously inflicted on the hunter and his dog (Im Thurn, 1883). Roth (1915) felt that the nervous system of the dogs was irritated to such an extent that it was responsive to even the slightest external stimulus and therefore more likely to be successful in hunting. There was also the belief that inflicting pain was a means of preparing to meet without flinching any pain or danger that could arise during the chase (Im Thurn, 1883). This preparation was not ill-advised since *Lachesis muta muta* often lives in the burrows of lappe and tatou (Mole, 1924). Each hunting dog was trained to hunt one sort of game (Im Thurn, 1883).

The use of the solitary wasp in the "steaming" process can also be linked to Amerindian traditions. Firstly, the Amazonian belief that the characteristics of one entity or object may pass to another (Russo, 1992), could explain the use of a wasp that hunts successfully in baths or decoctions to make dogs better hunters. Additionally there are records of a specific ant that was given to dogs by Guyanese Amerindians in order to make them good hunters (Roth, 1915). Amerindians also named their hunting dogs after ants and a wasp called "warribisi" that caught prey. *Costus* species is called Poivre Ginet in Dominica, while *Aframomum melegueta* is called Guinea pepper in most of the Caribbean. It is not known if the original Amerindian practice was for both plants to be used for hunting dogs.

According to Dennis (1988), plants are given symbolic payments if they are considered to have supernatural owners who require such payment. The payment is placed on the ground near the plant before it is picked and can be recovered later by the person who picked it (Dennis, 1988). Much of the plant use is based on the Doctrine of Signatures.. plant morphology suggests the medicinal use for a plant. Hazlett (1986) and Roth (1915) give the example of the use of leaves from various species of *Aristolochia* to treat snakebites. The triangular head of a *Bothrops* viper is similar in size and shape to many *Aristolochia* species leaves (Hazlett, 1986). Duke (1970) claims that it is the serpentine coloration of the flowers of the *Aristolochia* vines that suggest the use as tourniquets to prevent the spread of snake venom and the use of the leaves in snakebite potions. The Doctrine of Signatures is also seen in the plants used as "beenas" or "turals" which are supposed to have patterns on their leaves resembling different forest animals (Moodie-Kubalsingh, 1994). Im Thurn (1883) records that the beena for lappe had typical white markings similar to those of the lappe, while the beena for quenk had a leaf with a small secondary leaf under the surface that resembled either the scent gland of the quenk or its nostril tip. Medicinal plants are collected on Good Friday in Almería, Spain (Martínez-Lirola *et al.*, 1996).

Hunting success

The characteristics that dogs need for hunting success are scent-accuracy, speed, enthusiasm and stamina. However, several of the hunting dogs observed by the authors were in poor condition. Medicinal properties in the plants used for baths may help alleviate any subclinical infections these dogs might have due to their poor condition.

Agouti feed by day on fallen fruits. They run within particular territories when chased but have a habit of running and doubling back or crossing water to disguise their scent. Dogs pursuing this game have to have their wits about them, be fit, and be persistent. Smaller dogs are usually chosen so that they can follow agoutis through dense bush to their hiding places. Deer tend to run straight for miles until they have lost their pursuers. Deer dogs would need endurance. Deer are also solitary and nocturnal and enter water when chased. They are also adapted to swampy areas and are good at camouflage. All these characteristics are considered when choosing deer dogs. Lappe, tatou and manicou are nocturnal, living in hollow fallen trees during the day and they forage at night. Dogs pursuing this game would ideally have good night vision, a good sense of smell and cannot be afraid to dive into hollow logs or into water, since lappe often enter their burrows from under water (Alkins, 1979). Lappe have four longitudinal rows of white spots (Alkins, 1979). Hunters claim that the plants used to bathe dogs so that they will hunt lappe have similar markings. Dogs hunting tatou may have to dig to unearth their prey.

Wild hog/quenk can be very aggressive, especially in a group of five or six. They live in swampy parts of the forest and will cross water during the day. The bristles on the mid-dorsal line from crown to rump of the quenk raise when the animal is excited and the musk glands emit a musky odour (Alkins, 1979). Quenks eat succulent tubers and fallen fruits and nuts (Alkins, 1979). The bravery dogs need to hunt quenk is revealed in Carr (1893). Of an original pack of nine 'native curs' trained in quenk and lappe hunting, two received deep flesh wounds inflicted by the tusks of two quenks during a hunt. Four others were bitten by a *Lachesis muta muta* that one dog pulled out of a hollow tree (Carr, 1893). Two of the bitten dogs ran off before they could be treated and died within fifteen minutes. The two other dogs bitten by 'his snakeship' (7ft, 10ins) on the neck and paw were held and treated with the local folk medicine of roots, barks and seeds in a tincture with rum (Carr, 1893). These two were carried home and recovered in three days. The author did not indicate if the three uninjured dogs of the nine were the 'bravest' or the most 'alert', 'agile' or 'lucky'.

Olfactory considerations

The Mixe in Mexico consider that the odour and taste of a plant are important criteria in deciding what plants to use for an illness (Heinrich *et al.*, 1992). The Waorani in Amazonian Ecuador consider that plants with strong, or repulsive odours will force symptoms to flee from the body and this belief guides their use of *Renalmia alpinia* and a *Philodendron* for snakebites (Davis and Yost, 1983). The Warao in eastern Venezuela consider 'bad air' to be pathogenic and 'good' or perfumed air to be therapeutic (Wilbert, 1983).

The acute sense of smell in dogs is due to a large area of olfactory epithelium (Serpell, 1995). Smells have the advantage of remaining in the environment for a long time and are a useful means of communication in dense vegetation where verbal and visual

communication is impaired. When hunters bathe dogs with strongly smelling members of the *Piper* species they may be imitating animal behaviour or trying to mask the individual body odour of their dogs so that they remain undetected by game animals. Dogs show a form of behaviour called rolling/rubbing in strongly smelling objects (Beaver, 1999). The intention of the dog may be to eliminate or dilute the odour since this type of rolling is frequently associated with sneezing and running (Beaver, 1999). In other cases the dog may roll in an odour that is considered unpleasant by humans. There are two plausible explanations for this last behaviour. One is that the dog is attempting to take on the odour like a perfume, the other is that the odour is too strong to cover with a urine mark so the dog tries to cover it with its entire body surface (Beaver, 1999).

There are indications that South American Amerindians were aware of animal behaviour in relation to smells. For example, the bristles on the mid-dorsal line from crown to rump of the quenk elevate when the animal is excited and the musk glands emit a musky odour (Alkins, 1979). Quenks maintain odour homogeneity within the herd. Each animal rubs the lower portion of its jaw on a gland in the other's mid-dorsum. If a veterinarian removes a quenk from the herd for treatment, it will be killed when it is replaced, since it will no longer have this herd odour (Dr. Gabriel Brown, Department of Clinical Sciences, University of the West Indies, pers. comm. 2000). If hunters bathe dogs with a plant that quenks eat the temporary smell dogs obtain from this bath may be similar to the smell of a quenk that feeds on this plant.

Additionally, Roucouyennes (Caribs) rubbed their dogs with *Hibiscus abelmoschus* with the expectation that its pungent smell would prevent jaguars from biting the dogs (Roth, 1915). Tukanoan tribes in South America also believed that deer had an inoffensive body odour that was linked to their diet of "pure" foods such as fresh sprouts, young green leaves and sweet fruits (Urton, 1985). Tokanoan tribes also believed that people and animals have smells related to the food that they eat and the environment that they lived in (Urton, 1985). This association of animal smells with their environment is perhaps what the informant was referring to in his reference to an agouti and the smell of its *Piper marginatum* "bed". There is evidence that some of the plants used by hunters are eaten by deer and possibly by other game animals (these are *Costus* species, *Eschweilera* species, *Piper* species and *Pithecellobium* species (Branan *et al.*, 1985).

Tukanoan tribes also recognise the complex pheromonal system of chemical communication that deer and other animals use. For example they claimed that when white-tailed deer are frightened suddenly from close by, they run off and repeatedly break wind. These tribes interpret this behaviour as an attempt to mask the odour trail left by the deer's interdigital glands and thus mislead predators and hunting dogs (Urton, 1985).

Poisons

Caterpillars may accumulate chemical compounds from the plants that they feed on. Some hairy caterpillars have urticating hairs which can cause severe skin reactions and pain (Kenny *et al.*, 1997). Any effect of the plants claimed to be efficacious against scorpion stings may be due to symptomatic relief - analgesic, antiinflammatory, antipruritic effects, in addition to other biological activities (Hutt and Houghton, 1998).

While proteases, phospholipase A₂ and nucleotidases are responsible for the haemorrhagic lesions induced by *Bothrops jararaca* venom, most crotalid myotoxins are phospholipases and some exhibit proteolytic activities (Melo *et al.*, 1994). Crotalid snakes have a wide geographical distribution which may contribute to differences in their venom composition (Jorge *et al.*, 1997). *Lachesis muta* venom in Ecuador showed no phospholipase A₂ activity, low lethality and high coagulant activity (Kuch *et al.*, 1996). Phospholipase A₂ was purified from *Lachesis muta* venom in Brazil, which also showed procoagulant and proteolytic activities (Fuly *et al.*, 1997). Francischetti *et al.*, (1998) found high proteolytic activity for *Lachesis muta* and no platelet pro-aggregating activity, low inhibitory effect on platelet aggregation and low procoagulant, proteolytic and phospholipase activity for *Bothrops atrox* in Brazil.

Studies in South America detail the pain and oedema at the bite site and manifestations of autonomic nervous system stimulation (vomiting, diarrhoea, sweating, hypersalivation, bradycardia) that may be attributed to serine protease in *Lachesis muta* venom which causes hypotension by releasing kinins from plasma kininogen (Jorge *et al.*, 1997). There are also cases of bleeding distant from the bite site such as gingival haemorrhage, epistaxis, haemoptysis, haematuria, uterine bleeding, soft tissue haematomas and very infrequently intrathoracic or intrabdominal bleeding (Otero *et al.*, 2000c). Complications in the bitten limb can include secondary infections by Gram-negative organisms and acute renal failure among others (Jorge *et al.*, 1997). There is a bothrojaracin-like 27kDa protein in *Bothrops* species venom. Bothrojaracin forms a non-covalent complex with thrombin, blocking its ability to induce platelet aggregation and fibrinogen clotting (Jorge *et al.*, 1997; Castro *et al.*, 1999a). Haemostatic effects in *Lachesis muta* venom are attributable to an alpha-fibrin(ogen)ase and haemorrhagic metalloproteinases (LHF-1 and LHF-II) which have alpha-fibrin(ogen)ase activity (Jorge *et al.*, 1997).

The severity of envenoming depends on the species and length of the snake, the toxicity of the venom and the amount inoculated (Thomas *et al.*, 1998). Also important are physical activity after the bite and the physical characteristics of the victim. The severity of bites from *Bothrops laceolatus* in Martinique is increased due to the primary bacterial infection by bacteria present in the oral cavity of the snake (*Aeromonas hydrophila*, *Morganella morganii*, *Proteus vulgaris* and *Clostridium* species) (Thomas *et al.*, 1998). This means that antibiotic treatment is sometimes necessary.

Scorpion venom exerts a strong inflammatory response (Hutt and Houghton, 1998). Many plant species used against stings contain compounds with antiinflammatory properties, flavonoids (rutin, hesperidin, quercetin), coumarins (bergapten), coumestans, triterpenes, sterols and saponins (Pereira *et al.*, 1994; Hutt and Houghton, 1998). The mechanism of action of the flavonoids is based on the inhibition of enzymatic steps in the arachidonic acid cascade (Pereira *et al.*, 1994). Plant compounds which are immunostimulants at very low doses are some alkaloids, quinones, isobutylamides, phenolcarboxylic acid esters and terpenoids (Wagner, 1993). Other plant compounds with immunostimulatory effects are cepharanthine, tylophorine and sesquiterpene lactones (Houghton and Osibogun, 1993). Many polysaccharides and glycoproteins enhance the unspecific immune system by activating the phagocytotic activity of granulocytes and macrophages, or by inducing cytokine production or influencing complement factors (Wagner, 1993).

Some compounds from plants used for general inflammation also inhibit enzymes (like phospholipase A₂) from snake and scorpion venom (Houghton and Osibogun, 1993; Hutt and Houghton, 1998; Abubakar *et al.*, 2000). Some of these plant compounds are hypolaetin-8-glucoside and related flavanoids. Stimulation of the immune system might also contribute to reducing the effects of snakebites and improvement in recovery from envenomization by contributing to a more rapid removal of the venom (Hutt and Houghton, 1998). Chlorogenic acid acts as an antidote by binding to proteins through hydrophobic interactions and hydrogen bonds (Ejzernberg *et al.*, 1999). It presents anticomplementary action at the classical pathway (Ejzernberg *et al.*, 1999). Analgesic properties like those provided by tropane alkaloids would also lessen the pain of the bite, as would compounds that act as sedatives and tranquilisers (Houghton and Osibogun, 1993).

Several pharmacological properties of plants reputed to be snakebite antidotes include antimyotoxic, antihaemorrhagic, analgesic, and antiedematogenic, blockage of cutaneous and intraperitoneal capillary permeability activity caused by the venom and protection from its lethality (Pereira *et al.*, 1994). A more direct antivenom activity would involve complexation of the compounds with venom constituents thus rendering them unable to act on receptors; or to act by competitive blocking of the receptors (Hutt and Houghton, 1998). Phenolic compounds especially complex polyphenols like some tannins can bind with proteins (Abubakar *et al.*, 2000). Alternatively, the catecholamines released as a result of venom-receptor interaction may be antagonised or metabolised more quickly (Hutt and Houghton, 1998).

Plant extracts (*Mucuna pruriens* var. *utilis*) that produce a dose-related increase in the clotting time of blood induced by carpet viper venom (*Echis carinatus*) would be useful against bites from *Bothrops* species that cause haemorrhage at the point of injection due to the inhibition of the clotting mechanism (Houghton and Osibogun, 1993). Antivenom compounds so far isolated from plants include protocathechuic acid, a catechin-gallo-catechin tannin, caffeic acid derivatives (chlorogenic acid, cynarin) coumarins (bergapten), flavonoids (rutin, isoscutellarein, kaempferol, quercetin, hesperidin, apulein, derricidin), ar-turmerone, alkaloids (aristolochic acid), triterpenoids, triterpenes, coumestans (weddelolactone), sterols (sitosterol, stigmasterol, perandrin, beta-amyrin) and triterpenoid glycoside (gymnemic acid), gymnagenin acid as well as the alkaloids (allantoin, shumaniofioside) and lignoflavonoids (silymarin) (Martz, 1992; Houghton and Osibogun, 1993; Reyes-Chilpa *et al.*, 1994; Abubakar *et al.*, 2000). Many relevant compounds are widely distributed nitrogen-free, low molecular weight compounds (except aristolochic acid, an untypical non-basic, nitro-derivative) (Pereira *et al.*, 1994). The structural similarities of certain plant chemicals found in plants used for snakebites are an isoflavone skeleton, acidic nature and dioxygenated functionality (Reyes-Chilpa *et al.*, 1994).

Castro *et al.* (1999) found total inhibition of *Bothrops asper* haemorrhage with the ethanolic, ethyl acetate and aqueous extracts of plants containing catequines, flavones, anthocyanines and condensed tannins. These compounds may have played a role in the inhibitory effect observed, probably owing to the chelation of the zinc required for the catalytic activity of venom's haemorrhagic metalloproteinases (Castro *et al.*, 1999b). Reduction in the intensity of the effects of envenomation could also be achieved by a neutralisation of the venom peptides, polypeptides, proteins and enzymes (Pereira *et al.*, 1994; Hutt and Houghton, 1998). There are plants used for snakebite that act by inhibiting the proteolytic activities of the venom and antagonising crotoxin-induced haemolysis, myotoxic and haemorrhagic activities of crotalid venoms (Melo *et al.*, 1994).

Tityus trinitatis toxic fraction was recognised by the antiserum of the Venezuelan scorpion *Tityus discrepans* (which has a β -type toxin) (Hutt and Houghton, 1998; Borges *et al.*, 1999). The onset of symptoms from the time of evenomation is generally between five and thirty minutes. Local evidence of a sting is often minimal or absent but several patients report severe pain and a burning sensation with intense pruritis and local or general hyperesthesia (Hutt and Houghton, 1998). Symptoms may last from seven days to several weeks. Redness, inflammation and local oedema at the sting site are evident (Hutt and Houghton, 1998).

In Trinidad the following clinical features have been seen: tachypnea, restlessness, vomiting, increased salivation, cerebral oedema, pulmonary oedema, hypovolemic shock and convulsions, with myocarditis and pancreatitis being major complications (Daisley *et al.*, 1999). Scorpion venoms may cause these symptoms through release of catecholamines from the sympathetic nervous system (Hutt and Houghton, 1998). The venom exerts its effects primarily to the cardiovascular and respiratory systems, but there is also stimulation of both the sympathetic and parasympathetic peripheral activities (Hutt and Houghton, 1998). The venom is a complex mixture of phospholipase A₂, low molecular weight proteins, acetylcholinesterase, hyaluronidase, toxic polypeptides, amino acids, serotonin and neurotoxins (Hutt and Houghton, 1998; Daisley *et al.*, 1999). Two fatal cases suggested toxic myocarditis (Daisley *et al.*, 1999).

Review of the ethnomedicinal literature

This section reviews available literature on the plants identified in this study and compares their Trinidad and Tobago ethnoveterinary use to the folk-medicinal use in other countries (mainly Latin America and the Caribbean). All folk-medicinal uses are human uses unless otherwise specified. Plants used to achieve hunting success including those chosen according to the Doctrine of Signatures will be treated here as medicinal plants since supernatural emic can occasionally suggest etic efficacy (McCorkle and Mathias-Mundy, 1992). For each species or genus a summary of chemical constituents will be given, in addition to active compounds if known. This type of ethnopharmacological review and evaluation is based on that developed by Heinrich *et al.* (1992). The plants below are listed in alphabetical order.

Acrocomia ierensis (tentative ID). Chemical analysis has been done on the fruit of *Acrocomia totai* (Duke, 2000).

Aframomum melegueta has been previously recorded as a stimulant (Duke, 2000). Caribs of Dominica used *Aframomum granum-paradisi* leaves on their bodies while they were bathing and the plant was also given to their hunting dogs (Hodge and Taylor, 1957). Seeds were put into rum as a 'chauffe' to excite dogs (Hodge and Taylor, 1957). *Aframomum granum-paradisi* contains alkaloids (piperine), essential oils and resins (Lachman-White *et al.*, 1992).

Aristolochia rugosa and *Aristolochia trilobata* are recorded in a list of plants used worldwide and in the West Indies, Venezuela and Central America against snake bites and scorpion stings (Morton, 1975; Wong, 1976; Hazlett, 1986; Martz, 1992; Houghton and Osibogun, 1993; Coe and Anderson, 1996a; Jain *et al.*, 1994).

Caribs in Guatemala use *Aristolochia trilobata* root and tuber decoctions for stomach pains and use leaf tinctures for diarrhoea (Girón *et al.*, 1991). Aristolochic acid inhibits inflammation induced by immune complexes, and nonimmunological agents (carrageenan or croton oil) (Moreno, 1993). Aristolochic acid inhibits the activity of snake venom phospholipase (PLA₂) by forming a 1:1 complex with the enzyme (Moreno, 1993; Houghton and Osibogun, 1993; Pereira *et al.*, 1994). Since phospholipase enzymes play an significant part in the cascade leading to the inflammatory and pain response, their inhibition could lead to relief of problems from scorpion envenomation (Hutt and Houghton, 1998).

Barleria lupulina is well known in Thai folk medicine as an antiinflammatory, and is used against snake bites and against herpes simplex and varicella zoster virus lesions (Yoosook *et al.*, 1999). Compounds found in the leaves of *Barleria lupulina* are barlerin, acetylbarlerin, shanzhiside methyl ester, acetylshanzhiside methyl ester, ipolamiidoside and iridoid glucosides (Tuntiwachwuttikul *et al.*, 1998). An antibiotic and immunostimulant protein was reported from the plant and other species and patented (Yoosook *et al.*, 1999). A leaf and twig extract of *Barleria lupulina* showed activity against five clinical isolates of herpes simplex virus type 2 but not the standard strain (Yoosook *et al.*, 1999).

Bauhinia excisa vine decoction has been used for snake bites and pain and the root decoction is used for scorpion stings in Trinidad (Wong, 1976).

Indigenous Mayans and inhabitants of Eastern Nicaragua use *Capsicum frutescens* for fever, respiratory problems and infections (Cichewicz and Thorpe, 1996; Coe and Anderson, 1996a). Capsaicinoids are powerful skin irritants (Lachman-White *et al.*, 1992). Capsaicin is a vanillyl amide with hyperemic and anaesthetic properties (Wagner, 1993; Frei *et al.*, 1998). It causes vasodilatation, enhanced permeability and has antiinflammatory and neurotransmitter activation properties (Frei *et al.*, 1998). Capsicum species have inhibitory effects on *Bacillus* species, *Clostridium* species and *Streptococcus pyogenes* (Cichewicz and Thorpe, 1996).

Capsaicin's use in the treatment of chronic pain is due to an analgesic effect which is explained by capsaicin's action of depletion of stores of substance P from the sensory neurons as a consequence of the reduced production of prostaglandin (Wagner, 1993). Capsaicin's antiphlogistic activity is due to the "counter-irritant effect"; which means that a local irritant effect exerts an additional more remote antiinflammatory effect. This is explained by a liberation of corticoids under the influence of certain cutivisceral reflexes (Wagner, 1989). The counter-irritant effect on the gastric mucosa also occurs because capsaicin stimulates production of the cytoprotective prostaglandin E₂. Capsaicin produces analgesic and antiinflammatory effects because it inhibits both 5-lipoxygenase and cyclooxygenase (Wagner, 1993). A 10g human ingestion of red pepper stimulated carbohydrate oxidation (Al-Qarawi and Adam, 1999). This may explain why the Chocó Indians used it to give their hunting dogs more "energy" (Duke, 1970).

Cecropia peltata leaves boiled in water are used in a bath for rheumatism in Guatemala (Comerford, 1996). *Cecropia peltata* leaves are used for aches, abscesses, coughs, pains, fever, pertussis, skin lesions and digestive problems in Eastern Nicaragua, Jamaica and Cuba (Coe and Anderson, 1996a; Asprey and Thornton, 1953-1955). *Cecropia peltata* leaves are used for snake bites in Trinidad (Wong, 1976; Wilbert, 1996). Free fatty acids including stearic, arachidic, behenic, lignoceric and cerotic acids were isolated from *Cecropia* species. Leaves of *Cecropia peltata* contain leucocyanidin (Lachman-White *et al.*, 1992).

Cola nitida nuts contain a heart stimulant (kolanin), caffeine, strychnine, theobromine and quinine and are associated with increased blood pressure (Osim and Udia, 1993).

Costus species is called Poivre Ginet in Dominica and was used to bathe hunting dogs by the Caribs (Honychurch, 1986). *Costus scaber* (syn. *Costus cylindricus*) showed some activity against *Bacillus subtilis* (Verpoorte *et al.*, 1982). *Costus lasius* is used by traditional healers for snakebites in the northwest region of Colombia. An ethanolic extract of *Costus lasius* (leaves, branches and stem) partially neutralised *Bothrops atrox* venom when it was injected i.p. into mice (18-20 g) (Otero *et al.*, 2000b). *Costus speciosus* contains diosgenin, and beta-glucosidase which converts a furostanol glycoside (protogracillin) to a spirostanol glycoside (gracillin) (Indrayanto *et al.*, 1994; Inoue *et al.*, 1996).

Couroupita guianensis (Lecythidaceae) fruit pulp contains sugar, gum, and malic, citric and tartaric acids. 'When ripe the fruit pulp exceeds in foul odour all that is abominable in nature' (Anon, 1951).

Dendropanax arboreus is used for snakebites and foot inflammation in Columbia and is also used by the Tacana in the Bolivian Amazon (Laferriere, 1994; Bourdy *et al.*, 2000). Leaves of *Dendropanax arboreus* showed cytotoxic activity. The active compound is an acetylenic compound (Setzer *et al.*, 1995). Other compounds in the leaf extract are dehydrofalcariol, a diynene, falcariol, dehydrofalcariol, and two new polyacetylenes (dendroarboreols) (Bernart *et al.*, 1996).

The *in vitro* myotoxicity of the crotalid venoms (*Bothrops jararaca*, *Bothrops jararacussu* and *Lachesis muta*) and myotoxins (bothropstoxin, bothropasin and crotoxin) was neutralised by simultaneous exposure of isolated skeletal muscles to an aqueous extract of *Eclipta prostrata* or to wedelolactone, stigmaterol and sitosterol. Stigmaterol and sitosterol were less effective than wedelolactone, but interacted synergistically with it (Melo *et al.*, 1994). These effects were interpreted as consequences of antiproteolytic and antiphospholipase A₂ activities of *Eclipta prostrata* and its constituents (Melo *et al.*, 1994).

Ethanolic extracts of the aerial parts of *Eclipta prostrata* (Asteraceae) neutralised the lethal activity of the venom of South American rattlesnake (*Crotalus durissus terrificus*) when mixed *in vitro* before i.p. injection into adult Swiss mice (Mors *et al.*, 1989). Three plant compounds, wedelolactone, sitosterol and stigmaterol were able to neutralise lethal doses of the venom. Aqueous extracts of the plant inhibited the release of creatine kinase from isolated rat muscle exposed to the crude venom (Mors *et al.*, 1989). Melo and Ownby (1999) found that wedelolactone reduced the myotoxic effect of crude venoms *Crotalus viridis viridis* (western rattlesnake) and *Agkistrodon contortrix laticinctus* (copperhead) and two phospholipase A₂ myotoxins, CVV myotoxin and ACL myotoxin, isolated from them.

Eschweilera subglandulosa is a tree with smooth leathery leaves about 8 inches long. The fruit is well liked by agouti. This fact may explain its use, since after a bath the smell of its leaves may stay on the hunting dog.

Jatropha curcas latex is applied to external wounds in Peru and Indonesia (van den Berg *et al.*, 1995b&c; Fernández *et al.*, 1997²⁷). The leaf bath is used for rash, bewitchment and poultices for sores in Trinidad (Wong, 1976). *Jatropha curcas* leaf and bark contain

²⁷ See Villegas, Fernández, Maldonado, Torres, Zavaleta, Vaisberg and Hammond, 1997.

glycosides, tannins, phytosterols, flavonoids and steroidal sapogenins (Hufford and Oguntimein, 1978; Matsuse *et al.*, 1999). The latex contains proteolytic enzymes and provides significant cicatrizant activity (wound healing) (Fernández *et al.*, 1997). The sap inhibits growth of *Candida albicans* and *Staphylococcus aureus* (Robineau, 1991). Compounds found in *Jatropha multifida* with immunomodulatory activity are the cyanoglucoside (multifidin), labaditin (a cyclic decapeptide), a cyclic nonapeptide, a phloroglucinol derivative (multifidol) and two immunomodulatory cyclic peptides (Labadie *et al.*, 1989; van den Berg *et al.*, 1995a & b; Horsten *et al.*, 1995).

The leaf decoction of *Jatropha gossypifolia* is used for bathing wounds (Morton, 1968b). The stem sap stops bleeding and itching of cuts and scratches (Morton, 1980). The leaf bath is used for sores, sprains, rash and bewitchment in Latin America and the Caribbean (Wong, 1976; Morton, 1980). Poultices are used for sores and pain in Trinidad (Wong, 1976). These uses are similar to the ethnoveterinary use. *Jatropha gossypifolia* leaf contains histamine, apigenin, vitexin, isovitexin and tannins. The bark contains the alkaloid jatrophone and a lignan (jatrodien) is found in its stems (Robineau, 1991; Das *et al.*, 1996; Fernández *et al.*, 1997). The latex of *Jatropha gossypifolia* yielded two cyclic octapeptides (cyclogossine A and B) (Auvin-Guette *et al.*, 1997).

The use of *Justicia secunda* for rashes has been previously recorded (Wong, 1976). Different species have yielded steroids, lignans, betaine, triterpenoids, coumarins, dihydrocoumarin, umbelliferone and 3-(2-hydroxyphenyl) propionic acid alkaloids and flavonoids (MacRae and Towers, 1984; de Vries *et al.*, 1988; Gupta *et al.*, 1993). Wounds on Wistar rats treated with organic and aqueous extracts of *Justicia pectoralis* showed intermediate swelling in comparison to wounds treated with coumarin isolated from the plant extract (least swelling) and the controls (Mills *et al.*, 1986). This study supported local usage for wound-healing properties.

Throughout tropical Central and South America leaves of *Lepianthes peltata* Miq. (Piperaceae) (syn. *Pothomorphe peltata* Miq.) are used locally as antiinflammatory, antipyretic, hepatoprotective and diuretic infusions and to treat external ulcers and local infections (Desmarchelier *et al.*, 2000). A cataplasm of the leaves of *Lepianthes peltata* are used by the Cuna Indians for various external ailments and are rubbed on the body to exterminate lice (Duke, 1970, 1975). In South America leaves are used for inflammatory disorders and are warmed and rubbed with coconut (*Cocos nucifera*) or castor oil (*Ricinus communis*) and applied to any painful or swollen joints and inner body parts (Lachman-White *et al.*, 1992; Desmarchelier *et al.*, 1996, 1997a&b; Wilbert, 1996; Mongelli *et al.*, 1999).

Lepianthes peltata plants contain alkaloids, carotenoids, anethol, chavicine, piperine and lignans (Desmarchelier *et al.*, 2000). *S. aureus* was partially inhibited by *Lepianthes peltata*. *Lepianthes peltata* methanolic extract had antioxidant activity attributed to the catechol derivative (4-nerolidylcatechol) (Desmarchelier, *et al.*, 1997b). Plants showed a significant analgesic effect lasting for 30 minutes and the sap is repellent to ticks (Robineau, 1991). The antiinflammatory effectiveness of the methanol leaf extract support this traditional use of *Lepianthes peltata* (Desmarchelier *et al.*, 2000). The plant's analgesic, antiinflammatory and antibacterial effects may help clear up any health problems of the dog that prevent it from successfully tracking a game animal.

Momordia charantia is widely used in the Caribbean for various ailments (Morton, 1980; Muñoz *et al.*, 2000a). Leaves rubbed in coconut oil (*Cocos nucifera*) are used for scabies

and skin rashes in Eastern Nicaragua, the Caribbean and in the Philippines (Stimson, 1977; Morton, 1980; Tan, 1981; Coe and Anderson, 1996b). Aqueous and ethanolic extracts of *Momordica charantia* inhibit the growth of *Escherichia coli*, *Sacrina lutea*, *Staphylococcus aureus*, *Pseudomonas aeruginos*, *Bacillus subtilis*, *Proteus* species and *Staph albus*.

The Tacana of Bolivia use the heated leaves of *Monstera* sect. *Marcgraviospsis* species for boils and a leaf poultice of *Monstera subpinnata* for pain in the legs (Bourdy *et al.*, 2000). *Monstera* species accumulate caffeic acid derivatives (Hegnauer, 1986). *Monstera pertusa* stem fragments were carried in the Antilles as a charm to ward off poisonous snakes (Plowman, 1969).

Crushed leaves of *Nicotiana tabacum* are applied to wounds in Guatemala (Comerford, 1996). The steam vapour was a general cure-all in Latin America and the Caribbean (Hodge and Taylor, 1957; Kay, 1996). Hodge and Taylor (1957) record that powdered tobacco is burnt on the blade of a paddle as a propitiatory offering to the local boa snake (*Constrictor orophias*). The plant contains nicotine, malic and citric acids, phenolic acids (chlorogenic, quinic, nicotinic), flavonoids (rutoside), coumarins and enzymes (Robineau, 1991). Presumably the nicotine in the dog's nose would act as a stimulant.

Ottonia ovata contains an isobutylamide, piperovatine and a piperovatine derivative (Hansel *et al.*, 1980; Hegnauer, 1969). Piperovatine promotes the flow of saliva and anaesthetises the tongue (Hegnauer, 1969). *Ottonia anisum* essential oil contains monoterpenes and sesquiterpenes such as delta-cadinene and germacrene D gamma-muurolene (Moreira *et al.*, 1997).

Passiflora quadrangularis contains passiflorene, nor-epinephrine, 5-hydroxytryptamine and flavonoids (Joly *et al.*, 1987; Duke, 2000).

Kojoroot or Kudjuruk (*Petiveria alliacea*) is considered a charm and a medicine for aches and pain and respiratory conditions in Dominica and Eastern Nicaragua (Hodge and Taylor, 1957; Desmarchelier *et al.*, 1996; Coe and Anderson, 1996b). In Belize *Petiveria alliacea* leaf is put on the dog's nose to improve its ability to follow a scent (Arnason *et al.*, 1980). The plant can stimulate the phagocytosis activity of the reticulo-endothelial system and has antibacterial effects (Frei *et al.*, 1998; Muñoz *et al.*, 2000a). The plant contains isoarborinol, isoarborinol-cinnamate and sulphide compounds which give it a smell of onions or garlic (Morton, 1981; Duke, 2000). It is difficult to assess which medicinal properties of the plant could help in making dogs more alert.

Phyllanthus urinaria plant was used by Caribs with other plants in a bath against bad luck (called 'pia') (Honychurch, 1986). Pharmacological activities of various compounds in some species of *Phyllanthus* include analgesic, antiinflammatory, antilipoxygenase, antiallergic, nitrosamine blocker, aldose reductase inhibitor, antiviral, mitochondrial ATPase inhibitor, phosphodiesterase inhibitor and cyclooxygenase inhibitor. Other activities are hepatoprotective, phosphorilase and tyrosine kinase inhibitor, phospholipase A₂ inhibitor and increased the survival of hepatocellular carcinoma harbouring animals (Lachman-White *et al.*, 1992; Calixto *et al.*, 1998; Liu *et al.*, 1999; Rajeshkumar and Kuttan, 2000). The compound with hepatoprotective activity is triacontanol (Satyan *et al.*, 1995). Several compounds found in *Phyllanthus* species, like flavonoids (quercetin, rutin), tannins (geraniin, furosin), benzenoids (ethyl gallate, methyl gallate) and phytosterols showed antinociceptive effects in mice or multiple mechanisms of action (Calixto *et al.*, 1998; Santos *et al.*, 2000).

The hydroalcoholic extracts of *Phyllanthus amarus*, *Phyllanthus fraternus*, *Phyllanthus stipulatus* and *Phyllanthus orbiculatus* were 2 - 6 fold more active in causing antinociception than aspirin depending on the route of administration and the pain model used (Santos *et al.*, 2000). *Phyllanthus amarus* has antioxidant properties, reverses chromosomal alterations induced by genotoxic agents and has anticancer activity (Rajeshkumar and Kuttan, 2000). Active compounds may be flavonoids (quercetin, astragalin), ellagitannins (amarinic acid), hydrolysable tannins (phyllanthisiin D) (Rajeshkumar and Kuttan, 2000). The multiple plant compounds found in *Phyllanthus* species might help clear up any physiological condition that results in dogs having difficulty following game animals.

Piper auritum, and *Piper tuberculatum*, are used against dermatological illnesses in Mexico (Frei *et al.*, 1998). In Puerto Rico and the Caribbean chewed leaves of *Piper amalago* are put on bleeding cuts (Stimson, 1977; Honychurch, 1986). Caribs of Dominica considered *Piper* species to be charms (Hodge and Taylor, 1957). Hunting dogs were rubbed with *Piper* species plant leaves when bathed in order to make them "good" in the chase (Hodge and Taylor, 1957). *Piper auritum* leaf juice is applied topically to remove ticks and head lice in El Salvador and Ecuador respectively (Gupta *et al.*, 1993). In Guatemala the juice of crushed leaves of *Piper amalago* or the decoction of roots are drunk for snake bites or rubbed onto the body as a snake repellent (Comerford, 1996). In Eastern Nicaragua and Jamaica *Piper hispidum* is used in remedies for colds, fever, stomach aches and for aches and pains (Burke and Nair, 1986; Coe and Anderson, 1996a). In Trinidad, Puerto Rico and other Caribbean countries *Piper amalago* leaf infusions are used as ritual baths or baths to perfume the body (Wong, 1976; Duke, 1975; Hodge and Taylor, 1957).

The chloroform extracts of branches of *Piper auritum* and *Piper guineense* inhibit growth of *Candida albicans*, *Cladosporium cucumerinum* and the pathogenic fungus *Basidiobolus haptosporus* (Gupta *et al.*, 1993; Nwosu and Okafor, 1995). These results indicate a possible use of this plant extract in the treatment of subcutaneous phycomycosis in humans and animals (Nwosu and Okafor, 1995). *Piper* species contain lignans, benzoic acid derivatives, flavonoids including the dihydrochalcones (asebogenin) and the alkaloid pipartine-dimer A (Frei *et al.*, 1998; Jenett-Siems *et al.*, 1999). Asebogenin may have antiparasitic activity (Jenett-Siems *et al.*, 1999). The piperamides (cepharadione A and B) from *Piper auritum* possess antifungal and anaesthetic properties (Frei *et al.*, 1998). Dogs may be bathed with various *Piper* species to remove external parasites.

Pithecellobium unguis-cati is used as a febrifuge and for malaria in Guatemala and the Peruvian Amazon (Hirschhorn, 1982; Ayala Flores, 1984). Hunters wrongly claimed that *Pithecellobium unguis-cati* was parasitic. It has claw-like tendrils that allows the species to climb other plants (Honychurch, 1986). *Pithecellobium dulce* contains flavonoids and a triterpenoid saponin in leaves and seeds and 3'-Prenylapigenine 7-O-rutinoside in the stems (Saxena and Singhal, 1999).

The Mosetene Indians in Bolivia use the crushed *Renealmia alpinia* plant mixed with water and rub this preparation over the dog's body to improve its hunting ability (Muñoz *et al.*, 2000a). In Trinidad a leaf poultice or bath or root decoction is used on swellings, sprains, sores, wounds and for stomach pains and malnutrition (Wong, 1976; Lachman-White *et al.*, 1992; Wilbert, 1996). The purple-red juice from the *Renealmia alpinia* berries is used to treat eye diseases. *Renealmia alpinia* plant contains diterpenes and proanthocyanins (Wilbert, 1996; Zhou *et al.*, 1997). *Renealmia alpinia* rhizome is used by traditional healers for snakebites in the northwest region of Colombia and in Amazonian Ecuador (Davis and Yost,

1983; Otero *et al.*, 2000a). An ethanolic extract of *Renealmia alpinia* rhizomes demonstrated 100% neutralising capacity of *Bothrops atrox* venom within 48 hours when it was i.p. injected into mice (Otero *et al.*, 2000b).

Saccharum officinarum is used medicinally in Eastern Nicaragua and in the Caribbean for infections, chills, fever, rashes and sores (Longuefosse and Nossin, 1996; Coe and Anderson, 1996a). Chlorogenic acid, ferulic acid and p-cumaric acid have been found in the plant (Hegnauer, 1986; Hegnauer, 1963).

Sambucus species were recorded in Egyptian papyri as being of ancient use (Kay, 1996). *Sambucus lanceolata* flower decoction is used for open sores and leaves are used in poultices on bruises, wounds and sores in France, Turkey, Madeira and Porto Santo (Novaretti and Lemordant, 1990; Rivera and Obón, 1995; Yeşilada *et al.*, 1999). Infusions of *Sambucus nigra* inflorescence are used in baths as emollients in northwest Spain (Blanco *et al.*, 1999). Plant chemicals in *Sambucus simpsonii* flower are caffeic acid, chlorogenic acid, mucilage, potassium nitrate and rutoside (Duke, 2000). Compounds in *Sambucus mexicana* leaves are alkaloids, resin, tannins and essential oil (Cáceres *et al.*, 1993). *Sambucus mexicana* was shown to inhibit four dermatophytes (Cáceres *et al.*, 1991a).

Siparuma guianensis wood contains the oxoaporphine alkaloids liriodenine and cassamedine (Hegnauer, 1990). The leaves contain an essential oil consisting of furanosesquiterpenes (mainly cruzerenones), myristicin (8%) and cruzerene (0.4%) (Hegnauer, 1990).

Solanum americanum is used for fevers by the Mostenene Indians in Bolivia (Muñoz *et al.*, 2000a). *Solanum* species is used in Guatemala and by the Pilagá in Argentina to treat boils, dermatitis as a cicatrizant and analgesic (Filipov, 1994). *Solanum torvum* and *Solanum mammosum* leaf juices are rubbed onto afflicted areas for athlete's foot in Belize (Arnason *et al.*, 1980). *Solanum nigrescens* was suggested as an effective treatment for vaginal candidiasis (Girón *et al.*, 1988). *Solanum americanum* leaf extracts were active against *Microsporum* species, *Epidermophyton floccosum*, *Trichophyton* species and *Cryptococcus neoformans* and showed intraperitoneal subacute toxicity in mice (Cáceres *et al.*, 1991a; Cáceres *et al.*, 1998; Muñoz *et al.*, 2000a).

Vernonia scorpioides is used in Trinidad as an aphrodisiac and against witchcraft (Wong, 1976). *Vernonia tweediana* root decoction is used in Paraguay as a bath against itching (Schmeda-Hirschmann and Bordas, 1990). In Northern Venezuela *Vernonia scabra* branch tip decoction is used as an eye wash and for bathing the body (Morton, 1975). *Vernonia cinera* alcoholic extract is useful in wound healing and has immunomodulating activity (Bhargava *et al.*, 1989; Labadie *et al.*, 1989). *Vernonia* species are used worldwide to stop bleeding, allay inflammation and in the treatment of stomach aches, asthma, intestinal parasites and for protection against snakebites (Gupta *et al.*, 1993; Monteiro *et al.*, 2001). The use of *Vernonia scorpioides* for mange has been recorded (Duke, 2000). Two new isomeric 5-methylcoumarins were isolated from the roots of *Vernonia brachycalyx*. The polar fraction of an extract of *Vernonia condensata* produced greater analgesia in mice than aspirin but less than the other non-steroidal antiinflammatory drugs (indomethacin and dypirone) (Frutuoso *et al.*, 1994).

Vernonia scorpioides (syn. *Cyrtocymura cincta*) aerial parts and flowers and leaves of *Vernonia megaphylla* (syn. *Eirmocephala megaphylla*) contain sesquiterpene lactones,

glaucolides and piptocarphols. The fungicidal activity of *Vernonia scorpioides* against *Penicillium citrinum* and *Aspergillus alutaceus* has been attributed to the sesquiterpene lactones in the stalks and leaves (de Freire *et al.*, 1996). *Vernonia scorpioides* roots contain costunolide and eudesmanes (Jakupovic *et al.*, 1985; Gupta *et al.*, 1993; Borkosky *et al.*, 1996). A new hirsutinolide together with three known lactones were found in the aerial parts of *Vernonia cinerascens* (Abdel-Sattar *et al.*, 2000). Aqueous extracts of *Vernonia condensata* leaves showed analgesic properties and neither teratogenic nor mutagenic risks (Monteiro *et al.*, 2001). Isolated constituents of *Vernonia amygdalina* were known sesquiterpene lactones and new stigmastane-type steroid glucosides (Koshimizu *et al.*, 1994).

A *Xanthosoma* species has been tentatively identified in an Aztec herbal (Plowman, 1969). A *Xanthosoma* species called "chou poivre" was rubbed on the body by the Caribs in Dominica as a charm before going to war (Plowman, 1969). Another species called "chou froidure" was used as an infusion for chills (Plowman, 1969). *Xanthosoma auriculatum* leaf sap is used in Brazil for severe wounds and skin diseases (Plowman, 1969). *Xanthosoma brasiliense* and *Xanthosoma undipes* probably contain irritating compounds that irritate mucous membranes (Hegnauer, 1963; Hegnauer, 1986). *Xanthosoma brasiliense* belongs to the Araceae family which generally contain glycoflavones, flavonols and proanthocyanidins.

Xiphidium caeruleum leaves were rubbed on the feet and knees of children in Trinidad and Tobago that were learning to walk (Wong, 1976). Walkfast or corrimiento (Spanish *correr*: to run) is used to help hunting dogs in Trinidad run fast and "brighten them up" (Moodie-Kublalsingh, 1994). In Panama *Xiphidium caeruleum* ground stem infusion is drunk as an antiemetic and the leaf infusion is used externally for skin disorders (Joly *et al.*, 1987). Xiphidione and other 9-phenylphenalenone pigments are found in *Xiphidium caeruleum* (Hegnauer, 1986).

Conclusion

It is suggested that the medicinal plants exerted a physiological action on the hunter or his dog. Plant use is based on odour and plant morphological characteristics. Plant use is embedded in a complex cultural context based on indigenous Amerindian beliefs (Heinrich *et al.*, 1992). However, this does not mean that the plants have no effect. Some of the plants mentioned contain chemicals that may explain the ethnomedicinal and ethnoveterinary use. For instance some of the plants influence the immune system or are effective against internal and external parasites. Plant baths may contribute to the health and well being of the hunting dogs.

Case study 8: Horses

The intellectual contribution of indigenous peoples is quietly regarded as suffering from the three "Q"s: quaint (with no currency or modern utility); quackery (it never worked or is probably carcinogenic); or quits (well on its way to extinction) (RAFI, 1995)

10. Case Study 8: Horses

Abstract

Seventeen medicinal plants are used in equine ethnoveterinary medicine. *Psidium guajava* and *Musa* species are used for diarrhoea. *Aloe vera*, *Nopalea cochinellifera*, *Ricinus communis* are used for tendon problems. *Panicum maximum** and *Cordia curassavica* are utilised for grooming. *Ricinus communis* and *Kalanchoe pinnata* are employed for hoof problems and as poultices. *Curcuma longa* is used for swellings. *Chenopodium ambrosioides* is used as an anthelmintic. *Mucuna pruriens* is utilised as an irritant to enhance performance. *Nopalea cochinellifera* is used for inflammations. *Curcuma longa* and *Aloe vera* are employed for retained placenta. *Momordica charantia* is used as a tonic and blood purifier. *Aloe vera* is used for digestive problems, to remove blood clots, and to remove blood in the lungs. *Nopalea cochenillifera* and *Pimenta racemosa* are used to increase perspiration (diaphoretics/sudorifics). *Cecropia peltata* is used for kidney problems. *Nasturtium officinale* is used to increase blood counts. *Pueraria phaseoloides* and *Stachytarpheta jamaicensis* are used as high protein feeds.

Introduction

Horse racing has been established in Trinidad since 1828 (Cozier *et al.*, 1994). The Racetrack was moved from the capital city east to Santa Rosa in Arima in 1993. Locally bred Thoroughbreds (Creoles) have been racing since at least the early 19th Century (Cozier and Robertson, 1994). The Santa Rosa track has a turf course that is not used as frequently as the sand course. In the wet season the sand course is described as "sloppy".

Data collection

Interviews took place from July to September 2000. Some of these interviews were facilitated by a previously known contact who was a race horse owner, she drove the author to the initial visit to the racetrack and to the broodmare farm where her horses were kept. She also introduced the author to several of the trainers. Trainers who were later contacted by the author had also been informed by the contact of the research project. Three visits were made to the sole racetrack; one of these was on a race day. One visit each was made to three (out of six) brood mare farms. These were located in North, East and Central Trinidad. At the racetrack, ten trainers were interviewed; one retired trainer was interviewed by phone. The sample frame for choosing the trainers was obtained from reading the sports pages of three newspapers and from the statistics kept in the University of the West Indies library. Six of the ten trainers were recorded in the statistics among the top 25' winners

(1,4,8,9,12,15). The top trainer, whose first win was in 1959 and his 1000th in 1981, won 49 races out of 96 run. His earnings were \$41,898,55.45 from 1996 – 1998.

One of the trainers was also a practising veterinarian. Only one of these trainers used no ethnoveterinary medicines, 25% were active users while others reported past use in the 1970s or what they had observed others using. Four grooms were interviewed; they were current users of ethnoveterinary medicines. Six owner and / or breeders or their representatives were interviewed, two of them by phone. Four were ranked among the top '25' in winnings (1,7,8,12), only one knew of ethnoveterinary medicines. Three of the eight veterinarians associated with horses were interviewed, only two reported their knowledge of ethnoveterinary medicines, one was also a trainer as indicated above, the other a former jockey.

Results

The ethnoveterinary usage of locally available plants for horses in Trinidad are summarised in Table 16. Seventeen plants are used, most are common and well known.

Table 16. Ethnoveterinary medicines used for horses

Scientific name	Family	Common Name	Plant part used	Use
<i>Psidium guajava</i>	Myrtaceae	Guava	Leaf, bud	Diarrhoea
<i>Musa species</i>	Musaceae	Banana	Fruit	Diarrhoea
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Tendon problems
<i>Nopalea cochinellifera</i>	Cactaceae	Rachette	Joint	Tendon problems
<i>Ricinus communis</i>	Euphorbiaceae	Castor oil leaf	Leaf	Tendon problems
<i>Panicum maximum*</i>	Poaceae	Wiz/ Guinea grass	Leaf	Grooming
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leafy branch	Grooming
<i>Ricinus communis</i>	Euphorbiaceae	Castor oil leaf	Leaf	Hoof problems, poultice
<i>Kalanchoe pinnata</i>	Crassulaceae	Wonder of the world	Leaf	Hoof problems, poultice
<i>Curcuma longa</i>	Zingiberaceae	Saffron	Rhizome	Swellings
<i>Chenopodium ambrosioides</i>	Chenopodiaceae	Worm grass	Leaf	Anthelmintic
<i>Mucuna pruriens</i>	Fabaceae	Cow itch	Leafy branch	Enhance performance
<i>Nopalea cochinellifera</i>	Cactaceae	Rachette	Joint	Inflammation

Table 16. Ethnoveterinary medicines used for horses (cont.)

Scientific name	Family	Common Name	Plant part used	Use
<i>Curcuma longa</i>	Zingiberaceae	Turmeric	Rhizome	Retained placenta
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Retained placenta
<i>Momordica charantia</i>	Cucurbitaceae	Caraaili	Vine	Tonic, blood purifier
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Digestive problems
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Remove blood clots
<i>Nopalea cochenillifera</i>	Cactaceae	Rachette	Joint	Increase perspiration (Diaphoretic)
<i>Pimenta racemosa</i>	Myrtaceae	Bay leaves	Leaf	Diaphoretic
<i>Cecropia peltata</i>	Cecropiaceae	Bois canot	Leaf	Kidney problems
<i>Nasturtium officinale</i>	Brassicaceae	Water cress	Leaf	Increase blood count
<i>Pueraria phaseoloides</i>	Fabaceae	Kudzu	Leaf	High protein feed
<i>Stachytarpheta jamaicensis</i>	Verbenaceae	Vervine	Leaf	High protein feed
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Blood in lungs

* Respondent identification was not confirmed.

Plants used for diarrhoea

Guava leaves young fruits and/or buds are boiled and mixed with mash or bran or a combination of both and given to the horse to eat. Young green banana fruit including skins are boiled, crushed and mixed with the mash and given to the horse to eat. One respondent once used stale cow dung, which was pushed down the horse's throat in order to obtain beneficial bacteria.

Plants used for tendonitis

Tendon problems were described as the second biggest problem after lung problems. Respondents said that they fired the injured tendon with a hot soldering iron, bringing it across the tendon horizontally (rectangular pattern) behind the canon bone. Horses with sprained ligaments have joints of rachette (*Nopalea cochenillifera*) applied directly to the injured area. Some respondents practice tendon splitting, or splitting of the affected suspensory ligament and the flexor tendon into the normal tissue above and below the lesion. Both firing and tendon splitting are said to increase circulation to the affected tendon or ligament and thus enhance the healing process. Castor oil leaf (*Ricinus communis*) is quickly passed over a flame, and wrapped around the clay already placed on the injured tendon which is then left to heal. Joints of Rachette (*Nopalea cochenillifera*) can be split open and also be mixed with aloes or clay, and packed on to the tendon. This poultice is supposed to help with the healing process and to keep heat from the damaged tissue or injured joint out of the tendon. Alternatively wonder of world (*Kalanchoe pinnata*) leaves are used to remove the heat from the injured leg, this last is said to have antiinflammatory properties. The rest of the treatment consists of rest and some trainers use an ice pack.

Some interviewees blister flexor tendons or suspensory ligaments to help the healing process. The method consists of rubbing the tendon with iodine or mercuric iodine on a toothbrush. The tendon is rubbed for three days, left for three days, and then another

cycle is started. After the raw scab comes off, aloes (*Aloe vera*) is applied, and is said to help the tissues and skin heal. Blistering agents remove the hairs from the injured part there is localised swelling, the skin sloughs off and subcutaneous necrosis can also occur. Blistering necessitates rest since a long healing period is required. Horses are not blistered above the knee. The iodine is said to act as a counter irritant, which brings blood to damaged part, and the increased circulation enhances the healing process. Bucked skins are also blistered. This is described as an injury in the forelimb of young horses after exercise. There is periostitis of the dorsal (anterior) surface of the third metacarpal (or metatarsal) bone. Horses with tendon injuries are also taken to the sea for exercise. Alternatively the injured leg is placed in brine from salted pigtails, both practices are said to harden the tendon. Aloes (*Aloe vera*) is also used for soreness in horses' joints, the gel is made into a paste, and then the joint is bandaged.

Poultices are made with river clay or white clay. Some buy the clay already prepared while others do their own preparation. Other poultices are made with a combination of clay, washing soap (hard bar) and glycerine. The clay keeps the horses legs cool. poultices are sometimes made with a combination of aloes, rachette, glycerine and Epsom salts, and are said to have a 'drawing' effect (removing the inflammation). Medicinal plants are preferred by those who believe that horses don't have much circulation from the knee down, therefore ice is of no value for swelling.

Young castor oil leaves (*Ricinus communis*) or two - three young almond leaves (*Terminalia catappa* ?) are warmed and the veins are crushed. These leaves are put on slight injuries and bandaged. It is said that oil runs out of *Ricinus communis* leaf and cools the heat or swelling in the leg. Horses with bad tendon injuries are treated with rachette and aloes. This is called "sweating it down". The plants are grated and packed on the leg. The leg is then wrapped with football socks that have had the toe cut off. The sock is then tied at the bottom. The plants are thus packed inside the sock. The sock is then wrapped with a bandage to keep it in place. An alternative treatment is to put aloes on first, then wrap a heated bois canôt (*Cecropia peltata*) leaf on the leg, which is then bandaged with cotton. This is used for a few months. Horses also have a decoction of bay leaves (*Pimenta racemosa*), indigo blue and a scent like lavender (own preference for scent) rubbed on sore muscles and quarters.

Plants used for grooming

Wiz is the horse racing term for guinea grass *Panicum maximum*²⁸. A bundle of this dry grass is rubbed until it gets matted and soft. This matted bundle is then rubbed on the horses' skin and is said to make the skin shiny. A bundle of branch tips of black sage (also called shining bush in the horse racing industry) (*Cordia curassavica*) is used before horse races to make the horse's coat shiny, as a coat cleaner and to remove the superficial dust. The dust from the horses skin turns the bunch of leaves brown. Coconut oil (*Cocos nucifera*) is also used.

²⁸ Respondent plant identification not confirmed.

Plants used for hoof problems and other injuries

Wonder of the world (*Kalanchoe pinnata*), young banana leaves (*Musa species*), or castor oil leaves (*Ricinus communis*) are rolled with a bottle to burst the plant veins. They are then passed quickly over a flame to warm them. Soft candle (whale fat) and Epsom salts are pasted on and the leaves are then placed on top. The whole thing is then wrapped with vet wrap or elastoplast. Alternatively saffron (*Curcuma longa*) is pounded and used. The entire foot is then placed in a bag or bandaged for three or four days and "sweated" for as long as it takes to draw the inflammation out. This practice is said to draw infections out of injuries like bruises from stones below the hoof. For cuts, aloes is bandaged on for two to three days.

Plants used as anthelmintics

Worm grass (*Chenopodium ambrosioides*) is used as an anthelmintic, but less so than in the past. The very infrequently used *Leucaena* (*Leucaena leucocephala*) is said to make hairs from the horses' tail drop off.

Plants used for enhanced performance

Horse's hind quarters are occasionally rubbed with cow itch (*Mucuna pruriens*), this is said to help them come out of the boxes faster, since the plant acts as an irritant. Bay leaf (*Pimenta racemosa*), is used to bathe horses on race day, this is said to carry heat into body, which makes them run faster to get away from the sun's heat. If it is felt that the animal is not sweating, or is dry coated, aloes is mixed with water and drenched, or grated ratchet is put in the drinking water. These practices are said to cool down the horse's system and bring out the heat, the animal sweats a few hours later. In previous times horses were taken to the river to stand up in the water for an hour after the race, like a sauna.

Plants used for retained placenta

Horses with retained placenta are seen to have a black discharge three days post partum. These horses are given aloes (*Aloe vera*), and purged with castor oil (*Ricinus communis*). Or they are given pounded turmeric rhizome (*Curcuma longa*). The use of this plant is said to flush out the uterus. Horses are also given molasses water to drink, this is said to "clean them out", including the clotted blood and haematomas. Horses are also given a combination of glycerine, Epsom salts and ratchet (*Nopalea cochenillifera*) to remove inflammation.

Plants used for digestion and as blood purifiers

Aloes is boiled for five minutes and mixed with linseed oil. This is syringed down the horse's throat, some spit it out. Aloes is used for most internal problems and it is said to ease digestive problems. Subsequent to the administration of the *Aloe vera* the horse is given a purge with castor oil (*Ricinus communis*). Aloes is also given peeled and blended with water, this is then mixed with honey, and given orally with a syringe. A decoction of Caraailli (*Momordica charantia*) vine is given orally as a digestive aid. Ratchet (*Nopalea cochenillifera*) joints are pounded up, put in water, and given to horses to drink, they "sweat it out" and this helps them reduce their temperature. Horses are also bathed with bay leaves (*Pimenta racemosa*) to make them feel cool. A decoction of one or two cups of bay leaves is added to a half bucket of water, this is then used to sponge the horse. Alternatively they are

sponged with bay rum. Bay rum is a mixture of bay oil extracted from leaves of *Pimenta racemosa*, alcohol and water.

Plants used for bleeders and to boost the immune system

Water cress (*Nasturtium officinale*) is put in horses' food to increase their blood count. Vervine (*Stachytarpheta jamaicensis*) and kudzu (*Pueraria phaseoloides*) are fed as high protein feeds. Horses that collect blood in their lungs during or after a race are called "bleeders" (exercise induced pulmonary haemorrhage) and this condition is said to be more common than before. The interviewees did not know if this was related to the weekly rather than fortnightly racing or if the industry's allowing the use of the drug Lasix was a factor (implying the Lasix was being used to hide illegal drug use). The interviewees described the horse haemorrhaging from the nostrils, or the horse could be heard coughing while running, and their pace slowed. Interviewees also claimed that they heard horses trying to clear their nasal passages after they had stopped running, and they also heard oxygen gurgle when they looked at the palate. These observations were said to be confirmed by vets using an endoscope. It was felt that lung problems were the biggest health problems of horses. To treat these horses honey and aloes are given orally. Sometimes the white of an egg is included. This is said to break up the clotted blood in the lungs. Pure lemon juice is syringed into the horse's nostrils, this is said to curb bleeding by acting as an astringent.

Plants used for kidney problems

A decoction of bois canôt (*Cecropia peltata*) leaves is given as the drinking water. One respondent remembered seeing a veterinarian use the long stem of a pawpaw leaf (*Carica papaya*) as a funnel to clear a urinary blockage. To clean out the bladder of a horse a decoction of the dry leaves of Bois canôt (*Cecropia peltata*) is prepared in a bucket. A cup of this liquid is then put in the horses' drinking water.

Plants used for respiratory conditions

For bad head colds, horses are sweated or syringed with a cough medicine made of honey, garlic, onion and boiled bois canôt leaves. To 'sweat' the horse heated bricks from a dirt oven are put into a bucket with Vicks, peppermint oil or Foyles Balsam™. The horse's head is put in the bag, and forced to inhale the steam.

Discussion

Clay was used by Native American groups for broken bones in horses and humans (Lawrence, 1998). Firing and blistering are no longer recommended.

Review of the ethnomedicinal literature

The following section is an ethnopharmacological review and evaluation based on that developed by Heinrich *et al.* (1992).

Tona *et al.* (1999) and Olajide *et al.*, (1999) found that plant extracts made of the leaves of *Psidium guajava* act as antidiarrhoeic agents by a triple pronounced antibacterial, antiamoebic and antispasmodic action (inhibition of intestinal motility) (Tona *et al.*, 1999). *Psidium guajava* leaves are mentioned in the Farmacopea Mexicana as astringents (Ankii *et*

al., 1999). *Psidium guajava* plant parts contain cineol, tannins, triterpenes and flavonoids (Olajide *et al.*, 1999).

Musa paradisiaca stem is used in India for diarrhoea (Ahmad and Beg, 2001). *Musa sapientum* var. *Cavendishii* contains soluble and insoluble dietary fibre that contributes to its hypo-cholesterolaemic effect (Horigome *et al.*, 1992). A lectin has been isolated from *Musa paradisiaca* (Koshte *et al.*, 1990).

The wound healing and antiinflammatory properties of *Aloe vera* are due to the compounds mannose-6-phosphate, phosphatidyl choline and arachidonate (Davis *et al.*, 1994; Lal jawahar *et al.*, 1990; Afzal *et al.*, 1991). Immediately after an injury there is clot formation and the early phases of wound repair involve inflammation and synthesis of ground substance (Chithra *et al.*, 1998). The ground substance consists mainly of proteoglycans (PGs) and glycosaminoglycans (GAGs) (Chithra *et al.*, 1998). *Aloe vera* gel has significant influence on the PGs and GAGs in healing wounds and this healing may be related to the gel polysaccharides (mannose-6-phosphate and acemannan) (Chithra *et al.*, 1998). *Aloe vera* gel also increases the amount of hyaluronic acid and dermatan sulphate in the wound which may result in the formation of a more stable scar and faster healing (Chithra *et al.*, 1998).

In Aligarh India, leaves of *Ricinus communis* with mustard oil are used as poultices on wounds (Anis and Iqbal, 1994). *Ricinus communis* is used for skin diseases in Palestine and for wounds, pimples and swellings in Bolivia (Ali-Shtayeh *et al.*, 2000; Bourdy *et al.*, 2000). Ryu and Wang (1998) found that the wounded leaf of *Ricinus communis* contained increased free fatty acids and diacylglycerol and decreases in phospholipids. Akhtar and Alam (1989) found that leaves of *Ricinus communis* were nematocidal.

In India the mucilaginous joints of *Nopalea cochenillifera* are split open and applied as a poultice to relieve burns and skin diseases and are also used for inflammations (Morton, 1990; Duke, 2000). Intraperitoneal administration of the lyophilised aqueous extract of *Opuntia dillenii* (a species similar to *Nopalea cochenillifera*) exhibits central analgesic properties, associated with antiinflammatory effects on acute inflammatory processes similar to the action of morphine (Loro *et al.*, 1999).

Panicum maximum leaves contain ash, calcium, carbohydrates, carotene, chlorine, fat, fiber, HCN, iodine, iron, magnesium, oxalates, phosphorus, phytic acid, potassium, protein, sodium, sulphur, tocopherol (Duke, 2000).

Cordia species contains phenolic compounds (Ficarra *et al.*, 1995) and terpenoid quinones (Lachman-White *et al.*, 1992). Branches are reported to be resinous and leaves are aromatic and have stiff hairs on their upper sides (Morton, 1981).

Kalanchoe pinnata leaves are used in Brazil, Bolivia and India for treatment of wounds, bruises, boils and other skin diseases (Nassis *et al.*, 1992; Bourdy *et al.*, 2000). In Jamaica, Cuba and in Mayan medicine it was used for pains and sprains (Asprey and Thornton, 1953-1955). In the treatment of 50 trophic ulcers in the leg with *Kalanchoe pinnata* leaf juice applied externally, 46 cases resulted in healing (Robineau, 1991).

Curcumin from (*Curcuma longa*) has strong antiinflammatory and antioxidant activity (Oliver Bever, 1986; Kapoor, 1990). Fifteen isolates of dermatophytes and four isolated of pathogenic fungi were inhibited by turmeric oil (Apisariyakul *et al.*, 1995).

Chenopodium ambrosioides is considered an effective and well-known anti-parasitic remedy (Duke, 1989; Heinrich *et al.*, 1992).

Mucuna pruriens is used as a stimulant tonic and diuretic in India (Ghosal *et al.*, 1971; Deokule, 1991). Spicular hairs of the pod of *Mucuna pruriens* penetrate the skin causing intense irritation (Oliver Bever, 1986). Hairs contain 5-hydroxytryptamine (serotonin) and the itching produced by the hairs is due to the liberation of histamine in the epidermal layer of the skin (Oliver Bever, 1986).

Aqueous and ethanolic extracts of *Momordica charantia* inhibit the growth of *Escherichia coli*, *Sacrina lutea*, *Staphylococcus aureus*, *Pseudomonas aeruginos*, *Bacillus subtilis*, *Proteus* species and *Staphylococcus albus*. Aerial parts contain momordicines I,II, and III (Robineau, 1991). Alpha-eleostearic acid, lineolenic acid and palmitic acid are present, and the plant contains nutritionally useful quantities of iron, calcium, vitamin B, phosphorus and amino acids (Yuwai *et al.*, 1991; Robineau, 1991). Lal jawahar *et al.* (1990) extracted beta-sitosterol, glucose and potassium chloride from the whole plant excluding the roots. The ether insoluble fractions showed dose-related antiinflammatory activity.

Pimenta racemosa contains monoterpenes (Duke, 2000).

Cecropia sciadophylla infusion is used in the Peruvian Amazon for kidney stones (Jovel *et al.*, 1996). *Cecropia obtusifolia* leaves are sold in Mexican herb markets for their antidiabetic properties. Extracts of the leaves showed hypoglycaemic activity (Perez *et al.*, 1984). Free fatty acids including stearic, arachidic, behenic, lignoceric and cerotic acids were isolated from *Cecropia* species (Lachman-White *et al.*, 1992).

Goda *et al.* (1999) found histamine release inhibitors (flavonols and megastigmanes) in watercress (*Nasturtium officinale*). Phenethyl isothiocyanate (PEITC) which is released upon chewing of watercress (*Nasturtium officinale*) is a chemoprotective agent (Hecht *et al.*, 1995). A study by Chen *et al.* (1996) found that consumption of watercress causes a decrease in the levels of oxidative metabolites of acetaminophen, probably due to inhibition of oxidative metabolism of this drug (Chen *et al.*, 1996).

Stachytarpheta jamaicensis plant is rich in caffeic acid, stachytarphetin, chlorogenic acid, the hypotensive gamma-amino-butyric acid, flavones (luteolol and derivatives) and catechic tannins (Robineau, 1991; Heinrich *et al.*, 1992).

Conclusion

The plants used for ethnoveterinary remedies in horses are also used in Caribbean folk medicine and in other tropical countries for similar reasons. There are indications that some of the plants mentioned contain chemicals that may explain the popular use. These merit further scientific testing and verification.

Case study 9: Ethnomedicine

Tout hazyé sé rimèd (every bush is a remedy) (INRA-CARDI, 1991)

11. Case Study 9: Ethnomedicine not found in ethnoveterinary medicine

Abstract

Ethnomedicinal plants are used for colds, urinary problems, skin problems, high blood pressure, diabetes, stomach problems, pain, internal parasites, eye problems, headaches, dental problems and for miscellaneous problems and conditions. Many plants are used for more than one condition. Several (approx. 30) of the plant uses have already been recorded by Wong (1976) who conducted his ethnomedicinal study of one rural community in the northern range of Trinidad.

Introduction

This chapter returns to the questions of whether ethnoveterinary medicine is a separate field from human folk medicine. Most ethnoveterinary medicines are derived from a similar ethnomedicinal use. However the ethnomedicinal plants listed below were not found to have a closely corresponding ethnoveterinary use during the research. The chapter also addresses the research question of tracing the ethnomedicinal practices to the original continents of Trinidad and Tobago's current population. In both the first and second phases of the research the plants kojoroot and gullyroot were said to be the same and also said to be different plants. In this thesis the same botanical name is used but the local name specified for the particular use is given.

The Trinidadian hot/cold system is not humoral in the sense that balance must be established between hot and cold, it is cathartic in that remedies are taken to remove heat from the system (Littlewood, 1988). Heat comes from the sun, work, sleeping, burns, cooking, and reproductive activities. Linked to the hot/cold dichotomy is a system of blood beliefs where an excess or lack of cold or heat in the body through exposure or diet causes illness. Blood then becomes 'bad' or dirty. Illnesses with skin changes such as chicken pox, measles, rashes, urticaria, impetigo, ringworm, eczema, are associated with 'too much heat in the body' (Bayley, 1949; Aho and Minott, 1977; Mitchell, 1983).

Teas are used for 'cooling' if there is too much 'heat' in the body. Cooling teas are used prophylactically when they are taken to keep the body healthy by cooling the 'system', or the bladder, meaning that they remove the 'heat' or impurities in the system (Littlewood, 1988). Cooling teas become treatment when they are taken for undiagnosed or unspecified illnesses or when feeling unwell. Purges reduce the heat further and 'clean the blood' or remove unwanted foetuses. Purges are also used to remove internal parasites and for reproductive problems. 'Cold' is associated with experiencing a sudden change in temperature, drafts or getting wet (Mitchell, 1983). Parts of the body associated with 'coldness' are the mole (fontanelle), chest, head, back, womb, eyes, ears and knee, phlegm, discharge and arthritic pain (Mitchell, 1983). Aching is associated with 'cold' in the Aztec

system and several illnesses are attributed to the unhealthy penetration of excess cold and moisture (Messer, 1987). Liniments, poultices and laxatives are used for cold and for gas (wind) (Mitchell, 1983). Illnesses associated with coldness are influenza, asthma and the common cold (Aho and Minott, 1977). There are also 'hot' plants to stimulate the blood or to treat 'cold' illnesses, and 'hot' external applications like 'soft candle' 'grated nutmeg' and hot poultices (Laguerre, 1987; Littlewood, 1993). 'Hot' teas are used for colds and fevers.

Gas (wind) is associated with pain in the stomach but also in the joints and back and with pain that travels around the body (Mitchell, 1983; Littlewood, 1988). Medicines are administered in accordance with the identity between cause and effect. Expulsion of disease causing impurities is the primary mechanism by which bodily equilibrium is restored (Mitchell, 1983). Folk medicines achieve cures through 'bitterness', 'cutting', 'cooling', 'building', 'purging or washing out', and 'drawing out' (Mitchell, 1983).

Methods

Thirty respondents, ten of whom were male were interviewed from September 1996 to September 2000. These respondents are separate from the hunters and those who were interviewed specifically about ethnoveterinary medicine. The respondents were obtained by snowball sampling, and were found in thirteen different sites, 12 in Trinidad and one in Tobago. The majority of the plants were identified at the Herbarium of the University of the West Indies but voucher samples were not deposited.

Results

Bois canôt (*Cecropia peltata*) and black sage (*Cordia curassavica*) are considered hot bushes which explains why they are used for colds. *Pluchea odorata* and *Neurolaena lobata* are considered bitter and make the patient perspire so they are considered useful for colds. Nutmeg (*Myristica fragrans*) is grated for pneumonia. Respondents believed that bitter plants with unpleasant smells like z'herbe à pique (*Neurolaena lobata*) were more effective than non-bitter plants. The nutmeg is applied with soft candle (whale oil), or unscented vaseline or puncheon rum or bay rum. If rum is used the nutmeg is lit (flambé) to obtain a paste. The body is rubbed and covered to 'sweat' the cold out. Lochs are used for colds. One consisted of the root of fever grass (*Cymbopogon citratus*), roots and leaves of vetiver (*Vetiveria zizanioides*), garlic, sugar, and leaves of the following: bamboo (*Bambusa vulgaris*), bois canôt (*Cecropia peltata*), z'herbe à pique (*Neurolaena lobata*), chigger bush (*Tournefortia hirsutissima*), salt butter and lamp oil. It was said to 'become thick like jam'. It was taken for 9 days, then a purge was taken to 'flush everything out'.

Single or multiple plants are used in baths for ill health or bad luck. *Petiveria alliacea* leaves are used in baths on a Wednesday or Friday. Fever grass (*Cymbopogon citratus*) is used after childbirth. One multiple plant 'bush bath' (hydrotherapy) contained: leaves of mango (*Mangifera indica*), sugar cane (*Saccharum officinarum*), wild coffee (*Senna occidentalis*), christmas bush (*Chromolaena odorata*), olive bush (*Bontia daphnoides*), and the flower of boundary plant (*Cordyline terminalis*?).

Plant names

Some plant names have shifted from the original French. 'Jardon bene' (blessed weed) has become 'shadon bene' or more often 'shadow bene' (Reyes, 1977). Another French name that is still used in rural Mayaro is 'grain amba fen' (seed under leaf) which may have originally been 'grain en-bas fen' (leaf with seeds below).

Doctrine of Signatures

One respondent showed the researcher a leaf (*Hippobroma longiflora*) that he claimed looked like a liver and said that he would try it for liver problems. The red flowers of forest tree called cooper hook (*Brownea latifolia*) are used for women's menstrual problems, gripes and pain. A decoction of the flowers is red in colour. A male informant whose mother was a midwife used both *Brownea latifolia* and red monkey step vine (*Bauhinia cumanaensis* / *Bauhinia excisa*) to make tisanes for women's problems. He insisted that the vine when cut should not be white in colour but red like blood. This tisane he claimed would clean out women's insides preventing monthly period pain and would also improve fertility. The use of *Brownea latifolia*, in Trinidad for amenorrhea and as an abortifacient has been previously recorded (Wong, 1976).

Mimosa pudica was used by one midwife to unwrap the cord from around a baby's neck. Two plant tops were tied crossways, put in a pot and drawn. It was claimed that fifteen minutes after the pregnant woman drank the tisane the baby gave a flip. However a caesarean was still needed because the baby's due date had past.

Cecropia peltata is prepared as a snake medicine by pounding a 3-inch piece of root and then boiling this with a piece of brown paper. It was claimed that 'brown paper was a poison and that one needed a poison to kill another poison'.

Multiple plant use

There are several instances of multiple plant use. One given for jaundice included white bachelor button (*Gomphrena globosa*), olive bush (*Bontia daphnoides*), small white vere michelle (unidentified), and fine-stemmed rather than thick-stemmed love vine (*Cuscuta americana*). Certain spices are claimed to have bioavailability enhancing effects which explains why they are used for a range of disorders and added to multiple plant combinations (Eigner and Scholz, 1999).

Plant smell and taste

Buckleys™ Cough mixture is marketed on the basis that its unpleasant taste is an indication of its effectiveness. The perception of unpleasant smell and taste being an attribute of effectiveness is not limited to medicinal plants. Farmers also believe that pesticides that smell bad are more effective. The Mixe in Mexico consider that the odour and taste of a plant are important criteria in deciding what plants to use for an illness (Heinrich *et al.*, 1992).

Bitterness may be a fundamental norm unrelated to culture. For example bitter principles and related constituents were isolated from *Vernonia amygdalina* (Asteraceae), a plant ingested by wild chimpanzees suffering from parasite-related diseases in Tanzania

(Koshimizu *et al.*, 1994). The bitter (anti-parasitic) constituents including vernodalin may be used as signals to the ingester that guide the choice of the appropriate plant or plant part; and are possibly also to be used as signals that control the amount of intake (Koshimizu *et al.*, 1994).

Non-experimental validation

For each species or genus the ethnomedicinal uses in other countries are given. Then follows a summary of chemical constituents, in addition to active compounds if known. This type of ethnopharmacological review and evaluation is based on that developed by Heinrich *et al.* (1992). Information on plant activity of bacteria and fungi is provided if the bacteria and / or fungi are known pathogens that affect the respiratory and / or urinary tracts (or other body systems) as primary or opportunistic pathogens. Antibacterial activity would be useful to prevent secondary bacterial infections. It is not known in all cases whether the active ingredients of the plant extracts are absorbed from the gastrointestinal tract and distributed in an active form outside the gastrointestinal tract. Information that looks 'irrelevant' to the particular plant use is also provided since lay diagnoses would not always be 100% accurate, and different diseases may have several clinical signs.

The ethnomedicinal plants used in Trinidad and Tobago that did not seem to have ethnoveterinary parallels are summarised in Tables 17a - h.

Plants used for colds

Table 17a. Ethnomedicinal plants used for colds

Scientific name	Family	Common name	Plant part used	Use
<i>Abelmoschus moschatus</i>	Malvaceae	Gumbo musque	Seeds	Grind in rum for colds
<i>Abrus precatorius</i>	Fabaceae	Licourish	Leaves	Colds
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	Colds
<i>Ambrosia cumanensis</i>	Asteraceae	Altamis	Leaves	Colds
<i>Annona muricata</i>	Annonaceae	Soursop	Leaves	Feeling cold
<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Root, Leaves	Colds
<i>Bontia daphnoides</i>	Myoporaceae	Olive bush	Leaves	Colds
<i>Cajanus cajan</i>	Fabaceae	Pigeon pea		Colds, babies chest colds
<i>Cecropia peltata</i>	Cecropiaceae	Bois canôt	Leaves	Colds
<i>Centropogon cornutus</i>	Campanulaceae	Crepe coq	Leaves	Asthma
<i>Chromolaena odorata</i>	Asteraceae	Christmas bush	Leaves	Colds
<i>Chrysobalanus icaco</i>	Chrysobalanaceae	Ipecak		Colds
<i>Cissus verticillata</i>	Vitaceae	Blister bush		Colds

Table 17a. Ethnomedicinal plants used for colds

Scientific name	Family	Common name	Plant part used	Use
<i>Cocos nucifera</i>	Arecaceae	Coconut	Water	Pleurisy
<i>Coleus aromaticus</i>	Lamiaceae	Spanish thyme	Leaves	Colds, Asthma
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Colds
<i>Crotalaria retusa</i>	Fabaceae	Shack shack		Bad colds
<i>Cucurbita pepo</i> , <i>Cucurbita maxima</i>	Cucurbitaceae	Pumpkin		Dysentery
<i>Cymbopogon citratus</i>	Poaceae	Fever grass	Leaves	Fever
<i>Eleusine indica</i> *	Poaceae	Pied poule		Colds
<i>Eryngium foetidum</i>	Apiaceae	C/ b������	Plant	Colds
<i>Eupatorium triplinerve</i>	Asteraceae	Japanne	Leaves	Colds
<i>Gossypium species</i>	Malvaceae	C/ bush	Leaves	Colds
<i>Hibiscus rosa-sinensis</i>	Malvaceae	Hibiscus	Flower	Colds, whooping cough
<i>Hibiscus sabdariffa</i>	Malvaceae	Sorrel	Leaf	Colds
<i>Hippobroma longiflora</i>	Campanulaceae	Ipecac	Leaves	Children's colds
<i>Hyptis suaveolens</i>	Lamiaceae	Matrank		Fever
<i>Justicia pectoralis</i>	Acanthaceae	Z'herbe charpentier	Leaves	Fever, coughs, cold
<i>Lantana camara</i>	Verbenaceae	Kayakeet	Leaves	Fever, colds
<i>Leonotis nepetaefolia</i>	Lamiaceae	Shandileer		Colds
<i>Lippia alba</i>	Verbenaceae	Santa Maria		Fever, colds
<i>Microtea debilis</i>	Phytolaccaceae	Alantukai		Cooling
<i>Momordica charantia</i>	Cucurbitaceae	Caraaili	Vine	Fever
<i>Neurolaena lobata</i>	Asteraceae	Z'herbe �� pique	Leaves	Tincture for colds
<i>Paspalum virgatum</i>	Poaceae	Razor grass	Root	Colds
<i>Passiflora foetida</i> ?	Passifloraceae	Marie gourg��ois		Colds, cough
<i>Peperomia rotundifolia</i>	Piperaceae	Giron fleur, mowon	Vine	Colds, cold in blood, coughs
<i>Persea americana</i>	Lauraceae	Avocado	Leaf	Boil with bamboo, coffee for colds
<i>Petiveria alliacea</i>	Phytolaccaceae	Kudjuruk	Root	Colds, fever
<i>Pimenta racemosa</i> var. <i>racemosa</i>	Myrtaceae	West Indian Bay / Bay rum		Colds, feeling cold
<i>Piper hispidum</i>	Piperaceae	Candle stick		Colds
<i>Pityrogramma calomelanos</i>	Pteridaceae	White backed fern, Egyptian secret		Cough
<i>Pogostemon heyneanus</i>	Lamiaceae	Pachouli		Colds

Table 17a. Ethnomedicinal plants used for colds (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Pluchea carolinensis</i> <i>Pluchea odorata</i>	Asteraceae	Guerir toute	Leaves	Colds, fever, coughs
<i>Lepianthes peltata</i>	Piperaceae	Lani bois	Leaves	Colds
<i>Mimosa pudica</i>	Fabaceae	Mase marie	Leaves	Cold in head
<i>Myristica fragrans</i>	Myristicaceae	Nutmeg		Pneumonia
<i>Rosmarinus officinalis</i> *	Lamiaceae	Rosemary		Colds, put on mole of babies head when born
<i>Sambucus simpsonii</i> *	Caprifoliaceae	Syrio	Leaf, flower	Colds
<i>Tagetes patula</i>	Asteraceae	Marigold		Asthma
<i>Urena sinuata</i>	Malvaceae	Patte chien		Colds
<i>Vetiveria zizanioides</i>	Poaceae	Vetivert		Colds
<i>Wedelia trilobata</i>	Asteraceae	Venven caribe	Plant tops	Feeling cold

* Respondent identification not confirmed

Non-experimental validation of plants used for colds

The use of *Abelmoschus moschatus* (syn. *Hibiscus abelmoschus*) in Trinidad for respiratory conditions has been previously recorded (Wong, 1976). Mucilages are found in its leaves (Cambie, 1997).

Abrus precatorius leaf decoction was used in Jamaica and Barbados as a slave medicine for dropsy and coughs, it is used in the Dutch East Indies for throat ailments (Sheridan, 1991; Handler and Jacoby, 1993). *Abrus precatorius* leaves have a high glycyrrhizin content (Oliver Bever, 1986). This saponin has expectorant properties and is thus useful for coughs.

Aloe vera leaf aqueous extract was found to be active against *Staphylococcus aureus* and *Bacillus subtilis* (Martínez *et al.*, 1996b).

The use of *Ambrosia cumanensis* and *Ambrosia hispida* for colds in Trinidad has been previously recorded (Wong, 1976). *Ambrosia* species are also used for colds in Paraguay (Schmeda-Hirschmann and Bordas, 1990).

Annona muricata and *Annona reticulata* are used in Africa and the Dutch East Indies for coughs, colds and fevers (Hirschhorn, 1983; Honychurch, 1986). In Belize leaves of *Annona cherimola* are put on the forehead for fever (Arnason *et al.*, 1980). Monotetrahydrofuran acetogenins and diterpenoids were isolated from the leaves and seeds of *Annona* species. Most acetogenins show a broad range of activities such as anti-tumour, antibacterial, and immunosuppressive effects (Wu *et al.*, 1995, 1996; Zeng *et al.*, 1996; Chang *et al.*, 1998; Liu *et al.*, 1998; Kim *et al.*, 1998; Mootoo *et al.*, 2000).

An infusion of leaves of *Bambusa* species is used in India for fever (Kapoor, 1990).

The use of *Bontia daphnoides* for colds in Trinidad has been documented by Wong (1976). *Bontia daphnoides* crude leaf and stem ethanol extracts contained an insecticidally active compound, the sesquiterpene furan epigaione (Williams and Williams, 1998).

Cajanus cajan leaves are used in teas for colds in the Caribbean and the Malay Peninsula (Asprey and Thornton, 1953-1955; Honychurch, 1986; Duke, 2000).

Cecropia peltata leaves are used for aches, coughs, pains and fever in Eastern Nicaragua, Columbia and Belize (Amason *et al.*, 1980; Hirschhorn, 1981; Coe and Anderson, 1996a). Decoctions of *Cecropia peltata* leaves are used for colds, sore throat and hoarseness and nerves in Jamaica (Asprey and Thornton, 1953-1955).

Centropogon cornutus is used for philter (Duke, 2000).

Chromolaena odorata (syn. *Eupatorium odoratum*) is native to South America, but is now pantropical (Bamba *et al.*, 1993). It is used in Jamaica for sores and mouth ulcers (Michie, 1992). It is used in Paraguay, Trinidad, Jamaica and the Grenadines for colds, coughs and bronchitis in children (Asprey and Thornton, 1953-1955; Schmeda-Hirschmann and Bordas, 1990).

Chromolaena odorata essential oil was found to be active against Gram-negative species *Klebsiella pneumoniae*, *Escherichia coli* and *Pseudomonas aeruginosa* (Bamba *et al.*, 1993; Facey *et al.*, 1999). *Chromolaena odorata* contains monoterpenes, triterpenes and flavonoids (Duke, 2000).

Chrysobalanus icaco has been used for dysentery in Trinidad (Wong, 1976).

Cissus sicyoides is used in the Dominican Republic as a diuretic, antiinflammatory and anti-influenza agent (García *et al.*, 1999b, 2000). *Cissus verticillata* leaf contains steroids, flavonoids, phenolic compounds and alkaloids (Robineau, 1991). Extracts of leaves and stems have antibacterial activity against Gram-positive and Gram-negative microorganisms (Feng *et al.*, 1964; García *et al.*, 1999b). It has been placed in TRAMIL category B for internal and external uses (Robineau, 1991). The aqueous extract of *Cissus sicyoides* contracts the smooth muscle of the aorta in a dose-response relation and has antibacterial and oxytocic activities (García *et al.*, 1997; 2000). *Cissus sicyoides* showed a moderate cytostatic activity against HEp-2 cells and a stem decoction showed potent *in vivo* antiinflammatory activity after both oral and topical administration (García *et al.*, 2000; Saenz *et al.*, 2000).

Cocos nucifera is used for coughs and colds in Nicaragua and in Jordan (Barrett, 1994; Afifi and Abu-Irmaileh, 2000). Coconut water *Cocos nucifera* consists of a dilute solution of sugars and mineral salts with proteins and fats. The water of the unripe nuts contains the vitamin B group and 4.6% glucose (Kapoor, 1990).

Coleus aromaticus is known to be used for coughs in Trinidad (Wong, 1976). *Coleus aromaticus* leaves were used in the East Indian archipelago for aphthous stomatitis because of their antiseptic qualities. Bioactivity was attributed to carvacrol, thymol, eugenol and methyleugenol (Bos *et al.*, 1983). *Coleus amboinicus* contains a flavonol (quercetin) with antiinflammatory properties (Duke, 1989; Souza Brito and Souza Brito, 1993). *Coleus barbatus* contains a diterpene (forskolin) and the methanolic plant extract showed strong

relaxation activity on tracheal smooth muscle (Souza Brito and Souza Brito, 1993; Kasonia, 1995).

Cordia species are used in Jamaica, Nicaragua and India for colds, indigestion and sore throats (Asprey and Thornton, 1953-1955; Dennis, 1988; Barrett, 1994; Ahmad and Beg, 2001). *Cordia* species contains phenolic compounds and terpenoid quinones (Ficarra *et al.*, 1995; Lachman-White *et al.*, 1992). Ioset *et al.* (2000) isolated antifungal and larvicidal cordiaquinones from the roots of *Cordia curassavica*. These naphthoquinones demonstrated antifungal activities against *Cladosporium cucumerinum* and *Candida albicans*. *Cordia verbenacea* has antiinflammatory properties (Sertié *et al.*, 1988).

The most commonly quoted health damage from bush teas in the Caribbean is veno-occlusive disease of the liver attributed to the toxic alkaloids in *Crotalaria fulva* and *Crotalaria spectabilis* bush teas (Bras *et al.*, 1957; Porta *et al.*, 1972).

Cymbopogon citratus is one of the most used plant infusions in Brazilian, Belizean and Cuban folk medicine as an antiinflammatory, and for feverish conditions (Arnason *et al.*, 1980; Carlini *et al.*, 1986; Carbajal *et al.*, 1989). Lemon grass extract has antioxidant activity (Suaeyun *et al.*, 1997).

Myrcene and citral were identified as the major analgesic components in the oil (Lorenzetti *et al.*, 1991; da Silva *et al.* 1991; Rao *et al.*, 1990; Viana *et al.* 2000). Terpenes such as myrcene may constitute a lead for the development of new peripheral analgesics with a profile of action different from aspirin-like drugs (Lorenzetti *et al.*, 1991). The East Indian variety of the species contains moderate levels of myrcene and citral while the West Indian variety contains low myrcene and high citral levels (Viana *et al.*, 2000). These different levels may explain why Leite *et al.* (1986), Souza Formigoni *et al.* (1986) and others found that *Cymbopogon citratus* lacked hypnotic and anxiolytic properties (Leite *et al.*, 1986; da Silva *et al.*, 1991). A leaf decoction showed weak diuretic and antiinflammatory effects when given orally (Carbajal *et al.*, 1989). The popular oral therapeutic use of *Cymbopogon citratus* to treat nervous and intestinal ailments and feverish conditions was not supported (Carlini *et al.*, 1986). The alpha-citral (geranial) and beta-citral (neral) components of the essential oil of *Cymbopogon citratus* individually elicited antibacterial action on Gram-negative and Gram-positive bacteria. Myrcene, did not show observable antibacterial activity on its own but provided enhanced activities when mixed with either of the other two main components identified (Onawunmi *et al.*, 1984).

A decoction of *Eleusine indica* is used in Vietnam as a febrifuge (Phuong *et al.*, 1994). Flavonoids and two sterol glucosides have been found in *Eleusine indica* and *Eleusine* species (Hilu *et al.*, 1978; Phuong *et al.*, 1994).

Eupatorium species are used in Argentine and Catalonia folk medicine for the treatment of inflammation, pneumonia and pain-related problems (Raja *et al.*, 1997; Clavin *et al.*, 2000). Infusions of these plants showed antinociceptive effects (Clavin *et al.*, 2000). *Eupatorium triplinerve* contains coumarins and monoterpenes (Duke, 2000). *Eupatorium triplinerve* leaf essential oil inhibits the growth of *Escherichia coli*, *Proteus vulgaris*, *Bacillus* species and *Salmonella* species (Yadava and Saini, 1990).

Eryngium foetidum is used against colds, fevers and asthma in Bolivia, Mexico, Haiti and Jamaica (Weniger *et al.*, 1982; Zamora-Martínez and Nieto de Pascual Pola, 1992; Michie,

1992; Muñoz *et al.*, 2000a). This plant is used in the Caribbean for the treatment of several antiinflammatory disorders. *Eryngium nudicaule* showed moderate antimalarial activity *in vivo* (Muñoz *et al.*, 2000b).

Gossypium hirsutum leaf tea is used for coughs in Belize (Amason *et al.*, 1980). *Gossypium barbadense* whole plant contains the sesquiterpenoid gossypol, as well as catechins (Robineau, 1991). Citric and malic acid have been isolated from the leaf as well as beta-sitosterol (Robineau, 1991).

An ethanolic extract of *Hibiscus rosa-sinensis* flowers exhibited anticonvulsant activity (Kasture *et al.*, 2000). The flowers are used in folk medicine as demulcent, emollient, refrigerant and bronchial catarrh (Kasture *et al.*, 2000).

Hibiscus sabdariffa is used in Latin America for fevers (Duke, 2000). *Hibiscus sabdariffa* tea extracts (fifty percent methanol and acetone) contained hibiscus acid and its 6-methyl ester (Hansawasdi *et al.*, 2000). Three water-soluble polysaccharides isolated from flower buds of *Hibiscus sabdariffa* were composed of arabinans and arabinogalactans and showed immunomodulating effects (Müller and Franz, 1992).

Hippobroma longiflora was active against *Staphylococcus aureus* (Facey *et al.*, 1999).

Hyptis species are used in Jamaica, Bolivia and Guatemala for malnutrition, fever and colds (Michie, 1992; Comerford, 1996; Bourdy *et al.*, 2000). The species contains monoterpenes and sesquiterpenes (caryophyllene derivatives) (Porter *et al.*, 1995; Duke, 2000). Steam distilled oils of dry leaves of *Hyptis suaveolens* inhibited the growth of Gram-positive and Gram-negative bacteria and the aqueous residues of fresh leaves showed moderate inhibition of a Gram-negative bacteria (*A. viscolactis*) (Perumal Samy *et al.*, 1999). *Hyptis* species may be useful in the treatment of gout (González *et al.*, 1995).

Justicia pectoralis is used in Barbados for respiratory conditions (Handler and Jacoby, 1993). Different *Justicia* species have yielded steroids, lignans, triterpenoids, coumarins, alkaloids and flavonoids (Gupta *et al.*, 1993). *Justicia pectoralis* leaves contain coumarins and flavonoids. The coumarins have antinociceptive, antiinflammatory and bronchodilator activities (Leal *et al.*, 2000). Caffeic acid and volatile oils are also found in the leaves (Leal *et al.*, 2000). N,N-dimethyl tryptamine (a hallucinogen) was found in the dry leaves of the plant (Leal *et al.*, 2000).

Lantana camara is used against colds, fever and malaria in Mauritius, Rodrigues and India (Gurib-Fakim *et al.*, 1993; Ahmad and Beg, 2001). *Lantana camara* was found active against *Staphylococcus aureus* (Facey *et al.*, 1999). *Lantana camara* contains triterpenes, steroid(s) with cardiotonic properties (lancamarone) and alkaloid(s) with antipyretic and antispasmodic properties (lantamine) (Begum *et al.*, 1995; Ahmad and Beg, 2001). *Lantana* intoxicated sheep showed impaired phagocytosis (Ganai and Jha, 1991).

Laportea crenulata has been used for fevers in India (Duke, 2000).

Leonotis nepetaefolia originates from the Old World tropics. In Venezuela the leaves or flower heads are boiled and the decoction is taken as a tonic, febrifuge and diuretic (Morton, 1975). In the Congo, Madagascar and Nigeria, *Leonotis nepetaefolia* is used as a tonic and febrifuge (Asprey and Thornton, 1953-1955). Ethanolic extracts of *Leonotis intermedia* and

Leonotis leonorus showed strong inhibition of cyclo-oxygenase inhibitors *in vitro* (Jager *et al.*, 1996).

In Costa Rica *Lepianthes peltata* (syn. *Pothomorphe peltata* Miq.) leaves are boiled with *Piper auritum* to prepare a tea to treat coughs and colds (Hazlett, 1986). In the Caribbean and South America *Lepianthes peltata* leaves are ground and applied to cuts or boiled and taken for belly pain (Hodge and Taylor, 1957; Lachman-White *et al.*, 1992).

Lippia alba, *Lippia tripylla* and *Lippia dulcis* leaf teas are used as analgesics, tranquilisers, for asthma, bronchitis, coughs, colds and fevers and *Lippia dulcis* has been prescribed in the Mexican Pharmacopoeia for coughs and bronchitis since 1881 (Morton, 1968b; Zamora-Martínez and Nieto de Pascual Pola, 1992; Cáceres *et al.*, 1993; Barrett, 1994; Raja *et al.*, 1997; Uncini Manganelli and Tomei, 1999; Bonet *et al.*, 1999; Ankli *et al.*, 1999; Vale *et al.*, 1999). *Lippia alba* essential oil contains monoterpenes (Vale *et al.*, 1999; Duke, 2000). The essential oil of *Lippia alba* in Argentina as opposed to Brazil contained dipentenes, d-limonene and l-piperitone (Craveiro *et al.*, 1981). The essential oil of *Lippia alba* leaves had *in vitro* activity against the fungi *Trichophyton mentagrophytes*, *Candida albicans*, *Neurospora crassa*, *Dreschlera oryzae*, *Rhizoctonia solani* and *Fusarium moniliforme* but not against *Pseudomonas aeruginosa* (Dubey and Kishore, 1987; Vale *et al.*, 1999; Pino *et al.*, 1999). Carvone in the essential oil has antifungal and bactericidal activity (Vale *et al.*, 1999). The essential oil and ethanol extracts have shown various effects (anticonvulsant, antinociceptive, antiedematogenic, anxiolytic) and produced sedation and a myorelaxant effect similar to a benzodiazepine; the main active compounds may be the monoterpenes limonene, citral and beta-myrcene (Vale *et al.*, 1999; Viana *et al.*, 1998; de Barros Viana *et al.*, 2000). Differences in research results are attributed to differences in the chemical composition of aqueous extracts versus essential oils and in the variability between native and cultivated species from different places (Vale *et al.*, 1999).

Microtea debilis is used in Trinidad for respiratory conditions, pertussis (whooping cough) and as an expectorant (Wong, 1976). The flavone glycoside cirsimarin might contribute to the effectiveness of *Microtea debilis* which is used in Surinamese traditional medicine against proteinuria (Hasrat *et al.*, 1997a, 1997c).

Mimosa pudica root decoction is used to relieve cough, fever or headache in Guatemala and Malaysia (Ahmad and Holdsworth, 1994; Comerford, 1996). *Mimosa pigra* leaf was active against *Staphylococcus aureus* and against *Bacillus subtilis* (Martínez *et al.*, 1996b). The plant contains mimosine, sitisine and related alkaloids (Ahmad and Holdsworth, 1994).

Momordia charantia is widely used in the Caribbean for colds, malaria, and fever (Muñoz *et al.*, 2000a). *Momordia charantia* leaf tea is used as a tonic to build the blood in Belize (Anason *et al.*, 1980).

Myristica fragrans seed decoctions and infusions are used in Trinidad for malarial fever (Wong, 1976). *Myristica fragrans* oil contains camphene, pinene, borneol, geraniol and eugenol (Kay, 1996).

Neurolaena lobata was previously incorrectly named *Pluchea symphytifolia* (Miller) Gillis (Gracioso *et al.*, 1998). In Trinidad *Neurolaena lobata* used for colds and fevers is considered 'so bitter is it that it must be administered in some spirit, rum for instance, or in powder' (de Verteuil, 1889). *Neurolaena lobata* is used in western Panama, Nicaragua and Guatemala for fevers and malaria (Joly *et al.*, 1987; Pöll, 1993; Barrett, 1994; Comerford,

1996; Passreiter and Medinilla Aldana, 1998). The leaves contain thymol and flavonoids (derivatives of quercetagenin, kaempferol and luteolin) (Joly *et al.*, 1987; Gracioso *et al.*, 1998). The sesquiterpenes had antimalarial activity (Passreiter and Medinilla Aldana, 1998; Muelas-Serrano *et al.*, 2000). *Neurolaena lobata* has antinociceptive and antibacterial effects (Schoiz *et al.*, 1994; Gracioso *et al.*, 1998).

The use of *Paspalum conjugatum* for fatigue and respiratory conditions has been reported by Wong (1976). *Paspalum conjugatum* is used as an antiinflammatory in Amazonian Peru and for coughs in Mexico and is reported to contain cyanogenetic glycosides (Ayala Flores, 1984; Russo, 1992; Zamora-Martínez and Nieto de Pascual Pola, 1992).

Peperomia rotundifolia is used by the Yanomami in Brazil and by the Cabecar and Guaymi in Central America for coughs, asthma and abdominal pain (Hazlett, 1986; Milliken and Albert, 1996). *Peperomia rotundifolia* was found to be active against *Staphylococcus aureus* (Verpoorte *et al.*, 1982). *Peperomia pellucida* root decoction or leaf tea is used as a febrifuge in Bolivia and Jamaica (Muñoz *et al.*, 2000b; Michie, 1992). *Peperomia pellucida* shows antimalarial and analgesic activity (Muñoz *et al.*, 2000b; Aziba *et al.*, 2001). The plant contains isomers (apiole, dill apiole), sesquiterpenes (caryophyllene), betacarotene, minerals and some vitamins (niacin, riboflavin, ascorbic acid, thiamin) (da Silva *et al.*, 1999; Duke, 2000).

Persea americana leaves were used for colds and pains in Jamaica and Belize (Asprey and Thornton, 1953-1955; Arnason *et al.*, 1980). *Persea americana* leaf infusion had a spasmogenic activity on the ileum of hogs and the uterus of rats, as well as hypotensive and depressant activities on the respiratory system (Feng *et al.*, 1964). *Persea americana* methanol and aqueous leaf extracts produced alkaloids, triterpene glycosides, coumarins, saponins, flavonoids and catechol tannins (Adeboye *et al.*, 1999).

Petiveria alliacea leaves are boiled in water, and used in baths for high temperatures or drunk for stomach aches or colds in Guatemala, Nicaragua and Perú (Barrett, 1994; Comerford, 1996; Desmarchelier *et al.*, 1996). The root and stem powders are used for sinusitis.

Pimenta racemosa var. *racemosa* leaf is used to counteract chills in the Caribbean (Honychurch, 1986).

Piper hispidum is used in remedies for colds and stomach aches in Jamaica (Burke and Nair, 1986), and for aches and pains, fever and digestive problems in Eastern Nicaragua (Coe and Anderson, 1998). Compounds isolated from *Piper* species include dillapiol, aseboagenin (a chalcone derivative with antiplasmodial activity), a pipartine dimer, prenylated hydroxybenzoic acid derivatives and an imide (Maxwell and Rampersad, 1991; Seeram *et al.*, 1996a; Seeram *et al.*, 1996b; Jenett-Siems *et al.*, 1999).

Pityrogramma calomelanos is used for respiratory conditions in Nicaragua and this ethnomedicinal use in Trinidad has been previously recorded (Wong, 1976; Duke, 2000). The methanolic extract of the fronds of *Pityrogramma calomelanos* contained cytotoxic and antibacterial properties attributed to a dihydrochalcone (Lynch-Brathwaite *et al.*, 1975; Bardouille *et al.*, 1978; Sukumaran and Kuttan, 1991).

Pluchea odorata is used in Caracas, Mexico and Guatemala for colds and fever. *Pluchea* species are used for bronchitis and a variety of diseases in India (Morton, 1975; Sen and Nag Chaudhuri, 1989; Girón *et al.*, 1991; Zamora-Martínez and Nieto de Pascual Pola, 1992; Pöll, 1993; Comerford, 1996). *Pluchea carolinensis* contains alkaloids, alpha-amyrin, flavonoids, steroids, tannins and terpenoids in the leaves and plant (Duke, 2000). The shoot contains beta-amyrin-acetate, chlorogenic acid, taraxasteryl-acetate and thymohydroquinone-dimethyl ether (Duke, 2000). *Pluchea lanceolata* has antiinflammatory activities attributed to a sterol and triterpenes (Scholz *et al.*, 1994).

Pogostemon heyneanus is used in India for coughs and rheumatism (Duke, 2000). The use of *Pogostemon cablin* in Trinidad for colds and pneumonia was previously recorded by Wong (1976). *Pogostemon heyneanus* contains benzaldehyde, cinnamaldehyde and eugenol (Deshpande *et al.*, 1974). The following compounds were found in *Pogostemon cablin* : flavonoids, sesquiterpenes and daucosterol (Francis, 1972; Munck and Croteau, 1990; Guan *et al.*, 1994; Park *et al.*, 1998; Miyazawa *et al.*, 2000). Yang *et al.* (1999) found antiemetic effects from the n-hexane extract of *Pogostemon cablin*. Patchouli alcohol, pogostol, retusin, and pachypodol were tested and exhibited antiemetic effects (Yang *et al.*, 1999).

Rosmarinus officinalis is used for colds and as an antiinflammatory and antirheumatic in Spain and Italy (Vázquez *et al.*, 1997; Uncini Manganelli and Tomei, 1999; Blanco *et al.*, 1999; Bonet *et al.*, 1999; Pieroni, 2000). An infusion of the floral top is used as an antitarrhal and antihypertensive in Catalonia (Bonet *et al.*, 1999). The volatile oil extracted from the leaves of *Rosmarinus officinalis* has hyperglycaemic and insulin release inhibitory effects in the rabbit (al-Hader *et al.*, 1994).

Sambucus species leaf, berry and flower decoctions are used for coughs, colds, fevers, asthma and infections in Venezuela, Jamaica, Mexico, Guatemala, Jordan, Italy, Catalonia and the Spanish Mediterranean (Asprey and Thornton, 1953-1955; Morton, 1975; Latorre and Latorre, 1977; Ríos *et al.*, 1987; Cáceres *et al.*, 1993; Raja *et al.*, 1997; Bonet *et al.*, 1992, 1999; Affi and Abu-Irmaileh, 2000; Pieroni, 2000). Pharmacological studies have reported that flower extracts can modify the contractility of aortic, ileum and uterine tissues but not tracheal tissue (Cáceres *et al.*, 1993).

Tagetes species are used in Guatemala, Nicaragua and Bolivia for fever, aches, inflammation and nausea (Girón *et al.*, 1991; Cáceres *et al.*, 1993b; Barrett, 1994; Muñoz *et al.*, 2000a). *In vitro* screening showed activity against five enterobacteria (Cáceres *et al.*, 1993b).

Urena lobata was used for colds and coughs in Jamaica and Dominica (Asprey and Thornton, 1953-1955; Hodge and Taylor, 1957). The use of *Urena sinuata* in Trinidad for respiratory conditions has been previously recorded by Wong (1976). *Urena sinuata* is called Cadillo de Perro in Venezuela since its deeply lobed leaf suggests a dog's paw (Morton, 1975).

Vetiveria zizanioides (syn. *Andropogon muricatus*) root decoction is used in Pakistan, Mauritius and Rodrigues against asthma, flu and pleurisy (Gurib-Fakim *et al.*, 1993; Shinwari and Khan, 2000). *Vetiveria zizanioides* contains epizizanal and benzoic acid (Duke, 2000).

Wedelia trilobata is used in Jamaica, Trinidad and Nicaragua for fever and colds (Asprey and Thornton, 1953-1955; Wong, 1976; Barrett, 1994). Several species of *Wedelia* are used in many countries to treat a variety of diseases such as fevers, infections and respiratory pathologies (Block *et al.*, 1998b). Taddei and Rosas-Romero (1999) found that the hexane extract showed antibacterial activity against *Bacillus subtilis*, *Mycobacterium smegmatis*, *Staphylococcus* species (Gram-positive bacteria); along with *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Salmonella* group C, *Salmonella paratyphi*, and *Shigella sonnei* (Gram-negative bacteria). The ethyl acetate extract was active only against *Salmonella* group C; and the aqueous extract was inactive against all tested bacteria. No activity was found against yeasts (*Candida* species *Rhodotorula rubra*) or fungi (*Aspergillus* species, *Mucor* species and *Trichophyton rubrum*). *Wedelia calendulacea* is believed to have antihepatotoxic activity and contains the coumestans wedelolactone and demethylwedelolactone (Wagner *et al.*, 1986).

Plants used for urinary problems

Table 17b. Ethnomedicinal plants used for urinary problems

Scientific name	Family	Common name	Plant part used	Use
<i>Apium graveolens</i>	Apiaceae	Celery		Kidney tonic
<i>Bauhinia cumanaensis</i> <i>/ excisa</i>	Fabaceae	Monkey step	Bark	Gall stones
<i>Begonia humilis</i>	Begoniaceae	Lozeille		Cooling
<i>Bontia daphnoides</i>	Myoporaceae	Olive bush	Leaves	Cooling
<i>Capraria biflora</i>	Scrophulariaceae	Du thé pays	Leaves	Gall stones, cooling
<i>Cassia alata</i>	Fabaceae	Senna	Leaves	Cooling with cloves and ginger
<i>Chamaesyce hirta</i>	Euphorbiaceae	Malomay, Mal nommée		Kidney problems
<i>Cissus verticillata</i>	Vitaceae	Blister bush	Vine	Cooling
<i>Cocos nucifera</i>	Arecaceae	Coconut	Root	Bladder stones
<i>Coleus aromaticus</i>	Lamiaceae	Spanish thyme	Leaves	Cooling
<i>Commelina elegans</i>	Commelinaceae	Water grass	Plant	Cooling
<i>Costus scaber</i>	Zingiberaceae	Wild cane		Clean bladder
<i>Cuscuta americana</i>	Convolvulaceae	Love vine	Vine	Cooling
<i>Cynodon dactylon</i>	Poaceae	Dube		Stoppage of water
<i>Cyperus rotundus</i>	Cyperaceae	Nut grass		Cooling
<i>Desmodium canum</i>	Fabaceae	Sweet heart bush	Plant	Cooling
<i>Eleusine indica</i> (tentative id)	Poaceae	Dead man's grass	Root Leaves	Urinary

Table 17b. Ethnomedicinal plants used for urinary problems (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Entada polystachya</i>	Fabaceae	Mayoc chapelle		Cooling
<i>Flemingia strobilifera</i>	Fabaceae	Kidney bush		Kidney problems
<i>Gomphrena globosa</i>	Amaranthaceae	Bachelor button	Leaves	Urinary problems
<i>Hibiscus sabdariffa</i>	Malvaceae	Sorrel	Flower & seed	Cleans liver and blood
<i>Justicia pectoralis</i>	Acanthaceae	Carpenter grass	Leaves	Cooling
<i>K. pinnata</i>	Crassulaceae	Wonder of the world	Leaves	Cooling, Bladder stones
<i>Lepianthes peltata</i>	Piperaceae	Lani bois	Leaves	Tea
<i>Mimosa pudica</i>	Fabaceae	Ti marie, mese marie		Cooling, Kidney problems
<i>M. charantia</i>	Cucurbitaceae	Caraaili	Vine	Cooling
<i>Musa species</i>	Musaceae	Banana	Dry leaf	Boil for cooling
<i>N.cochinellifera</i>	Cactaceae	Rachette	Joint	Kidney stones
<i>Peperomia rotundifolia</i>	Piperaceae	Giron fleur, mowon		Kidney problems
<i>Peperomia pellucida</i>	Piperaceae	Shining bush		Cooling
<i>Pilea microphylla</i>	Urticaceae	Du thé bethelmay	Leaves	Bladder cleanser
<i>Pityrogramma calomelanos</i>	Pteridaceae	Fern		Urinary problems
<i>Portulaca oleraceae</i>	Portulacaceae	Pussley	Plant	Cholesterol, short breath
<i>Ruellia tuberosa</i>	Acanthaceae	Minny root	Root	Cooling
<i>Sansevieria guineensis</i>	Agavaceae	Langue bouef, lash	Leaves	Cooling
<i>Scoparia dulcis</i>	Scrophulariaceae	Sweet broom	Plant	Cooling for babies
<i>Solanum americanum</i>	Solanaceae	Agouma, gouma	Plant	Cooling, provides iron
<i>Solanum melongena</i>	Solanaceae	Melongene	Fruit	Cholesterol
<i>S. jamaicensis</i>	Verbenaceae	Vervine	Leaves	Cooling
<i>Theobroma cacao</i>	Sterculiaceae	Cocoa	Core	Eat for urinary problems
<i>Vetiveria zizanioides</i>	Poaceae	Vetivert		Urinary problems
<i>Zea mays</i>	Poaceae	Corn silk	Stigma	Diuretic

Non-experimental validation of plants used for urinary problems

Apium graveolens contains flavonoids and a furanocoumarin (bergaptene) (Lewis, 1989). It possesses antinociceptive and antiinflammatory effects. The latter may be due to the presence of volatile oils, flavonoids and resins (Atta and Alkofahi, 1998). The use of the plant extract for inflammation, pain and spasmodic colic is explained by these results.

Stems of *Bauhinia* species are ground, boiled in water and drunk to treat diarrhoea, dysentery or kidney disorders in Costa Rica, Brazil, French Guyana and Mexico (Jiu, 1966; Hazlett, 1986; Milliken and Albert, 1996).

Begonia species are used for dysentery, renal disorders and women's problems in Colombia and western Panama; for stomach aches, vomiting and diarrhoea by the Chocó Indians and by the Cabecar and Guaymi in Central America (Davis and Yost, 1983; Hazlett, 1986; Joly *et al.*, 1990; Laferriere, 1994). Anthocyanins have been found in flowers of *Begonia* species (Chirol and Jay, 1995).

The ethnomedicinal use of *Bontia daphnoides* for hypertension and nephritis in Trinidad has been previously recorded (Wong, 1976). *Bontia daphnoides* contains (-)-epingaione, a sesquiterpene furan (Chinnock *et al.*, 1987).

Capraria biflora has been used ethnomedicinally as a diuretic, and for intestinal problems, hypertension and gonorrhoea (Comerford, 1996; Duke, 2000). The aerial parts of *Capraria biflora* contain sesquiterpenoids, caprariolides A-D (Collins *et al.*, 2000). *Capraria biflora* is used in northern Venezuela, Cuba and Mexico for diarrhoea and to stop vomiting (Morton, 1968b, 1975).

Cassia alata tea is used for hypertension in Marie Galante (Honychurch, 1986).

Chamaesyce hirta is locally used in Africa, Australia, Mauritius, Rodrigues and Bolivia to treat numerous diseases, including hypertension, dysentery and oedema (Gurib-Fakim *et al.*, 1993; Bourdy *et al.*, 2000). The active component(s) in the water extract of *Chamaesyce hirta* leaf had a similar diuretic spectrum to that of acetazolamide a standard diuretic drug. These results validate the traditional use of *Chamaesyce hirta* by the Swahilis and Sukumas as a diuretic agent (Johnson *et al.*, 1999). Tona *et al.* (1999) found that the lyophilised aqueous extract of *Chamaesyce hirta* produced sedative properties at high doses (100 mg of dried plant/kg) and no toxic effects. These findings validate the traditional use of *Chamaesyce hirta* as a sedative with anxiolytic properties (Lanhers *et al.*, 1990, 1991).

Cissus sicyoides is used in Latin America for gonorrhoea, hypertension and inflammation (van den Berg, 1984; Garcia *et al.*, 1999b). *Cissus rubiginosa* is used as an antidiarrhoeal agent in Congolese folk medicine and has antibacterial activity (Longanga Otshudi *et al.*, 2000). *Cissus sicyoides* stems contain phenolic compounds. These latter compounds may be responsible for its activity against Gram-positive and Gram-negative microorganisms (Garcia *et al.*, 1999b).

Cocos nucifera root is used in India as a diuretic (Kapoor, 1990).

The use of *Coleus aromaticus* for stomach problems in Trinidad has been documented in Wong (1976).

The use of *Commelina elegans* in Trinidad for cystitis was documented by Wong (1976). *Commelina* species are used against diarrhoea, and as laxatives (Russo, 1992; Muñoz *et al.*, 2000b). *Commelina diffusa* contains anthocyanins (Cambie, 1997). *Commelina communis* contains n-hentriacontanol (Muñoz *et al.*, 2000b). *Cuscuta reflexa* is used in Uttar Pradesh India for jaundice (Singh and Maheshwari, 1994). *Cuscuta americana* showed activity against *Staphylococcus aureus* (Verpoorte and Dihal, 1987). The hydroalcoholic extract of *Cuscuta americana* showed hepatotoxicity (Joyeux *et al.*, 1995).

Cynodon dactylon is used in West Bengal, Turkey, Pakistan, Mauritius and Rodrigues as a diuretic, for dropsy, gonorrhea and dysentery (Gurib-Fakim *et al.*, 1993; Mukhopadhyay *et al.*, 1995; Shinwari and Khan, 2000; Yeşilada *et al.*, 1999).

Cyperus rotundus is used as an analgesic in traditional Chinese medicine (Jeong *et al.*, 2000). In Mauritius and Rodrigues. *Cyperus rotundus* decoction is used against dysentery and diarrhoea (Gurib-Fakim *et al.*, 1993). *Cyperus scariosus* root comprised one part of a polyherbal ayurvedic preparation that provided partial protection to rats with cisplatin-induced renal toxicity (Rao and Rao, 1998). The rhizome contains sesquiterpenes and monoterpene and aliphatic alcohols and shows antipyretic activity (Kapoor, 1990; Weenen *et al.*, 1990; Vedavathy and Rao, 1991; Thebtaranonth *et al.*, 1995; SunKee *et al.*, 2000).

Wong (1976) has documented the use of *Desmodium adscendens* and *Desmodium canum* in Trinidad as a depurative, and for oliguria, kidney disease and venereal disease. These uses are also current in Colombia, Mexico, Nicaragua and in Barbados where the ethnomedicinal use existed pre-1834 (Zamora-Martínez and Nieto de Pascual Pola, 1992; Handler and Jacoby, 1993; Barrett, 1994; Laferriere, 1994). *Desmodium adscendens* root decoction is used in Mauritius and Rodrigues as a bitter tonic and diuretic and is used for liver disorders in the Brazilian Amazon (Brandão *et al.*, 1992; Gurib-Fakim *et al.*, 1993). *Desmodium styracifolium* was used as one component in a twelve-herb mixture used to successfully treat bovine urolithiasis (Sugimoto *et al.*, 1992). The ethanol extract of *Desmodium canum* roots contains antimicrobially active prenylated isoflavanones (desmodianones) (Monache *et al.*, 1996).

Eleusine indica was used as a 'blood cleanser' by the Caribs (Honychurch, 1986).

The use of *Entada polystachya* in Trinidad for venereal diseases and as a depurative has been recorded by Wong (1976). *Entada* species leaf decoctions are used in the Dutch East Indies, in Mauritius and Rodrigues and in Mali for bloody diarrhoea and abdominal cramps (Hirschhorn, 1983; Gurib-Fakim *et al.*, 1993; Occhiuto *et al.*, 1999). Extracts of *Entada abyssinica* (stem bark), showed activity against various *Candida* species (Fabry *et al.*, 1996). *Entada africana* exhibited antimicrobial activity against *Vibrio cholerae* (Akinsinde and Olukoya, 1995).

Flemingia strobilifera is used in India for dysentery and as a sedative (Nigam and Saxena, 1975; Duke, 2000). Roy and Tandon (1996) found antifiuke activity in *Flemingia vestita*. Tandon *et al.* (1997) found *in vitro* vermifugal activity in *Flemingia vestita* probably caused by the isoflavone genistein.

Gomphrena globosa (white and rose coloured plants) are used for urinary problems in Trinidad and are used for dysentery in Venezuela (Morton, 1975).

Hibiscus sabdariffa has been used ethnomedicinally as a cholagogue, cholaretic, diuretic, tea, tonic and laxative (Duke, 2000).

Justicia pectoralis contains coumarins(dihydrocoumarin and umbelliferone), betaine and 3-(2-hydroxyphenyl) propionic acid (de Vries *et al.*, 1988). Coumarin and umbelliferone are major constituents of the plant and have the ability to relax smooth muscle (MacRae and Towers, 1984).

Kalanchoe pinnata leaf infusion is used in Bolivia and Guatemala to treat inflammation and pain in the stomach (Girón *et al.*, 1991; Muñoz *et al.*, 2000a).

Mimosa pudica exhibited antimicrobial activity against *Vibrio cholerae* (Akinsinde and Olukoya, 1995). It was not found to be effective in either preventing stone deposition or dissolving preformed stones (experimental urolithiasis in rats) (Joyamma *et al.*, 1990). *Mimosa pudica* leaf infusion is used for diarrhoea (Hirschhorn, 1981; Barrett, 1994). *Mimosa pudica* leaves contain ascorbic acid, crocetin, mimosine, norepinephrine beta-carotene, minerals, crocetin-dimethyl-ether and thiamin (Duke, 2000).

'Bark' and 'trash' of *Musa sapientum* were used for 'stoppage of water' and 'sourness of stomach', 'bad belly' and diarrhoea in Jamaica and Nicaragua (Asprey and Thornton, 1953-1955; Barrett, 1994). The use for urinary problems finds parallels in Mayan traditional medical practice (Asprey and Thornton, 1953-1955).

Nopalea cochinellifera decoction is used for inflammation, as a laxative and for urinary problems in Mexico and the Caribbean (Sheridan, 1991; Honychurch, 1986; Duke, 2000).

Peperomia pellucida is used in Nicaragua for kidney problems and cooling (Barrett, 1994). The methanol extract of *Peperomia pellucida* aerial parts showed significant analgesic activity (Aziba *et al.*, 2001). *Peperomia pellucida* ethyl-acetate soluble extracts were active against Gram-positive and Gram-negative bacteria (Bojo *et al.*, 1997). *Peperomia pellucida* lowers uric acid in the blood and was endorsed by the Department of Health in the Philippines (de Guzman, 1998). *Peperomia pellucida* showed selective antifungal activity but failed to show any antiviral or cytotoxic activity (Ali *et al.*, 1996; Mohammed *et al.*, 1996).

Pilea microphylla is used as a diuretic in Brazil and is used for urinary problems in Guatemala (Comerford, 1996; Duke, 2000). *Pilea microphylla* was found active against *Staphylococcus aureus* (Facey *et al.*, 1999). *Pilea imparifolia* stem decoction is drunk for diarrhoea in western Panama (Joly *et al.*, 1987).

Pityrogramma calomelanos methanolic extract has cytotoxic properties (Sukumaran and Kuttan, 1991).

Portulaca oleracea and *Portulaca* species are used in Arabian countries, Almería, Spain, Peru, Madeira, Jordan, India, Pakistan, Nicaragua and Nepal as a diuretic, laxative, for blood purification, for reducing ulcers, for liver problems, tumours and inflammation (Barrett, 1994; Rivera and Obón, 1995; Martínez Lirola *et al.*, 1996; Chan *et al.*, 2000; Joshi and Joshi, 2000; Afifi and Abu-Irmaileh, 2000; Ahmad and Beg, 2001). Ethanolic extracts have analgesic and antiinflammatory activities comparable to the synthetic drug sodium diclofenac (Chan *et al.*, 2000). Previous studies have investigated muscle relaxant activity, effect on

blood pressure, neuropharmacology and anticonvulsant activity (Chan *et al.*, 2000). The muscle relaxant properties of *Portulaca oleracea* are associated with high concentrations of potassium ions (Habtemariam *et al.*, 1993). The diterpenoid (pilosanone C) is found in *Portulaca pilosa* (Ohsaki *et al.*, 1995).

Ruellia species are used traditionally for sexually transmitted diseases. In Barbados *Ruellia tuberosa* is used for intestinal inflammation, blood disorders, cystitis and enteritis (Ahmad *et al.*, 1993; Handler and Jacoby, 1993). *Ruellia patula* yielded two lignan glycosides (Ahmad *et al.*, 1993).

Sansevieria guineensis originates in South Africa (Comerford, 1996; Franssen *et al.*, 1997). The methanol extract of the whole plant of *Sansevieria trifasciata* yielded 12 steroidal saponins and four pregnane glycosides (Mimaki *et al.*, 1996, 1997).

Scoparia dulcis was used in Barbados as a diuretic prior to 1834 (Handler and Jacoby, 1993). Freire *et al.* (1991) reported analgesic and antiinflammatory activity from water and ethanolic extracts of *Scoparia dulcis* related to the triterpene glutinol. The diterpene acid, scoparic acid A is a beta-glucuronidase inhibitor (Hayashi *et al.*, 1992). Antiviral diterpenoids and triterpenoids have been found in *Scoparia dulcis* (Mahato *et al.*, 1981; Morton, 1981; Asano *et al.*, 1990; Hayashi *et al.*, 1988, 1990; Heinrich *et al.*, 1992; Lachman-White *et al.*, 1992).

An infusion of the powdered or macerated *Solanum melongena* (eggplant) fruit is used to reduce serum cholesterol in Almería, Spain and Brazil (Martínez Lirola *et al.*, 1996; Guimaraes *et al.*, 2000). Flavonoids extracted from its fruits showed potent antioxidant activity and significant hypolipidemic action in normal and cholesterol fed rats. A significant increase in the concentrations of hepatic and faecal bile acids and faecal neutral sterols was also observed indicating a higher rate of degradation of cholesterol (Sudheesh *et al.*, 1997, 1999). *Solanum melongena* infusion reduced the blood levels of total and LDL cholesterol and of apolipoprotein B in humans. This effect was modest and transitory (Guimaraes *et al.*, 2000). *Solanum melongena* peels contain an anthocyanin (nasunin) which is a potent O₂[•]-scavenger and iron chelator that can protect against lipid peroxidation (Noda *et al.*, 1998). A lipoxygenase was also found in eggplant fruits (Nakayama *et al.*, 1995). *Solanum surrattense* was included in a twelve-herb mixture used to effectively treat bovine urolithiasis (Sugimoto *et al.*, 1992). *Solanum americanum* leaf extracts were active against *Microsporium gypseum* and *Cryptococcus neoformans* and showed intraperitoneal subacute toxicity in mice (Cáceres *et al.*, 1998; Muñoz *et al.*, 2000a).

The analgesic effect of *Stachytarpheta jamaicensis* was evaluated in rats and showed a lesser effect than morphine (Robineau, 1991).

Theobroma cacao whole plant contains epicatechin, gentistic acid (2,5-dihydroxybenzoic acid) and leucocyanidins (Hegnauer, 1973; Ortiz de Montellano, 1975). The leaves of *Theobroma cacao* contain chlorogenic acid, the flavonoid rutin, and glycosides of cyanidin (Hegnauer, 1973). Seeds of *Theobroma cacao* contain caffeine (0.3%) and theobromine (1.5%) and p-hydroxybenzoic acid, syringic acid, vanillic acid and ferulic acid (Hegnauer, 1973). Theobromine is a diuretic, stimulant and smooth muscle dilator (Ortiz de Montellano, 1975).

Vetiveria zizanioides is used by the Caribs in Guatemala for urinary infections (Girón *et al.*, 1991).

Zea mays corn silk or stigma/style has been included in the British Pharmaceutical Codex (1934) and the British Herbal Pharmacopoeia (1983, 1990). These monographs have listed the traditional uses of corn silk for cystitis, urethritis, nocturnal enuresis, prostatitis and for acute or chronic inflammation of the urinary system (Habtemariam, 1998). Studies have shown *in vivo* diuretic and hypotensive activity (Habtemariam, 1998). Corn silk contains amines, fixed oils, saponins, tannins, bitter glycosides, allantoin, cryptoxanthin, flavone and phytosterols including beta-sitosterol and stigmasterol. The last two compounds are known to have antiinflammatory activity *in vivo* and may have a beneficial effect in treating prostate problems (Habtemariam, 1998).

Plants used for skin problems

Table 17c. Ethnomedicinal plants used for skin problems

Scientific name	Family	Common name	Plant part used	Use
<i>Achyranthes indica</i>	Amaranthaceae	Man better man		Skin problems
<i>Acnistus arborescens</i>	Solanaceae	Wild tobacco	Leaves	Bathe babies for eczemas
<i>Azadirachta indica</i>	Meliaceae	Neem	Leaves	Measles
<i>Bidens alba</i> / <i>Bidens pilosa</i>	Asteraceae	Needle grass/ Railway daisy	Leafy branch	Bathe children
<i>Cassia alata</i>	Fabaceae-Caesalpiniaceae	Senna	Leaves	Skin problems
<i>Chamaesyce hirta</i> / <i>hypericifolia</i>	Euphorbiaceae	Malomay	Flower	Skin rashes, measles
<i>Croton gossypifolius</i>	Euphorbiaceae	Blood bush/ Bois sang	Leaves	Bathe babies for eczemas
<i>Eclipta prostrata</i>	Asteraceae	Congolala		Bathe for children's malnutrition for 9 days & woodlice nest
<i>Manihot esculenta</i>	Euphorbiaceae	Cassava	Leaves	Bathe babies for eczemas
<i>Origanum vulgare?</i>	Lamiaceae	Majoram		Bathe babies
<i>Sida carpinifolia</i> (syn. <i>Sida acuta</i>)	Malvaceae	Garaba broom	Leaf	Eczemas
<i>Solanum americanum</i>	Solanaceae	Agouma, gouma	Plant	Bathe for children's malnutrition
<i>Spondias mombin</i>	Anacardiaceae	Hogplum	Leaves	Eczemas

Non-experimental validation of plants used for skin problems

Achyranthes aspera leaf paste is applied on cuts, boils and blisters in Uttar Pradesh, India (Singh and Maheshwari, 1994). *Achyranthes bidentata* is a commonly used Chinese medicinal plant and is used in Nepal and in Mauritius and Rodrigues for skin diseases (Gurib-Fakim *et al.*, 1993; Zeng *et al.*, 1994).

Acnistus arborescens in Brazil contains a withanolide (Barata *et al.*, 1970).

Azadirachta indica oil has proved useful for wound healing (Bhargava *et al.*, 1989). Charles and Charles (1992) found that a paste made of *Azadirachta indica* and *Curcuma longa* used to treat 814 people with scabies cured 97% of them within three to five days of treatment.

Bidens pilosa is used as a bath for children (malaise or susto) for high temperatures and is applied externally to cure wounds in Guatemala, Madeira and Porto Santo Islands (Rivera and Obón, 1995; Tan *et al.*, 2000). Infusions of *Bidens aurea* are used in northwest Spain as sedatives (Blanco *et al.*, 1999). Geissberger and Sequin (1991) found that extracts of dried aerial parts of *Bidens pilosa* showed some antimicrobial activity. Similar results were found by Sarg *et al.* (1991), Rabe and van Staden (1997) and Alvarez *et al.* (1996) (*Pseudomonas aeruginosa*, *Trycophyton mentagrophytes*, and *Microsporum gypseum*). Components of the extract such as phenylheptatriyne, linolic acid and linolenic acid have antimicrobial activities (Alvarez *et al.*, 1999). The triterpenes as well as several flavonoids (aurones, chalcones) are antiinflammatory agents (Alvarez *et al.*, 1999). The chloroform fractions from the roots of *Bidens aurea* caused 86% inhibition of parasite growth *in vitro*. The constituents of *Bidens pilosa* explain the use of this plant in traditional medicine in the treatment of wounds, against inflammations and against bacterial infections of the gastrointestinal tract (Geissberger and Sequin, 1991). *Bidens pilosa* was screened for prostaglandin-synthesis inhibition and showed a high activity (Jager *et al.*, 1996).

Cassia alata is used for skin problems in the Caribbean, India and the Ivory Coast (West Africa) to treat bacterial infections caused by *Escherichia coli*, and fungal infections caused by *Candida albicans* and dermatophytes (Honychurch, 1986; Murdiati and Manurung, 1991; Crockett *et al.*, 1992). *Cassia alata* has antifungal activity that may be attributed to chrysophanol (Palanichamy and Nagarajan, 1990). When *Cassia alata* extracts were evaluated relative to a standard antibacterial agent chloramphenicol and antifungal agent amphotericin B and found to have therapeutic potential for the treatment of opportunistic infections of AIDS patients (Crockett *et al.*, 1992). A 10-year human study indicated that a *Cassia alata* leaf extract can be reliably used as a herbal medicine to treat *Pityriasis versicolor*. The leaf extract contains anthraquinones, flavonoids, quinones and sterols and had no side-effects (Damodaran and Venkataraman, 1994). An ethanolic extract of *Cassia alata* leaves showed high *in vitro* activity against various species of dermatophytic fungi, but low activity against non-dermatophytic fungi (Ibrahim and Osman, 1995). Bacterial and yeast species showed resistance against *in vitro* treatment with the extract.

Chamaesyce hirta is used in West Bengal for ringworm (Mukhopadhyay *et al.*, 1995). Antibacterial effects of *Chamaesyce hirta* leaves were found by several investigators (Emele *et al.*, 1998; Vijaya *et al.*, 1995). An aqueous extract of *Chamaesyce hirta*, strongly reduced the release of prostaglandins I₂, E₂, and D₂. Additionally *Chamaesyce hirta* extracts exerted an inhibitory effect on platelet aggregation and depressed the formation of carrageenin-induced rat paw oedema.

Barks of *Croton* species produce a red viscous latex which is used in South America for wound healing and is used by the Zapotecs of Oaxaca, Mexico for dermatological conditions (Frei *et al.*, 1998; Pieters *et al.*, 1993). *Croton lechleri* tree sap contains an alkaloid (taspine) which was responsible for cicatrizant activity in mice (Fernández *et al.*, 1997). In Belize *Croton schiedeana* is used as a bath tonic (Arnason *et al.*, 1980). *Croton guatemalensis* was active against *Candida albicans* (Cáceres *et al.*, 1991b). A biologically active lignan did not stimulate the cell proliferation needed for wound healing but inhibited thymidine incorporation, while protecting cells against degradation in a starvation medium (Pieters *et al.*, 1993). The sap was not cytotoxic but contained simple phenolic compounds and diterpenes which showed potent antibacterial activity (Chen *et al.*, 1994).

Eclipta prostrata contains steroidal alkaloids, resin, sulphur-containing peptides, coumestans, flavonoids, polyacetylenes, antiviral ingredients and tannins (Abdel-Kader *et al.*, 1998; Hudson, 1990; Kapoor, 1990; Melo *et al.*, 1994; Saxena *et al.*, 1993). The hydroalcoholic extract of *Eclipta prostrata* plant showed antinociceptive and antiinflammatory effects (Leal *et al.*, 2000).

The use of *Manihot esculenta* in Trinidad for boils, marasmus and sores has been previously recorded (Wong, 1976).

Sida acuta is used in Oaxaca, Mexico for dermatological conditions (Zamora-Martínez and Nieto de Pascual Pola, 1992; Frei *et al.*, 1998). *Sida rhombifolia* leaf paste is used in Uttar Pradesh India and in Madeira for cuts, open sores and boils (Singh and Maheshwari, 1994; Rivera and Obón, 1995). In previous studies alcoholic leaf extracts of *Sida cordifolia* and *Sida rhombifolia* showed antibacterial and antifungal activity in contrast *Sida acuta* did not show activity in this 1999 study or in previous ones (Oliver Bever, 1986; Perumal Samy *et al.*, 1999). Phytochemical analysis of the leaves of *Sida cordifolia* showed the presence of sympathomimetic amines, ephedrine and pseudoephedrine (a potent vasoconstrictor), and alkaloids (vasocinone and vasicine) (Franzotti *et al.*, 2000). *Sida cordifolia* aqueous extract exerts antiinflammatory and analgesic properties by interfering with the cyclooxygenase pathway (Franzotti *et al.*, 2000). *Sida rhombifolia* contains ascorbic, malvalic and sterculic acids, vasicine, choline, betaine, ephedrine, campesterol, minerals, vitamins and saponin (Dunstan *et al.*, 1997; Duke, 2000).

Solanum americanum is used in refreshing baths in the Caribbean and is used in Latin America against dermatomucosal infections, leucorrhoea and vaginitis (Honychurch, 1986; Cáceres *et al.*, 1998). *Solanum torvum* is used by the Zapotecs of Oaxaca, Mexico for dermatological conditions (Frei *et al.*, 1998). *Solanum nigrescens* extracts were active against *Candida albicans* and dermatophytes. The anti-yeast activity is attributed to spirostanol glucosides (Cáceres *et al.*, 1998; Muñoz *et al.*, 2000a). *Solanum surattense* showed antipyretic activity comparable to aspirin (Vedavathy and Rao, 1991).

Spondias mombin leaf poultice is used to bathe sores by the Caribs (Honychurch, 1986).

Plants used for reproductive problems

Table 17d. Ethnomedicinal plants used for reproductive problems

Scientific name	Family	Common name	Plant part used	Use
<i>Abelmoschus moschatus</i>	Malvaceae	Gumbo musque	Leaves, seeds	Female issues, remove placenta
<i>Achyranthes indica</i>	Amaranthaceae	Man/ man		Female issues
<i>Ageratum conyzoides</i>	Asteraceae	Z'herbe femme		Prostate Womens' issues
<i>Ambrosia cumanensis</i>	Asteraceae	Altamis	3-inch leafy branch	Inflammation, abortion, Menstrual pain
<i>Aristolochia rugosa</i> , <i>Aristolochia trilobata</i>	Aristolochiaceae	Mat root, anico	Root	Remove placenta, abortion, menstrual pain
<i>Artemisia absinthium</i>	Asteraceae	Wormwood		Female issues
<i>Brownea latifolia</i>	Fabaceae	Cooper hoop	Flower, leaves	Female issues
<i>Capraria biflora</i>	Scrophulariaceae	Du thé pays	Leaves	Menstrual pain
<i>Catharanthus roseus</i>	Apocynaceae	White Periwinkle		'Man's disease'
<i>Chamaesyce hirta</i>	Euphorbiaceae	Malomay		Infertility
<i>Cocos nucifera</i>	Arecaceae	Coconut	Shell	Abortion
<i>Cola nitida</i>	Sterculiaceae	Obie seed	Seed	Infertility
<i>Coleus aromaticus</i>	Lamiaceae	Spanish thyme	Leaves	Shorten labour
<i>Commelina elegans</i>	Commelinaceae	Water grass	Plant	Douche
<i>Cordia curassavica</i>	Boraginaceae	Black sage	Leaves	Menstrual pain
<i>Croton gossypifolius</i>	Euphorbiaceae	Bois sang	Leaves	Menstrual pain
<i>Cucurbita pepo</i> , <i>Cucurbita maxima</i>	Cucurbitaceae	Pumpkin		Prostate problems
<i>Desmodium canum</i>	Fabaceae	Sweet heart bush	Root	Venereal diseases
<i>Eleutherine bulbosa</i>	Iridaceae	Dragon blood	Bulb	Female issues
<i>Entada polystachya</i>	Fabaceae	Mayoc chapelle	Twigs	Menstrual pain
<i>Eryngium foetidum</i>	Apiaceae	Chadron bënëe	Leaves	Menstrual pain, remove placenta, shorten labour
<i>Eupatorium macrophyllum</i>	Asteraceae	Z'herbe chatte		Womens' issues
<i>Gomphrena globosa</i>	Amaranthaceae	Bachelor button		Prostate problems

Table 17d. Ethnomedicinal plants used for reproductive problems (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Hibiscus rosa-sinensis</i>	Malvaceae	Hibiscus	Flowers	Female issues
<i>Justicia pectoralis</i>	Acanthaceae	Carpenter grass	Leaves	Prostate problems
<i>Justicia secunda</i>	Acanthaceae	St. John's bush		Womens' issues
<i>Laportea aestuans</i>	Urticaceae	Red stinging nettle	Leaves	Shorten labour
<i>Leonotis nepetaefolia</i>	Lamiaceae	Shandileer		Menstrual pain
<i>Mimosa pudica</i>	Fabaceae	Mese marie		Childbirth
<i>Nopalea cochinellifera</i>	Cactaceae	Rachette	Joint	Menopause, hot flashes
<i>Parinari campestris</i>	Chrysobalanaceae	Bois bandé	Bark	Erectile dysfunction
<i>Parthenium hysterophorus</i>	Asteraceae	White head broom		Womens' issues
<i>Pilea microphylla</i>	Urticaceae	Du thé bethelmay	Leaves	Inflammation, womb cleanser
<i>Richeria grandis</i>	Euphorbiaceae	Bois bandé	Bark	Erectile dysfunction (ED)
<i>Ruta graveolens</i> (tentative identification)	Rutaceae	Ruda	Leaves	Childbirth, carminative, menstrual pain, cold in womb
<i>Scoparia dulcis</i>	Scrophulariaceae	Sweet broom	Leaves	Prostate
<i>Urena sinuata</i>	Malvaceae	Patte chien		Man's waist pain
<i>Vetiveria zizanioides</i>	Poaceae	Vetivert	Plant	Shorten labour
<i>Wedelia trilobata</i>	Asteraceae	Venven caribe	Leaves	Womens' issues
<i>Not identified</i>	Not identified	Matapal	Bark	Bark belt for man's waist pain

Non-experimental validation of plants used for reproductive problems

Abelmoschus moschatus plant is used for reproductive purposes in Fiji (Cambie, 1997). *Abelmoschus manihot* is used for menorrhagia in Vanuatu (Bourdy and Walter, 1992).

The use of *Achyranthes indica* for venereal diseases has been previously recorded (Duke, 2000). In Nepal *Achyranthes aspera* is used to facilitate parturition (Bhattarai, 1994). The benzene extract of the stem bark shows abortifacient activity in the rat (Bhattarai, 1994).

Ageratum conyzoides is used for venereal disease in El Salvador (Hirschhorn, 1982). Sampson *et al.* (2000) found that *Ageratum conyzoides* had activity on the mediation of acute pain in the mammalian central nervous system (Sampson *et al.*, 2000). *Ageratum conyzoides* plant extract inhibited uterine contractions induced by 5-hydroxytryptamine suggesting that the extract exhibited specific antiserotonergic activity on isolated uterus plant extract but had no effect on uterine contractions induced by acetylcholine (Achola and Munenge, 1998; Silva *et al.*, 2000). The results gave support to the popular use of the plant as a spasmolytic. Yamamoto *et al.* (1991) found that oral treatment of rodents with *Ageratum conyzoides* neither reduced the inflammatory edema nor did it decrease the reaction to pain stimuli. Chromenes, benzofurans, polyoxygenated flavones, sesquiterpenes (farnesene derivatives) and daucanolide have been isolated from the plant (Ahmed *et al.*, 1999; Vyas and Mulchandani, 1986).

The use of *Ambrosia cumanensis* for women's problems has been previously recorded (Wong, 1976). *Ambrosia cumanensis* contains 11-hydroxyguaian, altamisin, cumambrin-A, cumambrin-B, cumambrin-C and isoguaiane (Duke, 2000).

Aristolochia species are used in Mexico, western Panama and Guatemala as analgesics, for stomach pain, female disorders, menstrual pain and as contraceptives (Joly *et al.*, 1987; Girón *et al.*, 1991; Ankli *et al.*, 1999). Phytochemical analyses of *Aristolochia* species yielded essential oil, alkaloids, lignans, allantoin, nitrophenanthrenes (including aristolochic acid), aristolactams and phenanthrenes (Frei *et al.*, 1998). The latter group is assumed to have antiinflammatory effects.

Artemisia absinthium is used together with other plants as fertility regulators in western Panama and Paraguay (Arenas and Azorero, 1977; Joly *et al.*, 1987). *Artemisia* species are used similarly by the French, Spanish New Mexicans (emmenagogue) and in Madeira and this use is ancient (Conway and Slocumb, 1979; Weniger *et al.*, 1982; Novaretti and Lemordant, 1990; Rivera and Obón, 1995). *Artemisia absinthium* is used by the Caribs in Guatemala for fever, vaginitis and stomach pains (Girón *et al.*, 1991). In Mauritius and Rodrigues, Tuscany and Sardinia, *Artemisia* species leaf infusion or decoction is used for digestive upsets, and as emmenagogues (Gurib-Fakim *et al.*, 1993; Bruni *et al.*, 1997; Pieroni, 2000). Compounds in *Artemisia* species are sesquiterpene lactones, artemisinin, camphor and 1,8-cineole (Lewis, 1989; Allen *et al.*, 1997). *Artemisia absinthium* contains thujone a terpene that can cause excitation, convulsions that mimic epilepsy, and even permanent brain damage (Arnold, 1988).

Chamaesyce prostrata was used in Barbados prior to 1834 for venereal complaints (Handler and Jacoby, 1993). The water extract of the whole plant of *Chamaesyce hyssopifolia* (Euphorbiaceae) and its active compound corilagin were potent inhibitors of HIV-RT (IC₅₀: 6-8 microg/ml) (Matsuse *et al.*, 1999). The plant contains resin, tannin, gallic acid, phorbol esters (co-carcinogenic compounds) and quercetin among others (Chen, 1991; Duke, 2000). *Chamaesyce hirta* aqueous extract exerted central analgesic properties (Lanhers *et al.*, 1991).

Cocos nucifera shell produces a fluid when hot that is used ethnomedicinally in India (Kapoor, 1990).

Cola nitida nuts contain nitrogen-containing compounds, tannin and 2.5% caffeine (Oliver Bever, 1986; Osim and Udia, 1993). *In vitro* crude extracts of kola nuts depress smooth muscle activity (Osim and Udia, 1993).

The use of *Coleus aromaticus* for menorrhagia in Trinidad has been previously recorded (Wong, 1976). *Coleus barbatus* is used to interrupt pregnancy in Brazil and is used as an emmenagogue in other countries (Almeida and Lemonica, 2000). *Coleus barbatus* showed an anti-implantation effect in the preimplantation period in rats, but after embryo implantation the extract had little effect.

Commelina elliptica is used in a bath by the Alteños Indians in Bolivia to reduce high fevers (Muñoz *et al.*, 2000b). *Commelina pallida* is used as a haemostatic and ecboic in Mexico (Jiu, 1966).

Cordia alba was used by the Aztecs as a diuretic (Peña, 1999). *Cordia spinescens* is used in Colombia to relieve postpartum pain (Laferriere, 1994).

Cucurbita pepo is used for prostate disorders and urine intermittence in Palestine (Ali-Shtayeh *et al.*, 2000).

Desmodium gangeticum is used as an antipyretic in India (Oliver Bever, 1986).

Eleutherine bulbosa is used in Columbia for menstrual cramps and in Haiti as an antifertility agent (Weniger *et al.*, 1982; Laferriere, 1994; Fernández *et al.*, 1997). *Eleutherine* species are used in the Malay Peninsula, Bolivia and Peru for vaginal discharge, wounds, dysentery, diarrhoea and anaemia (Ayala Flores, 1984; Fernández *et al.*, 1997; Muñoz *et al.*, 2000a; Duke, 2000). *Eleutherine bulbosa* bulbs contain lipids (n-hentriacontane), triterpene alcohols, sterols, and quinones and the bulb extract showed antifertility and cicatrizant activity and was non toxic (Weniger *et al.*, 1982; Fernández *et al.*, 1997). Eleutherin extracted from the bulb has a weak and transient effect of decreasing the prothrombin time (*in vivo* in rats) and a weak antibacterial activity on *Bacillus subtilis* (*in vitro*) (Bianchi and Ceriotti, 1975).

Eryngium foetidum is used in the Caribbean and South America for the treatment of fevers and antiinflammatory disorders (Robineau, 1991; Muñoz *et al.*, 2000b). *Eryngium foetidum* hexane extract is rich in phytosterols, stigmasterol being the main component- 95% (García *et al.*, 1999a).

Eupatorium species are used in South America as contraceptives, abortives and emmenagogues (Elisabetsky and Posey, 1989). Two species of *Eupatorium* were used in Trinidad for menstrual problems in 1893 (Broadway, 1893). The use of *Eupatorium macrophyllum* for amenorrhoea, dysmenorrhea, prolapse and womb problems in Trinidad has been previously recorded (Wong, 1976).

The glycoside isorhamnetin 3-O-beta-robinobioside was found in *Gomphrena boliviana*. Upon inoculation of various doses of 5,6,7-trisubstituted flavones on two murine tumour lines, Sarcoma 180 and Ehrlich's carcinoma, a decrease of tumour growth was observed. An *in vitro* KB cultured cell screen indicated cytotoxicity (Pomilio *et al.*, 1994).

Hibiscus rosa-sinensis flower decoctions are used in folklore medicine in India and Vanuatu as aphrodisiacs, for menorrhagia, uterine haemorrhage and for fertility control (Bourdy and

Walter, 1992; Kasture *et al.*, 2000). Flower extracts produced an irregular estrous cycle in mice with prolonged oestrus and metoestrus and other indications of antiovaratory effects, androgenicity and estrogenic activity (Murthy *et al.*, 1997; Prakash *et al.*, 1990; Pakrashi *et al.*, 1986; Pal *et al.*, 1985; Reddy *et al.*, 1997). Flowers contain anthraquinone, quercetin, cyanidin and their glucosides and florachrome B (Cambie, 1997; Kasture *et al.*, 2000).

Justicia pectoralis showed antinociceptive, bronchodilator and antiinflammatory effects (Leal *et al.*, 2000). These activities might be due to the coumarin in the plant (Mills *et al.*, 1986).

Mimosa pudica is used in Nicaragua and Mexico for stomach aches, 'cleaning the womb', as a sedative, to stop menstruation and for gonorrhoea (Asprey and Thornton, 1953-1955; Zamora-Martínez and Nieto de Pascual Pola, 1992; Barrett, 1994).

Nopalea cochinellifera is used for pains and inflammations in India (Duke, 2000).

Parinari species are used for venereal diseases in some African countries (Lee *et al.*, 1996). Two ent-kaurene diterpenoids and 15-oxozoapatlin were isolated from the root bark of *Parinari curatellifolia* and fatty acids, flavonoids and their glycosides have been found in *Parinari* species (Lee *et al.*, 1996).

Parthenium hysterophorus is used as a tonic, analgesic, antipyretic, antiperiodic, febrifuge and emmenagogue in Mauritius, Rodrigues, Mexico, Belize and India (Gurib-Fakim *et al.*, 1993; Arnason *et al.*, 1980; Duke, 2000). Analgesic properties have been found in *Parthenium hysterophorus* (Duke, 2000). Vijayalakshmi *et al.* (1999) found depolarizing neuromuscular junctional blocking action of *Parthenium hysterophorus* leaf extracts in the rat. The plant contains pseudoguaianolides, sesquiterpene lactones, flavonoids, and a lignan ((+)-syringaresinol) among others (Sethi *et al.*, 1987; Das *et al.*, 1999; Lomniczi de Upton *et al.*, 1999; Duke, 2000). *Parthenium hysterophorus* has antibacterial activity against *Staphylococcus* species, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella* species and *Serratia* species (Facey *et al.*, 1999; Feresin *et al.*, 2000). *Parthenium hysterophorus* has antiamoebic activity against *Entamoeba histolytica* comparable to the standard drug metronidazole (Sharma and Bhutani, 1988).

Pilea microphylla is used ethnomedicinally in Asia and Tropical America (Hirschhorn, 1983; Duke, 2000). The entire plant is given to women in labour in Jamaica (Duke, 2000). *Pilea microphylla* was active against *Staphylococcus aureus* (Facey *et al.*, 1999).

The use of *Richeria grandis* (syn. *Guarania ramiflora*) as an aphrodisiac has been recorded by Uphof (1968). *Roupala montana* is also used in Trinidad and has been documented as a nervine by Uphof (1968).

Ruta graveolens and closely related species are used as emmenagogues, abortives, antispasmodics, sudorifics and anthelmintics in France, Spain, Brazil, Paraguay, New Mexico, Italy, Madeira and in other cultures and the antifertility uses were documented by Galen and Pliny the Elder (Arenas and Azorero, 1977; Conway and Slocumb, 1979; van den Berg, 1984; Novaretti and Lemordant, 1990; Riddle, 1991; Rivera and Obón, 1995; Martínez-Lirola *et al.*, 1996; Vázquez *et al.*, 1997; Guarrera, 1999; Bonet *et al.*, 1999). *Ruta* species contain different alkaloids and furanocoumarins and may show toxic side effects when used as abortifacients (Morton, 1975; Ankli *et al.*, 1999). *Ruta graveolens* has shown weak activity *in vitro* on excised uterine muscle (Conway and Slocumb, 1979). The

antimicrobial activity of the plant is possibly due to the essential oils or flavonoids (Ojala *et al.*, 2000).

Scoparia dulcis is used in Nicaragua for belly pain and to 'clean the blood, kidney and system' (Barrett, 1994). Antitumour-promoting compounds and antiviral agents were found in *Scoparia dulcis* (Nishino *et al.* 1993; Hayashi *et al.* 1988, 1990). Betulinic acid in the plant has antiinflammatory properties (Duke, 2000).

Urena sinuata plant is used for reproductive purposes in the Pacific, Trinidad, China and India (Wong, 1976; Cambie, 1997). In Mauritius and Rodrigues *Urena lobata* is used against intestinal inflammation and is emmollient (Gurib-Fakim *et al.*, 1993). The plant contains beta-sitosterol, stigmasterol and alkanes (Cambie, 1997).

Vetiveria zizanioides is used in Pakistan as an emmenagogue and stimulant and is used by the Caribs in Guatemala for stomach pains (Girón *et al.*, 1991; Shinwari and Khan, 2000).

The use of *Wedelia trilobata* for amenorrhea in Trinidad has been recorded by Wong (1976). *Wedelia paludosa* and *Wedelia trilobata* contain a diterpene (kaurenoic acid), eudesmanolide lactones and luteolin (in leaves and stems) (Block *et al.*, 1998a&b; Bohlmann *et al.*, 1981). Kaurenoic acid has antibacterial, larvicidal and tripanocidal activity; it is also a potent stimulator of uterine contractions (Block *et al.*, 1998b). Luteolin exerts antitumoural, mutagenic and antioxidant effects, has depressant action on smooth muscles and a stimulant action on isolated guinea pig heart (Block *et al.*, 1998b). Kaurenoic acid and luteolin in *Wedelia paludosa* showed antinociceptive action more potent than the standard analgesic drugs. The root was the most potent part while the flower showed weak activity. Kaurenoic acid was 2 - 4 fold and luteolin was 8 - 16 fold more potent than acetyl salicylic acid, acetaminophen, dipyron and indomethacin (some well-known analgesic drugs) (Block *et al.*, 1998b).

Plants used for high blood pressure, diabetes, ect

Table 17e. Ethnomedicinal plants used for high blood pressure, diabetes, etc.

Scientific name	Family	Common name	Plant part used	Use
<i>Aloe vera</i>	Liliaceae	Aloes	Leaf gel	High blood pressure
<i>Annona muricata</i>	Annonaceae	Soursop	Leaves	Pressure
<i>Antigonon leptopus</i>	Polygonaceae	Coralita	Vine	Diabetes
<i>Apium graveolens</i>	Apiaceae	Celery		Heart tonic, Low blood pressure
<i>Artocarpus altilis</i>	Moraceae	Breadfruit	Leaves	Pressure
<i>Bidens alba</i> / <i>Bidens pilosa</i>	Asteraceae	Needle grass	Leafy branch	Pressure, Diabetes
<i>Bixa orellana</i>	Bixaceae	Roucou	Leaves, root	Pressure, Diabetes, Jaundice

Table 17e. Ethnomedicinal plants used for high blood pressure, diabetes, etc. (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Bontia daphnoides</i>	Myoporaceae	Olive bush	Leaves	Diabetes, Jaundice, Pressure
<i>Carica papaya</i>	Caricaceae	Papaya	Green fruit	Pressure, Diabetes
<i>Catharanthus roseus</i>	Apocynaceae	White Periwinkle		Diabetes
<i>Cecropia peltata</i>	Cecropiaceae	Bois canôt	Leaves	Pressure
<i>Citrus paradisi</i>	Rutaceae	Grapefruit	Peel	Pressure
<i>Cocos nucifera</i>	Arecaceae	Coconut	Shell, flower	Diabetes
<i>Cola nitida</i>	Sterculiaceae	Obie seed	Seed	Pressure
<i>C. cujete</i>	Bignoniaceae	Calabash	Leaves	Pressure
<i>Cuscuta americana</i>	Convolvulaceae	Love vine	Vine	Jaundice
<i>Gomphrena globosa</i>	Amaranthaceae	Bachelor button	Leaves	Jaundice, Diabetes, Pressure
<i>Hibiscus sabdariffa</i>	Malvaceae	Sorrel	Leaf	Pressure
<i>K. pinnata</i>	Crassulaceae	W/ world	Leaf	Pressure
<i>Laportea aestuans</i>	Urticaceae	Red stinging nettle	Leaves	Diabetes
<i>M. charantia</i>	Cucurbitaceae	Caraaili		Diabetes
<i>Morus alba</i>	Moraceae	Pawi bush		Diabetes, Pressure
<i>N. cochinellifera</i>	Cactaceae	Rachette	Joint	Pressure
<i>Ocimum campechianum</i>	Lamiaceae	Ti bom	Leaves	Pressure
<i>Passiflora quadrangularis</i>	Passifloraceae	Barbadine	Leaves	Pressure
<i>Persea americana</i>	Lauraceae	Avocado	Leaf	Pressure
<i>Petiveria alliacea</i>	Phytolaccaceae	Mapourite, kudjuruk		Kidney problems
<i>Phyllanthus urinaria</i>	Euphorbiaceae	Red seed under leaf		Diabetes
<i>Spiranthes acaulis</i>	Orchidaceae	Lapsogen		Early diabetes
<i>Tamarindus indicus</i>	Fabaceae	Tamarind	Seed	Pressure
<i>Tournefortia hirsutissima</i>	Boraginaceae	Chigger bush	Leaves	Cooling

Non-experimental validation of plants used for high blood pressure, diabetes, ect.

Alleyne and Cruickshank (1990) did not find any difference between non-users of informal medication and those who used it in addition to, or in replacement of, formal medication to control diabetes mellitus in Jamaica. However teas made from periwinkle (*Catharantus* species) and rice bitters (*Andrographis paniculata*) interfered with the control of diabetes. In

a previous study, with more severe cases of diabetes, the authors found that formal medication gave better control of the diabetes than folk medicine teas (Alleyne *et al.*, 1979). Guilliford and Mahabir (1997) studied 622 people with diabetes mellitus in Trinidad and Tobago. Herbal remedies for diabetes were used by 152 (24%) of patients. Carailli, aloes, olive bush and seed-under-leaf were the plants most frequently used. Patients who reported burning or numbness in the feet or feelings of tiredness, weakness, giddiness or dizziness used bush medicines more frequently than those who reported other symptoms (Guilliford and Mahabir, 1997). A small percentage of pregnant women treated at the Mount Hope Women's Hospital experienced hypertension (Ali, 1995).

Antigonon leptopus Hook & Arn is in Mexico and Haiti (Zamora-Martínez and Nieto de Pascual Pola, 1992; Duke, 2000). The flowers contain several compounds and the plant contains flavonoids, alkaloids and saponins (Ahmad and Khan, 1991; Facey *et al.*, 1999; Duke, 2000).

Apium graveolens (celery) aqueous extract has an antihyperlipidemic property which was not due to 3-n-butylphthalide (BuPh) (BuPh was previously reported to produce the lipid-lowering action in celery) (Tsi *et al.*, 1995). Apigenin, isolated from *Apium graveolens*, relaxes rat thoracic aorta (Ko *et al.*, 1991). *Apium graveolens* has antiinflammatory activity (Al-Hindawi *et al.*, 1989).

Artocarpus altilis (Parkinson) Fosberg. (syn. *Artocarpus communis*) leaves were used in Jamaica for high blood pressure (Asprey and Thornton, 1953-1955). Leaves are used to treat liver diseases, hypertension, fevers and for their antiinflammatory and detoxifying properties (Lin *et al.*, 1992; Chen *et al.*, 1993). *Artocarpus altilis* contains camphorol, HCN, quercetin (Duke, 2000). Three prenylflavones and three flavonoids were isolated from the ethanol extract of dried stems (Chen *et al.*, 1993). Other constituents are listed by Dunstan *et al.* (1997). A geranylated chalcone was isolated from leaves of *Artocarpus incisus* and it showed potent 5- α -reductase inhibitory activity (Shimiz *et al.*, 2000). An extract of the leaves of *Artocarpus altilis* exerted a negative inotropic effect on rat myocardium (Young *et al.*, 1993).

Bidens pilosa is used in western Cameroon and in Central America for the management of problems related to high blood pressure (Tan *et al.*, 2000). *Bidens pilosa* aqueous leaf extract possesses aortic smooth muscle relaxant activity (Dimo *et al.*, 1998). Several compounds are found in *Bidens* species including alkaloids, saponins, flavonoids (quercetin), polyacetylenes, triterpenes, sterols, flavones and sesquiterpenes (Hoffman and Hölzl, 1987; Hoffman and Hölzl, 1988; Sarg *et al.*, 1991; Alarcon de la Lastra *et al.*, 1994; Zulueta *et al.*, 1995; Alvarez *et al.*, 1996; Chin *et al.*, 1996; Martin Calero *et al.*, 1996; Chippaux *et al.*, 1997; Brandão *et al.*, 1998; Alvarez *et al.*, 1999; Tan *et al.*, 2000). Sarg *et al.* (1991) and Ubillas *et al.* (2000) found that *Bidens pilosa* showed decrease of blood glucose possibly caused by polyacetylenic glucosides.

Bixa orellana is used in Trinidad and in Central America for diabetes, as a diuretic, for oliguria, as a purgative and for stomatitis (Duke, 2000). *Bixa orellana* root decoction is also used for diabetes by the Caribs of Guatemala (Girón *et al.*, 1991).

The ethnomedicinal use of *Bontia daphnoides* for hypertension and nephritis in Trinidad has been previously recorded (Wong, 1976). The use of *Bontia daphnoides* for jaundice may be related to its use for urinary problems as recorded by Wong (1976).

The fruit juice of unripened fruit of *Carica papaya* probably contains antihypertensive agent(s) which exhibit(s) alpha-adrenoceptor activity (Eno *et al.*, 2000).

Catharanthus roseus is used in Mauritius and Rodrigues for diabetes and fever (Gurib-Fakim *et al.*, 1993). Active principles are three alkaloids: leurosine, vindoline and vindolinine which are more potent than tolbutamide as hypoglycaemic agents (Oliver Bever, 1986).

Cecropia species are used for high blood pressure in Barbados and Panama and for diabetes in Mexico (Jiu, 1966; Honychurch, 1986; Caballero-George *et al.*, 2001).

Citrus sinensis root is used in Nicaragua for high blood pressure (Barrett, 1994). *Citrus aurantium* leaf decoction is taken for high blood pressure in Curaçao (Morton, 1968b). *Citrus* species are used in Spain as digestives (Vázquez *et al.*, 1997).

Cocos nucifera kernel is reported to contain a mannan (Kapoor, 1990). The juice from the flower stalk is used in India as a diuretic and laxative.

Cola nitida is chewed by Nigerians habitually. *Cola nitida* nuts contain a heart stimulant called kolanin, and also contains caffeine, theobromine and quinine which are associated with increased blood pressure (Osim and Udia, 1993).

The ethnomedicinal use of *Crescentia cujete* for high blood pressure in Trinidad has been previously recorded (Wong, 1976). *Crescentia cujete* is used for diabetes in Curaçao (Morton, 1968b). The pulp contains polyphenols, lipophile chromophores, quaternary alkaloids, hydrocyanic acid, crescentic, tartaric, citric, tannic and chlorogenic acids (Morton, 1968a; Robineau, 1991).

Cuscuta americana is used in India, Maderia, Mauritius and Rodrigues to 'purify the blood', against gout and for bilious conditions (Asprey and Thornton, 1953-1955; Gurib-Fakim *et al.*, 1993; Rivera and Obón, 1995). *Cuscuta reflexa* is used for jaundice in Pakistan (Shinwari and Khan, 2000). At high doses *Cuscuta* species can cause fatal gastro-intestinal toxicity (Muñoz *et al.*, 2000b).

Wong (1976) has recorded the use of *Gomphrena globosa* for oliguria, hypertension and diabetes in Trinidad. *Gomphrena martiana* and *Gomphrena boliviana* yielded five 5,6,7-trisubstituted flavones and a lipophilic flavonoid fraction (Pomilio *et al.*, 1992; Pomilio *et al.*, 1994). The ethnomedicinal use of *Gomphrena globosa* for jaundice may be related to its use for urinary problems as recorded by Wong (1976).

Hibiscus sabdariffa has been used ethnomedicinally as a cholagogue, cholaretic, diuretic and for hypertension (Duke, 2000). *Hibiscus sabdariffa* contains flavanoids, polysaccharides and organic acids (Dafallah and al-Mustafa, 1996).

Laportea aestuans Chew and *Laportea crenulata* have been used ethnomedicinally for dysentery, oliguria, as a diuretic and for biliousness (Duke, 2000).

Momordica charantia is widely used in the Caribbean for hypertension and diabetes (Guilliford and Mahabir, 1997; Muñoz *et al.*, 2000a). In normal mice intraperitoneal administration of *Momordica charantia* aqueous extract improved glucose tolerance in normal mice after eight

hours and reduced the level of hyperglycaemia in streptozotocin diabetic mice by 50% after five hours (Bailey *et al.*, 1985).

Morus alba is used for hypertension in Spain and as a hypoglycaemic in the Spanish Mediterranean, in Turkey and in Chile (Rios *et al.*, 1987; Vázquez *et al.*, 1997; Lemus *et al.*, 1999; Yeşilada *et al.*, 1999). The hypoglycaemic activity of a 20% dried leaf infusion of *Morus alba*, was not verified in alloxan and streptozotocin induced hyperglycaemic rats (Lemus *et al.*, 1999). Active principles were thought to be cyanidin, delphinidin glucosides as well as phytosterol glycosides (Oliver Bever, 1986). *Morus alba* leaves contain several flavonoids, two of which exerted significant inhibitory effect on the growth of the human promyelocytic leukaemia cell line and significant free radical scavenging effects (Kim *et al.*, 1999; Kim *et al.*, 2000). P-cresol, phenol and morin were identified in the leaves (Ahmad and Beg, 2001).

Nopalea cochinellifera is used in traditional medicine as a depurative and for inflammations (Duke, 2000)

Ocimum campechianum (syn. *Ocimum micranthum*) is used in Brazil for intestinal disturbances. *Ocimum campechianum* contains 1,8-cineole, alpha-pinene, beta-elemene, gamma-elemene, linalool, sabinene, thymol, eugenol and elemol among others (Vieira and Simon, 2000).

Passiflora quadrangularis is used for hypertension and diabetes in Trinidad (Wong, 1976; Joly *et al.*, 1987). The whole plant contains nor-epinephrine and 5-hydroxytryptamine; a cyclopropane triterpene glycoside (quadranguloside) was isolated from the leaves (Joly *et al.*, 1987). Sixteen flavonoids were isolated from the leaves of *Passiflora sexflora* (Joly *et al.*, 1987).

Persea americana leaves are used for high blood pressure and pains in Jamaica, Panama and Nigeria (Asprey and Thornton, 1953-1955; Adeboye *et al.*, 1999; Caballero-George *et al.*, 2001). Intravenous administration of methanol and aqueous extracts of *Persea americana* to anaesthetised normotensive rats produced a fall in mean arterial blood pressure which lasted less than five minutes (Adeboye *et al.*, 1999). The short duration of this effect may indicate rapid metabolism of the active principles (steroid and triterpene glycosides).

Petiveria alliacea has shown a hypoglycemic active principle in the leaves and stems of the plant (Lores and Cires Pujol, 1990). Extracts from leaves and stem powder were found to produce a decrease of blood sugar concentration of more than 60% one hour after oral administration in male Balb/C mice (Lores and Cires Pujol, 1990). Alpha-sitosterol in the plant has antihypercholesterolemic and antiprostatic activities (Duke, 1989). Clinical trials have demonstrated analgesic effects and the plant has been shown to have anticonvulsant properties (Morton, 1980; Elisabetsky and Wannmacher, 1993; Souza Brito and Souza Brito, 1993).

Phyllanthus urinaria and *Phyllanthus niruri* are used for diabetes and bladder calculus in Trinidad and Tobago in Perú and other countries (Desmarchelier *et al.*, 1996; Guilliford and Mahabir, 1997; Santos *et al.*, 2000). Some *Phyllanthus* species have shown activity against the hepatitis B virus and HIV type 1 (Rajeshkumar and Kuttan, 2000; Santos *et al.*, 2000).

Spiranthes autumnalis and *Spiranthes diuretica* are used as depuratives, tonics and diuretics (Duke, 2000).

Tamarindus indicus is used ethnomedicinally in Mexico (Duke, 2000). *Tamarindus indicus* aqueous extract presented protective activity against lipid peroxidation (Joyeux *et al.*, 1995).

Tournefortia hirsutissima plant was used in Jamaica and Mexico for diabetes (Steggerda, 1929; Duke, 2000). *Tournefortia hirsutissima* is used in Latin America as a diuretic, for infections, skin problems and venereal diseases (Duke, 2000). Alarcon-Aguilara *et al.* (1998) found that *Tournefortia hirsutissima* had a antihyperglycaemic effect validating its clinical use in diabetes mellitus control.

Plants used for stomach problems, pain, internal parasites

Table 17f. Ethnomedicinal plants used for stomach problems, pain and internal parasites.

Scientific name	Family	Common name	Plant part used	Use
<i>Abelmoschus moschatus</i>	Malvaceae	Gumbo musque	Seeds	Grind in rum for foot cramp
<i>Aframomum melegueta</i>	Zingiberaceae	Guinea pepper	Seeds	Carminative
<i>Ambrosia cumanensis</i>	Asteraceae	Altamis	Bark	Stomach pain, 2*3 inch piece bark in urine for 3 days use to wash foot for 3 days for arthritis
<i>Aristolochia rugosa, trilobata</i>	Aristolochiaceae	Mat root, anico	Root	Stomach pain, colic, poisoning
<i>Bambusa vulgaris</i>	Poaceae	Bamboo	Leaves	Poultice
<i>Bidens alba / Bidens pilosa</i>	Asteraceae	Needle grass	Leafy branch	Cuts
<i>Bixa orellana</i>	Bixaceae	Roucou	Root	Dropsy
<i>Brownea latifolia</i>	Fabaceae	Cooper hoop	Flower, leaves	Gripe, pain
<i>Cajanus cajan</i>	Fabaceae	Pigeon pea	Leaves	Food poisoning, colic, constipation
<i>Capraria biflora</i>	Scrophulariaceae	Du thé pays	Leaves	Flavour for purgative
<i>Cecropia peltata</i>	Cecropiaceae	Bois canôt	Stem	3 'Ridges' from inside stem boiled as a carminative
<i>Centropogon cornutus</i>	Campanulaceae	Deer meat, crepe coq	Leaves	Snake, scorpion bite
<i>Chamaesyce hirta</i>	Euphorbiaceae	Malomay		Diarrhoea

Table 17f. Ethnomedicinal plants used for stomach problems, pain and internal parasites (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Citharexylum spinosum</i>	Verbenaceae	Bois c��tlette	Leaf	Anthelmintic
<i>Cocos nucifera</i>	Arecaceae	Coconut	Root, 7 ins, Shell	Dropsy, Hernia
<i>Cola nitida</i>	Sterculiaceae	Obie seed	Seed	Any kind of pain
<i>Cucurbita pepo</i>	Cucurbitaceae	Pumpkin		Sprains, breaks
<i>Cucurbita maxima</i>	Cucurbitaceae	Pumpkin	Seeds	Anthelmintic
<i>Dorstenia contrayerva</i>	Moraceae	Refriyau		Food poisoning
<i>Eleusine indica</i>	Poaceae	Pied poule		Diarrhoea
<i>Eupatorium triplinerve</i>	Asteraceae	Ayapana, japanne	Leaves	Stomach problems (worms)
<i>Eupatorium macrophyllum</i>	Asteraceae	Z'herbe chatte		Pain
<i>Ferula asa-foetida</i>	Apiaceae	Asafoetida		Carminative
<i>Jatropha curcas/gossypifolia</i>	Euphorbiaceae	White/Red Physic Nut	Leaf	Clean sores
<i>Neurolaena lobata</i>	Asteraceae	Z'herbe �� pique	Leaves	Tincture for arthritis
<i>Nicotiana tabacum</i>	Solanaceae	Tobacco	Leaves	Arthritis
<i>N. cochinellifera</i>	Cactaceae	Rachette	Joint	Snake bites
<i>M. charantia</i>	Cucurbitaceae	Caraaili	Vine	Stomach problems
<i>Morinda citrifolia</i>	Rubiaceae	Noni	Leaves	Pains
<i>Petiveria alliacea</i>	Phytolaccaceae	Mapourite		Arthritis and rheumatism
<i>Peperomia rotundifolia</i>	Piperaceae	Mowon		Diarrhoea
<i>Phyllanthus urinaria</i>	Euphorbiaceae	Red seed under leaf	Plant	Diarrhoea
<i>Portulaca oleraceae</i>	Portulacaceae	Pussley	Plant	Anthelmintic
<i>Punica granatum</i>	Punicaceae	Pome-granate	Seeds	Stomach problems
<i>Rosmarinus officinalis</i>	Lamiaceae	Rosemary	Leaf	Arthritis, Snake bites
<i>Scoparia dulcis</i>	Scrophulariaceae	Sweet broom	Root	Diarrhoea
<i>Solanum melongena</i>	Solanaceae	Melongen e	Fruit	Breaks
<i>Solanum americanum</i>	Solanaceae	Agouma	Plant	Shingles
<i>Tagetes patula</i>	Asteraceae	Marigold		Anthelmintic
<i>Tamarindus indicus</i>	Fabaceae	Tamarind		Scorpion bite
<i>Tournefortia hirsutissima</i>	Boraginaceae	Chigger bush	Leaves	Tea, carminative, chiggers

Non-experimental validation of plants used for stomach problems, pain, internal parasites

The use of *Abelmoschus moschatus* in Trinidad for rheumatism has been previously recorded (Wong, 1976).

Aframomum melegueta is used in India as a carminative (Duke, 2000). *Aframomum melegueta* contains alkaloids (piperine), essential oils and resins (van Harten, 1970).

Ambrosia hispida has been used traditionally for rheumatism (Duke, 2000).

An infusion of *Ambrosia hispida* was used by Caribs for worms and in a tea with absinthe for gripe and stomach aches (Honychurch, 1986). The Jamaican *Ambrosia peruviana* contains sesquiterpene lactones and a sesquiterpene diol (Goldsby and Burke, 1987).

Aristolochia species are used by the Amerindians in western Panama, Brazil, Bolivia, Ecuador and French Guyana for diarrhoea and stomach ailments and as analgesics (Joly *et al.*, 1987; Milliken and Albert, 1996). Aristolochic acid shows enhancement of phagocytosis and was formerly used in Europe for that purpose but it was withdrawn due to suspected carcinogenic effects (Wagner, 1990; Kay, 1996; Frei *et al.*, 1998).

In Nepal *Bidens pilosa* is pounded and the juice is used to check bleeding (Joshi and Joshi, 2000). *Bidens pilosa* is used in Cameroon, Brazil and Venezuela for leg ulcers, wounds and chronic ulcers (Tan *et al.*, 2000). Alvarez *et al.* (1996) found bioactive polyacetylenes in the methanolic extract of *Bidens pilosa* (whole plant). The antiinflammatory effect of aqueous extracts of the three plants *Bidens pilosa* var. minor (Blume) Sherff, *Bidens pilosa* and *Bidens chilensis* DC was significant (Chih *et al.*, 1995). The immunosuppressive activity of *Bidens pilosa* is attributed to the polyacetylene isolated from leaves (Pereira *et al.*, 1999). One new compound showed overgrowing action against normal and transformed human cell lines in culture (Alvarez *et al.*, 1996). Mirvish *et al.* (1985) found that *Bidens pilosa* as eaten in South Africa contributes to the aetiology of human oesophageal cancer. Alvarez *et al.* (1996) found insecticidal activity in *Bidens pilosa*. Brandão *et al.* (1997) found antimalarial activity of *Bidens pilosa* related to the presence of aliphatic acetylene compounds.

Bixa orellana has been used ethnomedicinally for dysentery and malaria (Ankli *et al.*, 1999; Duke, 2000).

Brownea latifolia is used ethnomedicinally in Trinidad (Wong, 1976).

Cajanus indicus leaves are used ethnomedicinally in India. A protein was purified from the leaves and may enhance body immunosurveillance (Datta *et al.*, 1999).

Capraria biflora is used in Cuba and Mexico for indigestion and is used for cooling in Martinique (Morton, 1968b; Honychurch, 1986).

Centropogon cornutus is used for ulcers in the Atlantic forests of Brazil (Voeks, 1996).

Chamaesyce hypericifolia causes vomiting and is considered poisonous in Nicaragua (Barrett, 1994). *Chamaesyce hypericifolia* contains caoutchouc, gallic acid, phorbol esters,

resin and tannin (Duke, 2000). *Chamaesyce hirta* plant extracts act as antidiarrhoeic agents by a triple pronounced antibacterial, antiamebic and antispasmodic action. The flavonoid quercitrin is the active compound (Galvez *et al.*, 1993; Tona *et al.*, 1999). Biological activities of *Chamaesyce hirta* were concentrated in the polyphenolic fraction, and not in the saponin or alkaloid-containing fractions (Tona *et al.*, 2000). *Chamaesyce hirta* whole plant extract inhibited *Entamoeba histolytica*, *Vibrio cholerae* and *Shigella flexneri* and showed inhibition of induced contractions on isolated guinea-pig ileum (Vijaya and Ananthan, 1997; Tona *et al.*, 2000).

Citharexylum spinosum is used in the Caribbean and Mexico (Honychurch, 1986; Duke, 2000). *Verbenoxylum reitzii* (Citharexyleae) leaves contain the viroside (10-hydroxy-iridoid) (Von Poser *et al.*, 1995).

Cocos nucifera root decoction is used as a diuretic in India. The red-hot shell is used as a rubefacient (Kapoor, 1990).

Cola nitida nuts contain primary and secondary amines, polyphenols, tannins and caffeine (Atawodi *et al.*, 1995).

Cucurbita species seeds are used as a vermifuge in Jamaica, Turkey, South America, India and Europe (Asprey and Thornton, 1953-1955; Oliver Bever, 1986; Sezik *et al.*, 1997). Cucurbitine is active on trematodes but inactive against nematodes and cestodes. Cucurbitine is active against *Taenia* but a purge is necessary to expel the parasite (Oliver Bever, 1986).

Dorstenia contrayerva is used by the Kuna Indians of Panama, in Mexico, Belize and formerly in Jamaica for snakebites, as an anthelmintic and for muscle aches (Amason *et al.*, 1980; Sheridan, 1991; Terreaux *et al.*, 1995; Tovar-Miranda *et al.*, 1998). *Dorstenia contrayerva* is used in Jamaica, Guatemala, Costa Rica, Panama and Mexico it is used for digestion, diarrhoea, to 'strengthen the stomach', gastrointestinal cramps, and promote diaphoresis and urine (Hazlett, 1986; Sheridan, 1991; Pöll, 1993; Comerford, 1996; Ankli *et al.*, 1999; Duke, 2000). The dichloromethane extract showed antimicrobial activity against *Bacillus subtilis* and yielded two furanocoumarins (Terreau *et al.*, 1995). From the roots of *Dorstenia contrajerva* dihydrofurocoumarin 1b was obtained (Tovar-Miranda *et al.*, 1998). Aerial parts of *Dorstenia mannii* in Cameroon yielded prenylated flavanones and flavonoids (Ngadjui *et al.*, 2000).

Eleusine indica ethanol extract showed activity against vesicular stomatitis virus (Ali *et al.*, 1996). The plant is reported to contain hydrocyanic acid (Ahmad and Holdsworth, 1994).

Eupatorium macrophyllum tea is used as a carminative in the Caribbean and for headaches by the Shuar in the Ecuadorian Amazon (Honychurch, 1986; Russo, 1992).

Eupatorium triplinerve leaf infusion is used for burning sensations in the stomach, indigestion, diarrhoea, insomnia, nausea, ulcers, vomiting and for respiratory conditions in Trinidad, Mauritius and Rodrigues (Wong, 1976; van den Berg, 1984; Gurib-Fakim *et al.*, 1993). *Eupatorium triplinerve* ethanol extract and its essential oil were active against *Staphylococcus aureus*, *Aspergillus flavus*, *Penicillium digitatum* and *Aspergillus fumigatus* (Verpoorte and Dihal, 1987; Yadava and Saini, 1990).

Asa-foetida is the resin of the root of *Ferula asa-foetida*. Asa-foetida is considered to be a sedative, carminative, antispasmodic, diuretic, and expectorant in Nepal (Eigner and Scholz, 1999). *Ferula asa-foetida* effects a slight inhibition of the growth of *Staphylococcus aureus* and *Shigella sonnei* (Eigner and Scholz, 1999). *Ferula asa-foetida* oleogum resin contains glucuronic acid, galactose, arabinose, rhamnose, sulphur containing compounds, farnesiferols, umbelliferone and ferulic acid (Eigner and Scholz, 1999).

Momordica charantia is widely used in the Caribbean for digestive troubles and intestinal worms (Muñoz *et al.*, 2000a). *Momordica charantia* was active against *Staphylococcus aureus* and *Streptococcus* group A (Martínez *et al.*, 1996b; Facey *et al.*, 1999).

Morinda citrifolia is used in Nicaragua and Asian countries for inflammation, swelling, infections and for its antiseptic and antibiotic properties and hypotensive and anticoagulant activities (Barrett, 1994; Farine *et al.*, 1996). The ripe fruit contains carboxylic acids (octanoic, decanoic and hexanoic), alcohols, methyl and ethyl esters, ketones, lactones, coumarins (scopoletin) and other compounds (Farine *et al.*, 1996).

Nopalea cochinellifera is used for inflammations in India (Duke, 2000).

Peperomia rubra is used in Peru for intestinal infections and cholera (Jovel *et al.*, 1996). *Peperomia galioides* H.B.K yielded two prenylated quinones and a prenylated dihydroquinone and prenylphenols (Mahiou *et al.*, 1996). Clusifolol (a prenylated benzopyran derivative) has been isolated from whole plants of *Peperomia clusiifolia* (Seeram *et al.*, 1998). Proctoriones A-C were isolated from the endemic Jamaican species *Peperomia proctorii* (Seeram *et al.*, 2000). Hydropiperone exhibited significant anti-parasitical activity against three species of *Leishmania* (Mahiou *et al.*, 1996). *Peperomia galioides* showed cicatrizant activity in mice (Fernández *et al.*, 1997).

Petiveria alliacea root macerated in alcohol is used for hip and knee osteoarthritis and for rheumatic pain in Brazil (Ferraz *et al.*, 1991; Muñoz *et al.*, 2000a; Bourdy *et al.*, 2000). de Lima *et al.* (1991) found that *Petiveria alliacea* extract showed an antinociceptive effect which may be responsible for its popular use as an analgesic (de Lima *et al.*, 1991).

Portulaca oleracea is used in St. Lucia, Mexico, Venezuela, China, Iraq and in the Malay peninsula as an anthelmintic (Wong, 1976; Didier *et al.*, 1988; Duke, 2000). Extracts of *Portulaca oleracea* are bactericidal (Jimenez Misas *et al.*, 1979). *Portulaca oleracea* contains alkaloids, coumarins, flavonoids, alkanes, waxy esters, caffeic, ferulic and sinapic acids, beta sitosteryl glucoside, lupeol, flavonoids (quercitrin, kaempferol), phytoecdysones, cardiac and anthraquinone glycosides, and a leucocyanidin (Cambie, 1997). The stem contains the acylated betacyanins, oleracin 1 and oleracin II (Cambie, 1997).

Punica granatum has been used since ancient times as an anthelmintic and astringent drug. *Punica granatum* is used for the digestive system in Palestine, Malaysia, India, Mexico, Spain and Sardinia (Bruni *et al.*, 1997; Vázquez *et al.*, 1997; Ong and Norzalina, 1999; Ankli *et al.*, 1999; Ali-Shtayeh *et al.*, 2000; Ahmad and Beg, 2001). Four yellow-coloured ellagitannins were isolated from the pericarp of *Punica granatum*. Tannins and a ellagitannin (punicafolin) were found in the leaves (Tanaka *et al.*, 1985). *Punica granatum* showed activity against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Candida albicans* (Navarro *et al.*, 1996).

Rosmarinus officinalis (tincture of aerial parts) is used in Almería, Spain for rheumatism (Martínez Lirola *et al.*, 1996).

Solanum torvum and *Solanum mammosum* leaf juice is used for ringworm in Belize (Arnason *et al.*, 1980). *Solanum surrantense* is used for breaks in Pakistan (Shinwari and Khan, 2000). *Solanum americanum* extracts were active against *Microsporum gypseum* and *Cryptococcus neoformans* and showed intraperitoneal subacute toxicity in mice (Cáceres *et al.*, 1998; Muñoz *et al.*, 2000a).

Scoparia dulcis is used for diarrhoea in Nicaragua (Barrett, 1994).

Tagetes erecta was used by the Aztecs as a diuretic while *Tagetes patula* is currently used in Mauritius and Rodrigues as a mild laxative (Gurib-Fakim *et al.*, 1993; Peña, 1999). *Tagetes lucida* tincture inhibited five bacteria and was active against *Vibrio cholerae* and *Candida albicans* (Cáceres *et al.*, 1991b; Cáceres *et al.*, 1993a). *Tagetes erecta* and *Tagetes filifolia* inhibited two enterobacteria (Cáceres *et al.*, 1993a).

Tamarindus indicus is used ethnomedicinally for fevers and stomach problems (Duke, 2000)

Tournefortia hirsutissima is used in Central America for stomatitis (Duke, 2000). *Tournefortia hirsutissima* has been used in Latin America as a larvicide (Duke, 2000). *Tournefortia densiflora* is used by the Zapotecs in Oaxaca, Mexico for dermatological conditions (Frei *et al.*, 1998). The plant contains sesquiterpene lactones (tagitinins) with reported antitumour activity (Frei *et al.*, 1998).

Plants used for eyes, headaches, dental problems, ect.

Table 17g. Ethnomedicinal plants used for eyes, headaches, dental problems, ect

Scientific name	Family	Common name	Plant part used	Use
<i>Acnistus arborescens</i>	Solanaceae	Wild tobacco		Headache
<i>Annona muricata</i>	Annonaceae	Soursop	Leaves	Nerves, Sleep aid
<i>Aristolochia rugosa</i>	Aristolochiaceae	Mat root, anico	Root	Toothache
<i>Capraria biflora</i>	Scrophulariaceae	Du thé pays	Leaves	Eye wash
<i>Chrysobalanus icaco</i>	Chrysobalanaceae	Ipecak		Tonsils
<i>Citrus nobilis</i>	Rutaceae	Portugal	Bud	Sleep aid for babies
<i>Cocos nucifera</i>	Arecaceae	Coconut	Root	Bleeding gums
<i>Crescentia cujete</i>	Bignoniaceae	Calabash	Leaves	Sleep aid
<i>Datura stramonium</i>	Solanaceae	Datur		Narcotic
<i>Kalanchoe pinnata</i>	Crassulaceae	Wonder of the world	Leaves	Eye problems

Table 17g. Ethnomedicinal plants used for eyes, headaches, dental problems, ect (cont.)

Scientific name	Family	Common name	Plant part used	Use
<i>Lepianthes peltata</i>	Piperaceae	Sun bush	Leaves	Headache
<i>Musa species</i>	Musaceae	Banana	Young leaf, green fruit	Tie on head for headache, Boil with skin for nerves, 'run down'
<i>Ocimum gratissimum</i>	Lamiaceae	Fon bazin	Seeds	Clears eyes
<i>Piper hispidum</i>	Piperaceae	Candle bush	Leaves	Nerves
<i>Ricinus communis</i>	Euphorbiaceae	Castor oil leaf	Leaves	Tie on head for headache
<i>Rosmarinus officinalis</i>	Lamiaceae	Rosemary		Brain tonic
<i>Senna occidentalis</i>	Caesalpiniaceae	Wild coffee	Leaves	Tie on for headaches
<i>Spondias mombin</i>	Anacardiaceae	Hogplum	Leaves	Mouthwash, tonsils, sore throat
<i>Tagetes patula</i>	Asteraceae	Marigold		Pain in ear, Toothache

Non-experimental validation of plants used for eyes, headaches, dental problems, ect.

Acnistus arborescens leaves have been used traditionally to treat cancerous growths (Kupchan *et al.*, 1965). Alcoholic extracts of dried leaves of *Acnistus arborescens* contained a novel steroidal tumour inhibitor (Kupchan *et al.*, 1965).

Annona muricata fruit and leaves are used in Caribbean traditional medicine for their tranquillizing and sedative properties (Hasrat *et al.*, 1997b). Bourne and Egbe (1979) found that an alcoholic extract from the ripe fruit of soursop (*Annona muricata*) decreased the motor activity and prolonged the barbiturate (thiopentone sodium) sleeping time of rats. The study supported local claims of sedative properties (Bourne and Egbe, 1979). Studies showed that the fruit of *Annona muricata* possesses antidepressive effects (in contrast to sedative properties), possibly induced by alkaloids, benzyltetrahydroisoquinoline, annonaine, normuciferine, asimilobine or reticuline (Hasrat *et al.*, 1997b). In the French West Indies, PSP and atypical parkinsonism predominated in patients who consumed herbal tea and fruits of the Annonaceae (custard apple or pawpaw family). Benzyltetrahydroisoquinolines (alkaloids), present in Annonaceae, are neurotoxic to the basal ganglia in animals (Caparros-Lefebvre and Elbaz, 1999). This analysis was based on small numbers of cases.

Aristolochia species are used in western Panama as analgesics (Joly *et al.*, 1987).

Capraria biflora is used as a bath tonic in Belize and Curaçao (Morton, 1968b; Arnason *et al.*, 1980).

The use of *Chrysobalanus icaco* as an astringent in Trinidad has been previously recorded (Wong, 1976).

Citrus aurantifolia was found active against *Staphylococcus aureus* (Facey *et al.*, 1999).

Cocos nucifera nut shell is used as a rubefacient in India (Kapoor, 1990).

Crescentia cujete is used in Panama as a tranquiliser (Duke, 2000).

Datura stramonium is used as a narcotic in Pakistan and in the republic of Niger, alkaloids in the plant have an atropine-like effect (Djibo and Bouzou, 2000; Shinwari and Khan, 2000).

Kalanchoe pinnata is used for headaches by the Caribs in Guatemala (Girón *et al.*, 1991).

In the Caribbean and South America, warm *Lepianthes peltata* leaves are tied to the head and forehead to relieve headaches (Hodge and Taylor, 1957; Lachman-White *et al.*, 1992). *Lepianthes peltata* leaves are also applied to other areas for the relief of arthritic pains, hernia pains, liver pains and other inflammatory disorders (Lachman-White *et al.*, 1992; Mongelli *et al.*, 1999). *Lepianthes peltata* and *Lepianthes umbella* showed no mutagenicity (Felzenszwaib *et al.*, 1987). A catechol derivative (4-nerolidylcatechol) was isolated from the methanolic leaf extract (Mongelli *et al.*, 1999).

Musa paradisiaca is used for epilepsy in India and for fevers in Barbados (Handler and Jacoby, 1993; Ahmad and Beg, 2001). Heated leaves of *Musa* species are used for eye infections in Brazil and Indonesia (Milliken and Albert, 1996).

Ocimum micranthum was used as a wash for bloodshot eyes when the condition was caused by a blow (Asprey and Thornton, 1953-1955). *Ocimum* species seeds are put into the eye in Belize and Mexico (Arnason *et al.*, 1980; Ankli *et al.*, 1999). *Ocimum* species grown in Rwanda were found to be antimicrobially active against *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Trichophyton mentagrophytes* var. *interdigitale* (Janssen *et al.*, 1989). The essential oil (EO) and leaf extracts of *Ocimum gratissimum* inhibited *Staphylococcus aureus*, *Shigella* species, *Aeromonas sobria*, *Salmonella* species, *Plesiomonas shigelloides*, *Escherichia coli*, *Klebsiella* species and *Proteus mirabilis*. The endpoint was not reached for *Pseudomonas aeruginosa* (≥ 24 mg/ml). Eugenol was responsible for the observed antibacterial activity (Ilori *et al.*, 1996; Nakamura *et al.*, 1999). Combinations with antibiotics potentiated the antibacterial activity of *Ocimum gratissimum* (Jedlickova *et al.*, 1992).

In Costa Rica *Piper marginatum* leaves are boiled and the tea is drunk to treat headaches (Hazlett, 1986). The plant and leaf contain ascorbic acid, beta-carotene, minerals, cepharadione-B, riboflavin, safrole and thiamin (Duke, 2000). Aqueous and ethanol extracts of aerial parts of *Piper auritum* have produced spasmogenic uterine stimulant and vasodilator effects (Gupta *et al.*, 1993).

Ricinus communis is put on the head for headache in Belize (Arnason *et al.*, 1980). Stems contain flavonoids, phenolic acids, triterpenes and phytosterols (Cambie, 1997).

Rosmarinus officinalis is used as a tonic in Venezuela (Morton, 1975).

Spondias mombin contains long-chain phenolic acids, a long-chain phenol, two antivirally active ellagitannins and five 6-alkenylsalicylic acids (Corthout *et al.*, 1990 a & b; Corthout *et al.*, 1994). *Spondias mombin* has antibacterial and molluscicidal properties (Ajao *et al.* 1985; Corthout *et al.* 1994).

Tagetes patula contains polyacetylenes, ellagic acid and thiophene derivatives. The leaves contain flavonoids (quercetagenin, patuletin, patulitrin, mannitol) (Cambie, 1997).

Creolization with western medicine

Creolization with Western medicine is seen in Trinidad, the Caribbean and South America in the combination of western drugs with folk medicines (see also Coe and Anderson, 1996a). Rubbing alcohol, aspirin, spices, Vicks, Negasunt™, petroleum products and other products are used. More on these is given in the list below.

List 1: Pharmaceutical and non-plant ingredients and their uses

1. Arrow root flour mixed with water and drunk for diarrhoea. Soda water is mixed with a tablespoon of arrowroot flour and used for dysentery.
2. Babash/mountain dew is illegally-produced rum. It is used for menstrual period pain. It is also used with z'herbe á pique (*Neurolaena lobata*) for colds/fever.
3. Sour milk / Dahi is used for calf diarrhoea, for purges and for fevers.
4. Disinfectant is used on inflamed hooves, wounds, myiasis and to replace iodine.
5. The brine from pickled meat is used for external injuries and warts.
6. Fiery Jack™ balm was used to irritate horses to make them run faster but is now a banned substance.
7. Garlic and coals from fireside cooking is used for snake bites on dogs.
8. Ashes from fireside cooking are used on wounds, maggots, pip, sore hoofs, diarrhoea, as a charcoal substitute and to wash gumboils. Charcoal is used on wounds.
9. Gas/kerosene is used for maggots and mange.
10. Used engine oil is put on horses hooves to make them pliable and is also used for maggots and mange.
11. Sugar is used for respiratory problems in chickens, as an antidote to poison, and the osmotic gradient is put to use for prolapse and eye infections.
12. Vicks™ is used for respiratory problems in horses.
13. Salted butter is used on prolapses and for udder problems.
14. Blue stone (copper sulphate) is used on stone bruises.
15. Blue soap is used on chicken pox and for fleas.
16. Epsom salts is used for tendon injuries on horses, as a purge, for ground itch and on animal's hooves.
17. Cobwebs are used on broken horns and to seal cuts, similarly to Turkey (Sezik *et al.*, 1997).
18. Ants nests are used for mastitis.
19. A piece of termite nest is lit and put in a bucket attached to a horse's halter. The smoke from the nest is said to help with lung problems in horses. An infusion of a piece of termite nest (couloubois) is drunk for high blood pressure
20. Soft candle is used for colds, to poison goats and for abscesses.
21. Stout/ Guinness is drunk hot with various plants two days before the menstrual period, to remove the blood clots responsible for the pain. Hot stout is also used for retained

- placenta and as an abortifacient. B) Boiled stout was combined with one common fowl egg, a handful of bamboo leaves and put in a bottle. This decoction was given to the cow in first quarter moon phase. Three days before the full moon the cow would be ready to be bred.
22. Camphor (*Camphora officinarum*) with coconut oil was used as a replacement for NegasuntTM, for the umbilicus of neonates. Three veterinarians accepted and used/recommended this substitute. Camphor is also used for respiratory problems in horses.
 23. Sugar of lead or lead acetate is used for sores on the shoulders of draft animal. It is also used for tete worm, ground itch, men's genital problems and burns.
 24. Vaseline is used for wounds, sores and eye problems. Yellow tanner grease is rubbed on cows skin.
 25. Coal tar is put on broken horns, used for ground itch and for hoof care.
 26. Jack spaniard (wasp) stings are used to make dogs aggressive and for arthritis.
 27. Lime $\text{Ca}(\text{OH})_2$ is put on walls to repel ticks.
 28. Linseed oil is drunk for retained placenta.
 29. Castor oil and lamp oil are used as a purge, colds and for colic.
 30. Shark oil, cod liver oil or peppermint oil are used to 'clean out' horses or as diet additives.
 31. Mustard oil was put into the dog's drinking water for distemper.
 32. Coconut oil is used on neonate navels, warts, fever, joints, and for cows with headaches.
 33. Alum (a double sulphate of aluminium and potassium) (2 or 3 ounces) is mixed with water in a bucket. Ruminant hooves are put in the bucket. This practice keeps the hoof solid. Alum is also used for shaking teeth and for oestrous induction.
 34. Snails are rubbed on warts.
 35. Molasses is used for oestrous induction, to improve appetite, for milk production, as a purge, as a tonic, as a component in poultices, for colic and for retained placenta.
 36. Salted fish is used to induce oestrous.
 37. Asafoetida (tatajab) is used to repel insects, deworm children, keep away spirits, bathe guns for hunting and as a carminative.
 38. Salted beef is used for 'loss of cud'.
 39. A hair from a cow's tail is used to remove warts.
 40. Gentian violet (*Gentiana lutea*) is rubbed on dogs for mange.
 41. The penis of the leatherback turtle is used to increase the effectiveness of hunting dogs.
 42. Canadian healing oil is used for many purposes including to help heal horses tendons.

Non-experimental validation of snake oils, etc

In Nepal, crushed snails are used to treat skin diseases with the root powder of *Achyranthes bidentata* (Joshi and Joshi, 2000). Researchers at the University of Wisconsin Medical school discovered that dark beer like Guinness contains large amounts of flavonoids which have an antioxidant effect, absorbing the free radicals of cholesterol which cause blood platelets to stick together and clog up arteries. Guinness was given to new mothers in Irish hospitals until the 1970s for nutritional reasons (M. Hanrahan, Dept. Communication and Innovation Studies, WUR, pers. comm. 2001). Pugliese *et al.*, 1998 claim that shark liver oil has been used for over 40 years as both a therapeutic and preventive agent. Shark liver is a major natural source of alkylglycerols, which have no known side effects in dosages of 100 mg three times a day. Alkylglycerols may be used both as an adjunct therapy in the treatment of neoplastic disorders and as an immune booster in infectious diseases (Pugliese

et al., 1998). Boa constrictor fat (BCF) significantly (p less than 0.0001) inhibited the *in vitro* growth of both keloid and normal dermal fibroblasts. Fatty acids which are the main constituents of the oil may in part account for this observed *in vitro* effect (Datubo-Brown and Blight, 1990).

Conclusion

The ethnomedicinal use of plants in Trinidad is similar to the use in other Caribbean islands and to that in other countries. There is evidence that some of the plant uses have been transferred from the original countries of Trinidad's first migrants. Those plants with very few ethnomedicinal references are perhaps the true 'indigenous [to Trinidad] knowledge'; or perhaps the relevant ethnomedicinal references were not found or are still unpublished. These 'indigenous' ethnomedicinal plant uses are those that involve *Antigonon leptopus*, *Justicia secunda*, *Microtea debilis*, *Eupatorium macrophyllum*, *Centropogon cornutus*, *Bontia daphnoides*, *Brownea latifolia*, *Richeria grandis*, *Roupala montana*, *Eupatorium triplinerve*, *Persea americana*, *Richeria grandis*, *Hippobroma longifolia*. Some of the local claims of medicinal properties of the ethnomedicinal plants have been supported by scientific studies.

Part 3: Synthesis and Conclusions

'coarse-grained, wide-meshed intellectual conceptions cannot grasp a more finely woven Nature' (Steiner 1924).

Networks, ethnoveterinary medicine and sustainable agriculture²⁹

The Creoles, in general, have only precarious medical attendance, because of their own unwillingness to remunerate a regular practitioner; in lieu of this, they prefer the assistance of a class of imposters, both male and female, who unite the practice of obeahism and quackery, exact little from their patients but are commonly satisfied with the amount and mode of remuneration tendered for the nostrums they administer, and the incantations they perform (L.A.A. de Verteuil, 1884)

12. Networks, Ethnoveterinary medicine and Sustainable Agriculture

The spread of agricultural knowledge has been discussed extensively by Juska and Molnar *et al.* (1992), Busch (1994) and de Sousa and Busch (1998). Innovations reach farmers through market transactions that favour large-volume processors, and through social networks (Molnar *et al.*, 1992). Space limits an enlargement of the discussion on conventional technology transfer here. This chapter looks at how knowledge on sustainable agriculture (in this case ethnoveterinary medicine) has in the past been left out of the scientific knowledge network. This chapter looks at the actual practices and discourses of local scientists and veterinarians and the tension between them and ethnoveterinary practitioners. This chapter is not a post-modern attack on science or scientists or new w(h)ine in old bottles. It seeks to point out a few of the processes by which some knowledge is accepted as science and some is excluded from science. It focuses on the 'politics of knowledge' accepting the view of Christoplos and Nitsch (1996) that extension is a political process and putting indigenous knowledge (IK) at the center of extension planning is a political act. As such it hopes to provide a 'tool for understanding' that interested scientists can use as the first step towards putting useful technologies in sustainable agriculture 'on the shelf' in research institutions (Christoplos and Nitsch, 1996; Flora, 1992). Knowledge produced about human actors re-enters society, is interpreted and affects human action (Röling, 1994). By focusing equally on the actors in the animal health network as well as on the ethnoveterinary knowledge, this chapter attempts to challenge the animal health actors to reconsider their actions and attitudes. This chapter uses the ideas of praxis in Medical Anthropology, i.e. tackling both the "actors" and "structure" separately and simultaneously. The "actors" would include the individual remedies while the "structure" would involve looking at the scientists' view of folk medicine and the actor networks in science and folk medicine.

Indigenous knowledge is local, orally transmitted knowledge which is derived from practical experimentation reinforced by experience, and embedded in cultural matrices (Ellen, 1996a). Ethnoveterinary medicine is the local, mainly plant-based medicines used for animals. The study of indigenous knowledge related to animal health is typically undertaken to assess its usefulness. It has been a named and recognised area of academic interest

²⁹ Article peer-reviewed by Rural Sociology and includes some sections taken from Lans, C., Röling, N. 1998c. Feminist methods, women's traditional health knowledge and ethnoveterinary knowledge. Working Paper No.3. Centre for Gender and Development Studies, University of the West Indies, St. Augustine.

since the mid-1970s. Ethnoveterinary knowledge is greatly influenced by cultural beliefs, religion, societal norms and trends and by the materia medica available in terms of local flora, fauna and minerals (Mathias-Mundy and McCorkle, 1997).

Extension is often seen by other groups as a delivery mechanism to transfer the results of scientific work (Röling, 1997). However new forms of extension incorporate learning, participation and process facilitation. In these new models the resource user or farmer is not on the receiving end of scientifically-produced knowledge, but is an active expert who must be helped to learn and organise (Röling, 1997). Sustainable agriculture³⁰ requires the development of new and more sustainable systems, technologies and practices, which farmers are able, willing and capable of applying and /or adapting. Sustainable pest control has become successful because a promising technology was available (Leeuwis, 1997). Availability of technology is the issue. Christoplos and Nitsch (1996) claim that extension effectiveness in promoting sustainable agricultural technologies (like ethnoveterinary medicine) is limited by the few technologies available 'on the shelf' in research institutions that are suited to low resource farmers. Christoplos and Nitsch (1996) give two reasons for this: an élite bias on the part of research and extension, and the limitations of applying 'normal control-based science' technologies to constantly fluctuating Third world conditions. Indigenous knowledge, like ethnoveterinary knowledge, if proved effective can help farmers adapt to nature, minimise risk and optimize, rather than maximize production (Christoplos and Nitsch, 1996).

For the purposes of this chapter the definition of science as a human performance or human enterprise is the most relevant (Goodwin and Tangum, 1998). As part of this human enterprise the boundaries and contents of science are continually negotiated and re-negotiated rather than being only pre-existing entities needing to be discovered and revealed (Goodwin and Tangum, 1998). A minority holds this view of science; there are more scientists who see science as the objective disembodied report of value-free context-independent facts (Molnar *et al.*, 1992). The field of science and technology studies sees scientific discoveries and experimental findings as social constructions. This means that non-scientific events and circumstances such as social interests and negotiations shape scientific knowledge (Kloppenburg, 1992; Flora, 1992; Code, 1993; Henry, 1998). Truth claims are then the result rather than the cause of agreement within a scientific community (Nelson, 1993). Therefore scientists cannot claim that they are accountable only to their evidence since scientists act as epistemic agents and their evidence is selected and not found (Kloppenburg, 1992; Nelson, 1993; Code, 1993; Deichmann and Müller-Hill, 1998). Moderate constructivism allows for a study of science and technology that addresses issues of science policy, appropriate technology and science-and-technology created dependency (Baber, 1992).

Many scientists assume 'that if the[ir] science is good, it will serve the people' (Star, 1991). But some feminists have pointed out that no one is responsible for ensuring that science does serve the people. If we accept that scientific and technical truths and indigenous knowledge are partial (Kloppenburg, 1992; Longino, 1993) we are still faced with the problem of distinguishing what knowledge (including knowledge on sustainable agriculture) is helpful and which is not (Longino, 1993; Nelson, 1993). Before useful knowledge can be identified it is necessary to recognise that the motivations, norms and values of researchers and their institutions isolate them from the complex worlds of farmers

³⁰ Technology for sustainable agriculture is defined as low-external-input, low cost and locally available technology.

and extension agents and constrains their ability to produce useful knowledge (Christoplos and Nitsch, 1996).

Actor Network analysis is used in this chapter to study scientific and folk knowledge networks. Actor Network Theory has been discussed in relation to agriculture by Kloppenburg (1992), Juska and Busch (1994), and de Sousa and Busch (1998) and in this chapter strategic references will be made to those discussions and to the excellent review of extension science provided by Christoplos and Nitsch (1996). An actor network is best described as the totality of social, political, economic, technological and other relationships that shape science, technology, knowledge production and society (Law, 1991). It is within and out of the relationships of the actor-networks that technology, science, knowledge and society are produced (Law, 1991). The agency and power of 'normal' science lies in the interlocking interests that make up the 'Old Boy' networks of relationships that exist in science (Callon, 1991; Juska and Busch, 1994; Deichmann and Müller-Hill, 1998). Actors in these relationships are sometimes resistant to new ideas that require a loss of, or at least renegotiation of existing scientific networks and interests (Goodwin and Tangum, 1998; Kloppenburg, 1992; Law, 1991). Junior scientists need to publish in the top journals, are cautioned against straying too far from the existing scientific norms, manicure their manuscripts to fit whatever form is in vogue and network with potential reviewers of their articles (Lawrence, 1999). Senior scientists and consultants are inclined to cling to established theories like the 'Training and Visit System' which they are familiar with and into which they have invested their reputations (Christoplos and Nitsch, 1996). In addition some scientists (including some in science studies) prefer to ignore the existence of something real (like indigenous knowledge) rather than risk making scientific errors; or challenge the hierarchical structures in traditional institutions (Deichmann and Müller-Hill, 1998). When these social factors are combined with the fact that professionals can and do claim that only scientists can generate valid information (Flora, 1992), there are indications as to why there are so few sustainable technologies available in research institutions.

This chapter describes aspects of a five-year research study into ethnoveterinary medicine, which revealed an on-going tension between western-trained scientists and practitioners of ethnoveterinary knowledge. Extracts from interviews conducted in 1995 with a representative sample of Trinidad and Tobago's animal health professionals are used to show how the less powerful actor-network of folk medicine is kept in marginalised parallel to the more powerful actor-network of 'normal science'. The assumption that there is a reality which is knowable through interviews is rejected. The interview transcripts are not reproduced as a reflection of a static reality since there is no way of knowing the relationship between truth and the interview text (Holland and Ramazanoglu, 1994). An interview is a specific account given to a particular interviewer at a particular moment. An interview with the same person could have produced a different text in other circumstances since interviews are accounts in which people present themselves to specific audiences. Therefore we can allow diverse accounts to speak for themselves through multiple possible readings of transcripts as texts (Holland and Ramazanoglu, 1994). These interview extracts are also built into the matrices presented in the body of the chapter. Newspaper clippings and one example are also utilised to show how scientific debates can shape which knowledge is accepted and which not.

This combination of approaches is used to reflect the heterogeneous nature of an actor-network, its tactics and its effects and the implications for sustainable knowledge production and dissemination. The study is not a normative account of what is wrong and

how things should be (Christoplos and Nitsch, 1996). Rather it aims to be of use to those who seek to put traditional knowledge on sustainable agriculture into scientific knowledge networks so that its efficacy can be tested. No claim is made that traditional knowledge should replace scientific knowledge but that each has its merits and flaws.

The context

This chapter contains one example from the poultry industry, which is unique in having a Poultry Surveillance Unit (PSU). The PSU was started in 1981 as a veterinary and technical service provider and it is part of the Ministry of Agriculture Land and Marine Resources (MALMR). In 1981 the staff consisted of three animal health assistants (AHAs) and a veterinarian head of unit, (the only veterinarian willing to work with poultry at that time). The PSU was put in place based on the recommendations from a committee of poultry farmers who had complaints about vaccine efficiency. The PSU was initially run with three AHAs. The unit staff of 1995 consisted of eight AHAs, including two women, who were assigned to different districts in Trinidad. In 1994 the PSU staff made a total of 544 visits to 55 layer farms with a capacity of 477,500 layers and a total production of 3,583,983 dozen eggs (Table 18a). The PSU staff also made 2073 visits to 165 broiler farms with a production of 5,954,710 broilers (Table 18b).

Table 18a. Layer farm surveillance 1994

	No. farms visited	Capacity '000	Total production	Total visits
Islandwide	55	477.5	3,583,983	544

Source: Annual Report 1994. Animal Health Sub-Division, Ministry of Agriculture, Land and Marine Resources.

Table 18b. Broiler farm surveillance 1994

Districts	No. farms visited	Capacity '000	Total production	Total visits
St. George	13	165	122	60
Wallerfield	50	162.6	122	60
Caroni	33	557	1871.61	425
Victoria	40	710	2683	1006
St. Patrick	29	408.5	1205.1	557
Total	165	3610.5	5954.71	2073

Source Annual Report 1994. Animal Health Sub-Division, Ministry of Agriculture, Land and Marine Resources.

The PSU deals with ducks, guinea fowls and turkeys on a very limited level. The majority of Trinidad and Tobago's chicken farmers are contract farmers who rear broilers in an all-in-all-out system for two large poultry processing plants or five integrators (Warner Grain Mills (WGM), Supermix, Nutrimix, Malabar Farms, Mastermix). These contract farmers have broiler capacities ranging from 5,000 to 90,000. The processing plants supply government institutions, supermarkets and hotels. In 1996 it was estimated that 350,000 chickens were consumed every week. There are also small independent broiler operations that supply live birds to small-scale roadside pluck shops where birds are kept in floor-systems until they are slaughtered and dressed for consumers on demand. There are fewer egg producers than broiler operators in the country. In 1996 it was expected that 2.5 million

chicks would hatch from eggs set in August 1996. The chicken industry has been referred to as an assembly-type industry since all the inputs; corn, soya, equipment and the majority of the day-old chicks are imported from the USA. Annual consumption of poultry meat in Trinidad and Tobago in 1994 was 9 kg (24 kg/person) and the number of slaughtered broilers and culled layers was estimated at 16 million in 1995 and 1996 (Lambie *et al.*, 2000).

Poultry health is controlled by the PSU. Infectious Bursal Disease is under better control than in the past. Infectious Coryza and Fowl Cholera have been reduced due to better water sanitation. (Brown, 1999b). The PSU recommends *Aloe vera* for Cocci-bacillosis. Coccidiosis has a negative influence on poultry production (Brown, 1999b). The PSU recommends management practices to control Newcastle Disease Virus such as minimising the stress on the immunological system. *Salmonella* species can influence poultry health, productivity and food safety (Brown, 1999b). Pox and yaws have declined due to better management practices. Vaccines are used for viral diseases such as Mareks, Pox, Gumboro, Avian Reovirus, Avian Cephalomyelitis and Infectious Bronchitis. In recent years there has been a resurgence of Gumboro.

Study methods

The analysis and matrices in the body of the chapter are derived from data collected in a five-year study (1995-2000) of ethnoveterinary medicine. The study investigated ethnoveterinary practices but it also revealed the ongoing tension between western-trained scientists and practitioners of ethnoveterinary knowledge. This tension is the focus of this chapter because it affects the survival of the ethnoveterinary knowledge. The interview extracts are taken from group and individual interviews that were held in 1995 with officials from the Ministry of Agriculture Land and Marine Resources (MALMR). The sample was obtained by visiting four regional MALMR offices in Trinidad. The officials interviewed were 19 Agricultural Officers (AOs) and Animal Health Assistants (AHAs) (50% of all employed in that category) and 27 Extension officers (EOs) (33% of all employed in that category) from one East and two South Regional Offices in Trinidad. The interviews were guided discussions, semi-structured by a mental checklist of relevant points. The visit to the North Regional Office provided no information, only a contact in the East Regional office. None of the equivalent staff in Tobago was interviewed. The AHAs and EOs in Trinidad were spoken to at their workplaces and they willingly explained what they knew about ethnoveterinary knowledge. However since the EOs specialised in crop production they knew less than the AHAs. Both the AHAs and the EOs indicated which Veterinarians had practices that included large animal farmers and were thus likely to know about ethnoveterinary practices. The sample of veterinarians was derived from these interviews and is thus a stepwise sample. Thirty veterinarians (50% of all practising in 1995) were then contacted by phone to arrange interviews (including both of the Veterinarians located in Tobago). Nineteen of these discussed what they knew and their attitudes towards ethnoveterinary knowledge were recorded. Those who declined to be interviewed claimed to know nothing about the subject.

Three veterinarians claimed to know nothing about ethnoveterinary medicine, however one of the three was present in one of the group interviews with the South-based AHAs and contributed examples of ethnoveterinary medicine that he knew. It is doubtful that a 50% sample of Ministry of Agriculture personnel and veterinarians is not representative of the larger population. Extracts from the interviews conducted with practitioners of ethnoveterinary medicine, AHAs, EOs and veterinarians contained themes related to the

'unscientific' and unvalidated nature of folk and ethnoveterinary medicine. These interview extracts are built into the matrices presented in the body of the chapter. The extracts represent views that were heard repeatedly throughout the fieldwork. Participant observation took place from 1996 - 2000 at the School of Veterinary Medicine; these interactions were used to confirm the initial observations in 1995. In 1997 the author also initiated an organising committee that planned to host an herbal medicine workshop in 1998. Extensive participant observation of nine meetings of this organising committee was conducted in the last quarter of 1997. Data from these meetings, the resulting Herbal conference, and the formation of the scientific association called the Caribbean Association of Researchers and Herbal Practitioners (CARAPA) are used to illustrate the operations of a newly created actor-network based on alternative knowledge.

Negative media coverage of folk medicine is also presented to show how this impacts on the survival of folk medicine. The media-related secondary source material was obtained from the daily newspapers existing in Trinidad and Tobago — the *Trinidad Guardian*, *Newsday* and the *Express*. Three library collections of media clippings on folk medicine were examined in 1995 and twelve articles dating from 1984 to 1994 were copied. Media clippings from 1996 – 1999 were taken from the authors' personal collections. Herbalists wrote eight of these articles and recommended folk medicine. Four articles were written by two doctors and a chemist and recommended caution. The last was an obituary for a well-known herbalist. Three extracts from these newspaper clippings are used as 'texts' to show how the struggle and conflict over the control of knowledge is conducted in the media and how emphases are placed on risks or benefits. A brief illustration of the extension work conducted by the PSU is used to show how information on ethnoveterinary medicine is shared in an actor-network.

Analysis: Science, technology and society

Scientific knowledge bases its claim to superiority on the basis of universal validity, since its methodologies are said to be applicable across time and space (Raedeke and Rikoon, 1997). This conception of science leads to an understanding of the world that exists outside of cultural and social contexts and ignores the origin of western science from very specific networks in specific institutions at particular times (Raedeke and Rikoon, 1997). Biomedicine can transfer almost intact from western countries because of its reference to the natural science paradigm and its standardised jargon and procedures (Brodwin, 1998). Biomedicine is similar to other formal institutions and ideologies such as schools or churches in which people must negotiate the discourse and social norms of western powers while failing or succeeding in holding on to local beliefs (Brodwin, 1998). However the cosmopolitanism of biomedicine has its limits since local medical beliefs exist in localised pockets.

Many of the professionals interviewed had personal knowledge of ethnoveterinary medicines, which were often identical to the folk medicines used for human illnesses. For example during a follow-up interview with veterinarian Churaman³¹ to obtain more details on the ethnoveterinary practices that he knew, Churaman called his mother to obtain the name of a medicinal plant that he had forgotten. Churaman claimed to be actively involved in collecting ethnoveterinary practices used for ruminants from the older villagers that he met in

³¹ All names are pseudonyms except for Chadband.

rural areas. He said that he used some of these practices with poorer rural clients. The following interview extracts will provide a richer picture of the socio-economic environment in which folk medicine exists. Veterinarian Ivan who was formerly in charge of the PSU notes how folk knowledge dies with its holder-practitioners:

"My old aunt was a walking encyclopaedia but she died. I wasn't willing to listen until I was in university and it was too late then. Folk medicine used to be recognised as real knowledge, but not by the modern generation. Plus their parents don't use it anymore. Where do you get folk medicine now? You cannot ask anymore. The old aunts used to say pick two leaves of this, four leaves of that."

The emphasis given to import substitution in manufacturing in the 1950s and 1960s led to shoddy manufactured goods. The perception that everything foreign is automatically better is seen in this interview extract:

"Old people used to know more about folk medicine but now everyone goes to the doctor. It is more convenient to go to the doctor around the corner. The doctors are wise enough to get medication from herbs. They can work out a dosage while we will just take two leaves and boil it. Foreign herbs are packaged. Foreigners are better salesmen. The herbs we use (for racing pigeons) are not manufactured locally. I don't know if they are available here. I see the success stories in foreign magazines. These stories encourage you to go and buy the same medication as that mentioned. Everything outside, foreign, is always better. It is substandard locally with funny labels on it. Some 'around the corner' herbalists don't know the Latin names of the plants, they are just selling. "

Harry's ideas are one actor's views on the acculturation process referred to in the ethnomedicinal literature which is always in evolution since it is always open to new ideas, discarding the ineffective and incorporating the latest remedies (Christoplos and Nitsch, 1996; Laguerre, 1987).

The western system produces curing and pain relief while simultaneously reproducing trust, authority and control (dominance) (Pappas, 1990). Through the respect and authority that doctors get from their helping activities they are also able to reinforce the status hierarchy (Pappas, 1990). When dominance is harnessed to professional interests exploitation results for example doctors can perform unnecessary procedures and withhold public access to information on drugs (Pappas, 1990). Dominant professions not only control the content of their own work, but also try to define the limits of the work practices of allied or competing occupational groups (Gilbert, 1998). Opportunity hoarding in professions can be allied to subordinating other disciplines as inferior (doctors versus veterinarians), limiting education and practice of the profession to an élite (students with the best marks rather than aptitude) or restricting other disciplines to one part of the body (dentistry) or one role (pharmacy) (Gilbert, 1998; Mathias, 1998).

Emulation - the copying of established organisational models and/or the transplanting of existing social relations from one setting to another helps the societal spread of the categorical inequality (Tilly, 1998). Professional dominance can involve what Foucault (1980) calls the operation of power through discursive practices, which make certain practices possible and excludes others. These operations of power are clearly demonstrated in Goodwin and Tangum (1998) who show that some of the scientific resistance to new ideas arises when 'outsiders' to the particular discipline in question act as 'usurpers' by

attempting to cross over to higher status professions. Scientific resistance to 'usurpers' acting as 'popularisers' who take their message directly to the public still exists as can be seen in the interview extract below from Scientist Guardia:

"Duke like Farnsworth³² and Awang tend to popularise, and challenge the system. Duke is a hard scientist, but he is fooling around, popularising. Scientists should know what they are doing when they popularise [they are] acting like novelists. [Duke, Farnsworth and Awang] can't get into the scientific literature so [they] have started popular magazines to establish guidelines on standardisation for adoption by countries. Readers might assume it's [the standardisation] happening already. They are challenging the system by making connections in WHO. WHO can't discuss 'Health for all', unless the Ministries strive through primary health care to legalize herbal medicine"

This phenomenon of professional control and the economic valuation of knowledge are hardly new as seen in the quote from a speech given in 1910 by L.O. Inniss the head of the Pharmacological society in Trinidad and Tobago.

Creole Remedies. Paper read before the pharmaceutical society by the President L.O. Inniss.

.....One wonders what those Creole remedies are, which succeed, when duly diplomaed scions of AEsculapius have signally failed and I have often tried to investigate some of the cases so as to find out these famous remedies -generally of the bush persuasion. It is not however at all an easy matter, as the votaries of Creole remedies, are very shy of giving anyone information about them, except he be a true believer in them and any signs of scepticism, at once close their mouths. Very often the almost miraculous cure, was the result of a **dream** (emphasis added). Someone came to them in a dream and told them to take two leaves of this bush and two pieces of the root of the bark of the other one, boil them together for an hour, then add ten cents worth of something from the doctors shop and take it for **nine days** and lo! the cure, which has defied the medico for so many weeks, was effected. At other times it is not a dream, but the result of a seance, "remede magnetism" as the Martiniquans call it. Every druggist is familiar with those pieces of paper, written in the most barbarous French, fearfully and wonderfully spelled in which roots and barks and leaves are all jumbled up with alcali, lavande rouge, vinaigre, quart voleurs and beaume tranquille and there is no doubt that those archaic and delphic remedies have been credited with more cures, than the most skilful and learned doctors have achieved. Let me say just here, that the Creole manner of diagnosing any disease is so simple that any one could pass as an MD after a few minutes explanation of the process. The sole and solitary cause of all diseases that Creole flesh is heir to is a cold—pleurisy is a severe cold, rheumatism is a cold in the blood, dysentery a cold in the bowels, asthma a cold on the chest, phthisis a cold on the lungs, influenza a fresh cold, etc, etc. There can be no doubt that many of our native herbs have good medicinal properties and it is well that people should know and use them, **especially in the country parts where doctors and pharmacies are few and far between**, (emphasis added) but I have always been induced to discount the value of these bush remedies, on account of the vague information their votaries seem to possess as to the dosage of them. Having been trained as a druggist and having had to pass many hours before my examination, learning the doses of medicine, I can't understand the fast and loose way in which these Creole remedies are prescribed. The only quantity mentioned is 'some'. If no one is ever killed by these Creole remedies, it must be because their virtues are very mild indeed. Then the numbers of them which are taken together are a great stumbling block to my faith in them; although there are some doctors who do a lot of that kind of thing too, as high as a dozen different ingredients in one mixture, so that if the Creole doctress errs in that respect, she does so in good company, and I ought not to throw it in her teeth. When the symptoms are very puzzling and the bush bath,

³² Dr. James A. Duke, Economic Botanist, USDA (Ret.), Dr. Dennis Awang, Medi-Plant Ltd., Canada, Dr. Norman Farnsworth, University of Illinois at Chicago.

tisanes and rubbings do not have any effect, the verdict is "she take cold all over", and then it is judged to be **time to send for the doctor and let him try with the doctor shop remedies. Then the druggist gets his innings** (emphasis added)

There are also on-going negotiations as to who can be recognised as an actor with 'visibility', and a 'voice'. An extract from a newspaper advertisement taken out by the late self-described research herbalist Chadband is reproduced below. Chadband claims that in his network of relationships he is recognised as an authority. However when he tries to enter a more professional network several strategies are employed to prevent this:

The names of the people worldwide I have helped are on record. I have the help of God. Every disease that is said to have no cure comes here. All I know is that I was called in by one of the *Dateline* Programme [TV show] officers, and was told that there was a meeting of the Dental Association and those who were called 'Quacks' were invited, and someone asked where I should be placed whether among the quacks? So, he was advised to ask me to present my papers, which I immediately did. Two months have since passed, and each time I make inquiries, I am told that they are very busy. (Chadband, 1987)

Chadband's claim that he was called a quack is one of two published in advertisements by Chadband and was also referred to in his eulogy published by one of the media houses. According to Latour (1988) some forms of knowledge are 'higher' than others because 'the superior have used their power to raise themselves with the connivance of the inferior'. Power is one aspect of relationships and is visible in the use of resources or 'using your strategies and skills to get others to do what you want' (Pappas, 1990). Power is then based on successful use and is present in all interpersonal interactions. Powerful professions can protect their task domain and professional boundaries from perceived encroachment (Gilbert, 1998). The irony is that herbalists have been the ones to see their boundaries encroached and their practices made illegal or sanctioned by professional medicine. It has been said by a veterinarian-insider that only two government employed veterinarians (one of whom has since migrated) did not limit their knowledge interactions with Animal Health Assistants (AHAs) in order to prevent these AHAs from setting up competing unofficial practices. The attitude of these two veterinarians was to teach the AHAs everything so that the farmers would get the best service possible. Categorical inequality results when those who have access to resources like knowledge put mechanisms in place to prevent others from accessing them by using opportunity hoarding (Tilly, 1998). Continuous access to and control of scientific resources requires the maintenance of distinctions between insiders like doctors and non-group members like herbalists and 'quacks' or between insiders and non-true scholars (Douglas, 1995; Tilly, 1998).

Maintenance of group control and guaranteeing continuity and the status quo can be obtained using gatekeeping tactics such as querying the credentials of traditional medicinal practitioners and writing a letter to the editor expressing caution over 'non-scientific' knowledge. Professional monopolisation of knowledge can involve calling a committee to investigate a new topic or a science-created problem, issuing a news release, or other everyday recurrent practices that maintain or modify the positions of the scientists vs. the 'uniformed layperson' (Tilly, 1998). Group control also occurs when 'big men' control ceremonies, select neophytes, exclude deviants and hierarchise research topics (Douglas, 1995). These professional boundaries can become locked into place, making them habitual and necessary to both insiders and outsiders (Tilly, 1998; Gilbert, 1998). When science as a

whole and all associated professional associations adopt the same categorical distinctions, these distinctions become more omnipresent and deep-rooted (Tilly, 1998).

The term professional gatekeeping is familiar to those involved in conventional science trying to incorporate new insights or paradigms into a discipline when those insights contradict well established theories (Goodwin and Tangum, 1998; Spender, 1981). Professional gatekeeping can include political ritual or exerting social authority. Other gatekeeping practices are hosting a conference to establish a new subject area, or calling for more research before action on a specific area can be taken. Longino (1993) has claimed that power is not located [only] in texts, but exercised through texts by those who rule. The newspaper extract that follows shows an individual act of gatekeeping. A heart specialist Kenroy, through the intermediary of a letter to the editor, uses denouncing language against the uninformed laypersons:

'I wish to comment on material contained in an article in the *Trinidad Guardian* under the headline *Ayurveda Prevention Centre uses local herbs to fight disease*. With reference to the advised usage of local medicinal plants to 'cure' a wide range of illnesses, I wish to warn: much research requires to be done on this subject before attributing properties to certain plants. The fact that a particular plant might have customarily been used for a particular illness is no proof whatsoever as to the medicinal efficacy of that plant. [Lists 7 doubtful uses then says] The situation could be considered mildly amusing if only minor illnesses were involved in this herbarium brew. However, when one begins to discuss diabetes, cancer, hypertension, and leprosy, as being possible indications for the use of unproven herbal medicine, we are letting ourselves in for a great deal of trouble, and risking lives. This is dangerous tomfoolery, and the proposed practice should not be allowed to go unchallenged, especially when traditional medicine has so many proven means of management of these illnesses. []. I fear the Greeks even when they bring gifts. Let this be a warning. [Mentions a book on medicinal plants written by an academic]. The research goes on []. In the meantime, let us be careful and do not make fools of ourselves by dispassionately imbibing without forethought any form of witches' brew, that might be inflicted on us by any charlatans, who might suddenly appear out of the blue'. (*Trinidad Guardian* 1988).

The research referred to in the letter above was conducted prior to 1988 in Trinidad and Tobago and it was minimal, concentrated on 'poisonous' plants, and was not written in a way that made it accessible to the lay public (Lans, 1996). Despite this the lay public is being cautioned not to bypass it. This heart specialist wrote a similar letter in 1999 published in two newspapers (*Express* July 3, 1999; *Newsday* July 5, 1999 pg. 24), repeating his warnings against vague and unproven remedies and added brief accounts of three patients who were adversely affected by taking a herbalist's advice instead of his own, one of whom died. This letter in turn generated two feature articles in the *Express* newspaper (*Express* July 18, 1999 pg. 7; *Express* July 20, pg. 21) in which the writer(s) claimed that:

'...many [] remain adamant that herbalists are little more than charlatans promising their patients miracle remedies. One of these is [Kenroy] who has noted a marked increase in the use of alternative forms by his patients'. (*Express* July 18, 1999 pg. 7).. an Arima-based herbal company has accused [Kenroy] of doing a hatchet job on the (herbal) industry....[the owner of this company claims that] 'Government [is] looking at the implementation of complementary medicine within the National Drug Policy. In the interim doctors like Kenroy were hiding behind the laws of the country which give doctors a monopoly on health care'³³ (*Express* July 20, 1999, pg. 21).

³³ British law in the Commonwealth forbids the sale of bush teas as medicines.

If Kenroy has noted a marked increase in the use of alternative forms by his patients, this might be related to recent findings of high levels of patient dissatisfaction related to inadequate communication of information by doctors to their female patients, and an apparent insensitivity to the patients' condition (Phillips, 1996). High levels of professional dominance were noted in a sample of obstetric and gynaecology wards in four of Trinidad and Tobago's public hospitals and there was also evidence of negligence, incompetence, malpractice and evasive practices (Phillips, 1996).

One source of the patient dissatisfaction may be related to the differences in traditional versus western medical systems. Western medical practitioners look at symptoms as subjective, which have to be tested and validated through a battery of 'objective' diagnostic tests. In contrast, patients seeking traditional cures sometimes present self-diagnosed illnesses for validation by the traditional practitioner (Tan, 1989; Mischel, 1959; Croom, 1983). This is an example of a strong hermeneutic model, with a small social, psychological and professional distance between the patient and the healer. In the hermeneutic model some terms are accepted by the patient and the healer as subjective expressions of the pain, in addition to being objective and implicitly valid explanations for the illness itself. In addition, individual perceptions of the efficacy of therapy, the medication, or even the healer, are shared and incorporated into the folk medical system (Tan, 1989).

In the next section the process through which folk knowledge is being marginalised through micro-practices of power and the beneficiaries and losers of this marginalisation process are presented in Matrices. Matrix 2 below uses a moderate form of constructivism (Henry, 1998) and the Actor network theory, and links these to science and technology. Actors in the matrix are portrayed in two dimensions, as a set of strategies that exercise power and as a set of materials that are the end results of those strategies (Law, 1991).

Matrix 2. Science, Technology and Society (STS), and this research

Term	Definition	Consequence
Maintenance	Maintaining power by constituting a set of relations and holding these in place. This set of relationships becomes the actor-network	Retention of scientific objectivity and standard dosage as norms makes it difficult for alternatives to take shape
Distribution	A set of relations is constituted between elements of the network. The original actor network is enlarged by enrolling others and maintaining the structure	Pioneers bring IK into 'normal science' they give it respectability and so are able to enrol others
Circuits	Patterns in the network are circuits that reproduce themselves and their distributive effects. Another form of maintenance	Conferences and newsletters are circuits. So are regional institutes that are set up worldwide to investigate, document and share information
Social Relations	The distribution goes on to regulate the relations between elements. Through social relations norms are maintained and left unchallenged to become self-evident	Farmers are not considered to be information producers in normal science.

Source: Law (1991) and Henry (1998).

Actor-networks such as universities and research institutions grow by enrolling other entities. Entities here mean students, other scientists and their institutions. The heads of these actor networks are successful based on their 'translating' the projects and purposes of these other 'entities', and establishing themselves as the spokesmen of those who are being

associated (Callon, 1987). The [core] translator thus makes the enrolment either desirable or unavoidable from the standpoint of the [peripheral] entity being enrolled (Collins, 1981), using research and development funds for example (Alatas, 1993). Scientific objectivity is one [translation] that the dominant group uses to deny other people access to power, political power or fact-making power (Hubbard, 1988). The Actor network theory shows that Science continues to be powerful because its adherents attempt to replicate the conditions of the lab in the field. They do this because it is economically beneficial for the entire interlinked Science-Research-Industry Network (Kloppenborg, 1992). Research is then not invested in those areas of research that cannot be quickly or easily packaged and sold (Kloppenborg, 1992). This is easily justified because professionals can and do claim that theirs is the only information that possesses the ability to generate valid (plausible) findings. The Network of Science-Industry becomes linked to the global Communication network, through reputable scientific journals. These journals are very conservative about publishing 'alternative theories' like homeopathy and chaos (Witt et. al, 1989; Gleick, 1987). The result is that information that is 'good enough' but is not acceptable to the critical community and scientific tradition for what ever reason, is quietly shelved and farmers who might profit from such information do not get it (Walter 1992, 1993).

The way that alternative knowledge can be brought into science to be validated and a real world example of the term 'distribution' in Matrix 2 is best illustrated those working in ethnoveterinary medicine. These pioneers have been able to publish books (McCorkle *et al.* 1996), host participatory conferences (IIRR, 1994) and set up an email Ethnoveterinary mailing list under the auspices of NUFFIC³⁴ in the Netherlands. This mailing list is a good example of a circuit. A regional collaboratory body like TRAMIL (Traditional Medicine in the Islands) that has been set up to investigate, document and share information on Caribbean folk medicine could be described as a very useful circuit. These pioneering efforts in addition to those of the late Dr. M. Warren and others have given indigenous knowledge respectability in certain quarters.

The beneficial effects of a scientific actor-network can also be illustrated by the PSU. The PSU was always extension-based despite the views of the Head of the Veterinary Services expressed at staff meetings that the 'animal health service was not about extension'. The PSU's philosophy was always to treat the farm, not sick animals and they made regular farm visits as well as responding to calls from farmers. In the interviews conducted with the AHAs of the PSU they stated that they had learnt of folk medicinal practices from farmers, neighbours and relatives. Poultry farmer-experimenters were conducting informal experiments on medicinal plants due to economic constraints in the poultry industry (Lans and Brown, 1998a). Since the external financial situation was unpredictable due to structural adjustment and the entire industry was based on external inputs, farmers made an opportunistic and rational decision to see if they could replace imported drugs with farm-grown medicinal plants. The medicinal plants were tested for common health problems on poultry farms such as reduced appetite, chick mortality, heat stress and respiratory conditions. The plants tested were *Aloe vera*, *Momordica charantia* and *Citrus* species. The plants were administered to the chickens by placing them in the drinking water. The AHAs monitored the progress of these informal experiments and informed the rest of the PSU about them at weekly meetings. Information also flowed in the opposite direction with the PSU Head of Unit and staff informing farmers of any scientific work being done outside the Caribbean on medicinal plants that could be useful under local

³⁴ Netherlands Organization for International Co-operation in Higher Education.

conditions. Three criteria were used to assess which information from the farmers' experiments should be disseminated by the PSU to other farmers: the investigated medicinal plants were seen to have a positive impact on production parameters, no harmful effects were seen, and the farmer-experimenters were repeat users of the technology. A dose was worked out for each plant but this was offered as a guideline for farmers to work with and not as a standard.

The farmer-experimenters were all intensive poultry producers using open water systems based on bell or trough-type automatic drinkers which are gravity fed from overhead storage tanks. The broiler houses are typically floor-rearing systems with bagasse- and/or wood shaving based litter and wire mesh side walls. The development of the medicinal plant technology by poultry farmers and the similarity of all broiler systems made it easy for this medicinal plant technology to be diffused by the PSU to several other farmers. Factors affecting the success of the diffusion process include the simple methods of preparing the plants for administration to the birds. In addition the plants were easily available, relatively hardy and easily grown on-farm and were already part of the culture and diet of the farmers. Since the plant products were natural it was assumed that overdosing would not be detrimental. Additionally the impact of the technology was expressed in improved health and decreased mortality, both of which were easily monitored by farmers and should have a positive impact on farm profitability.

Farmers attached to one large integrator were using medicinal plants but that integrator was not told since the perception was that the managers would object. The large poultry integrators rely on the PSU staff to solve their poultry health problems. Two integrators adopted the use of garlic to enhance productivity. As large operators they were even more concerned than the farmers with exact dosages, effectiveness, availability of the plants for large flock sizes (e.g. 10,000+), and how the medicinal plant compared to conventional drugs in terms of effectiveness. The smaller operators who use garlic are primarily East Indian farmers in South Trinidad. All the farmers who use garlic use garlic corms purchased in the market or supermarket. Dr. Brown of the PSU read the Solvay Animal Health research on *Aloe vera*³⁵; which indicated that the use of acemannan enhanced the chicks's immune response to Marek's disease vaccine; this information suggested that *Aloe vera* products might also enhance the response to other vaccines. Based on this information PSU staff then began suggesting that farmers give *Aloe vera* around vaccination time although the PSU did not know if *Aloe vera* worked similarly when given orally. When farmers started adding plant products to the drinking water no one thought about immunomodulatory activity and any such effect would have been a beneficial "side effect". The ideas about immunomodulatory activity only arose after Dr. Brown read about Solvay's work with acemannan. The company literature outlined the conventional trials, the active ingredient in the *Aloe vera*, the proper dosage, cost, and the specific use. Dr. Brown, the PSU, the large integrators and some farmers appreciated the research and technology used to study the medicinal plants they had long been accustomed to using since this natural product research paralleled that described in the literature on conventional drugs that they were given from western drug suppliers.

An exact match between programme and goal defined in modern scientific terms, is not as important for sustainability as the feedback of information which might continuously

³⁵ Karaca, K., Sharma, J.M and Nordgren, R. 1995. Nitric oxide production by chicken macrophages activated by acemannan, a complex carbohydrate extracted from *Aloe vera*. Int. J. Immunopharmac., 17 (3), 183-188.

adjust one with the other (Hornborg, 1996). The PSU demonstrates how science and extension can benefit from this type of feedback. The close connection to farmers is partly due to the diagnostic services that the PSU provides. The former head of the PSU was responsible for all post-mortem examinations of diseased birds. This gave him credibility and institutionalised an interactive relationship with poultry farmers. This interaction facilitated trust between the two sides and also gave the farmers a demand-pull on the PSU to provide solutions for the health problems on their farms. Due to his involvement in these post-mortem examinations the PSU head had complete knowledge of on-farm conditions and knew which farmer-knowledge was of most beneficial to those conditions. Healthy flocks would imply a reduction of his need to perform post-mortem examinations and this reduced workload could then be considered an incentive for effective implementation of appropriate research.

Schon (1991, p.50) refers to tacit knowledge as knowing-in-action, which will remain implicit unless effort is used to make it explicit. Reflection-in-action is usually triggered by some 'disorientating dilemma' (like economic constraints coupled with disease problems). The disorientation is faced when the actions habitually guided by tacit knowledge do not produce the results expected from previous experience and problem setting and reflection are needed to bring about a paradigm shift which then determines the next action (farmers experimentation) (Hatten *et al.*, 2000). Reflection-on-action occurs when post mortem examinations are carried out after the use of ethnoveterinary medicines. Feedback to farmers stimulates reflection, which encourages the PSU and farmers to continue experimentation and develop new insights. The PSU as a 'reflective practitioner' is then practising the art of transformative learning (Hatten *et al.*, 2000). Professional expertise then becomes as much 'art' as knowledge (Schon, 1991, p.50).

In the actor-network of the government veterinary service one of the intermediaries was drugs and the reliance on drugs did shape the network. The PSU staff never carried drugs, after the farm diagnosis they told farmers what drugs to buy. Other government veterinarians had the opposite approach. They carried drugs to treat sick animals and only visited farms when called by the farmer for a specific case. These veterinarians only looked at the sick animal, they never discussed the underlying farm management problem, never dealt with poultry, and they were often juggling their Government job with their own private practices. The PSU decided to sell advice rather than drugs because they did not want to deal with receipts, cash theft or have to account for the cash received from farmers. Other veterinarians sold drugs at cost price plus ten percent. The PSU did not want its staff to have the incentive to return to the farm to sell more drugs. In the late 1980s and in 1998/1999 the Ministry of Agriculture did not have the finances to provide drugs for its veterinary staff who responded by saying that they could not service the farmers without a full car trunk of drugs. This official network declined whenever there was a shortage of drugs. The PSU staff had empty car trunks and blossomed with folk medicine, which was seen as an alternative to expensive drugs and antibiotics. The PSU tried to help farmers using whatever means was at their disposal and also gave advice on other species besides poultry. Farmers were told what management steps they needed to take to alleviate their problems.

Actor-networks as constraining forces

Some professionals in Third World countries are distant from some of the constraining norms of western science since they are restricted economically from participating in the homogenising circuit of international conferences, workshops and journals (Jiggins, 1989; Brodwin, 1998). Perhaps because the majority of veterinarians were not interested in poultry health, the veterinarians in charge of Animal Health in the Ministry of Agriculture did not put any constraints on the PSU and did not monitor their activities closely. Other veterinarians were more fully enrolled in regional scientific networks where conventions guide behaviour (de Sousa and Busch, 1998). The strength of these scientific constraints is illustrated by Sillitoe (1998) who calls the Participatory Technology Development school "the radical farmer-participatory wing, which proposes that poor producers, should set research agendas"... "to suggest to a research scientist that farmers should set the research agenda would appear incomprehensible and ridiculousthreatening such violence to scientific work as to stop it dead in its tracks" (Sillitoe, 1998).

The term 'circuits' in Matrix 2 is best illustrated by the history of the First International Workshop on Herbal Medicine in the Caribbean (FIWHMC). It was hosted in 1998 by the School of Veterinary Medicine of the University, a local NGO-the Caribbean Network for Integrated Rural Development (CNIRD), and a regional organisation the Inter-American Institute for Co-operation in Agriculture (IICA). The original idea was to have a participatory workshop similar to the one that resulted in the publication Ethnoveterinary medicine in Asia: An information kit on traditional animal health care practices (IIRR, 1994). The originator of the workshop idea invited CNIRD because it was a locally-based NGO with Caribbean-wide projects. It was felt that the involvement of CNIRD would help focus the workshop committee on the original goal of a participatory workshop that would ultimately benefit small-scale herbalists and farmers. CNIRD's mandate is integrated rural development. CNIRD quickly recognised that its client group of micro-entrepreneurs involved in herbal medicines could be helped with a medicinal plant-based project. CNIRD also recognised the scepticism that exists about available non-standardised herbal products.

However after numerous committee meetings and the involvement of the Inter-American Institute for Co-operation on Agriculture (IICA), the coalitions in the committee and the focus for the conference shifted. The result was a conference held with great fanfare at the Holiday Inn Hotel in Trinidad in April 1998 with the main presenters being scientists (field notes and various Minutes of the FIWHMC Organising Committee). At the first Herbal medicine conference an umbrella organisation the Caribbean Association of Researchers and Herbal Practitioners (CARAPA)³⁶ was formed. The Trinidad and Tobago Steering

³⁶ The Caribbean Association of Researchers and Herbal Practitioners (CARAPA) promotes responsible bioprospecting and the appropriate use of Indigenous Caribbean herbs, based on sound information about their properties and their therapeutic effectiveness. CARAPA is the Amerindian name of the indigenous evergreen Caribbean tree *Carapa guianensis*.

CARAPA's mission is: 1. To establish with all national authorities and in the public mind, the recognition of herbs that are proven to be safe and effective; provide sound therapeutic approaches for treating and preventing disease conditions in man and animals. 2. To promote the development of a sustainable herbal industry based on the safe and cost effective use of herbal therapies. CARAPA's goals are the following : Excellence in dissemination of carefully analyzed information, among members, within countries and in the region, on production, processing / marketing and use of Caribbean herbs. Developing and strengthening formal and informal networks for exchange / dissemination of information. Strengthening institutional support for the three levels of activity, production, processing / marketing and use of Caribbean herbs. Supporting and/or initiating relevant research activities. CARAPA has the following specific objectives: To establish a forum for the generation and exchange of ideas and information among persons involved in all aspects related to herbal medicines in the Caribbean. To facilitate collection and dissemination of information among individuals, groups and institutions engaged in herbal medicines and to support networking with all existing information channels. To ensure that all information resulting from the networking described above is accessible

Committee of CARAPA comprised six scientists and one herbalist with a B.Sc. in Botany. The Caribbean island and South American mainland representatives of CARAPA-Trinidad, CARAPA-Jamaica and CARAPA-St. Lucia were again scientists. This was to be expected since scientists were the main participants of the first Conference (CNIRD, 1998). This means that successful 'translation' has taken place since the original committee grew into an actor network by enrolling other entities and shaped the second conference in the U.S. Virgin Islands (UVI) on June 14 - 16, 1999 as seen in the extract below:

'The [CARAPA] meeting agreed with the [UVI representative] that attendance at the technical sessions of the [UVI] conference should be restricted to serious herbalists, producers and students while other sessions could be available to the interested public... The meeting also agreed that pharmaceutical companies and business interests should be invited to participate in the conference since their business and marketing expertise was needed' (CARAPA minutes April 7th 1999).

The former head of the PSU who was now in academia did not challenge the form that this first conference took. Non-scientific members of the original Organising Committee either fell by the wayside or went along with the majority. The extensive discussion sessions of the first conference were reproduced at the end of the proceedings³⁷ (print and CD-ROM versions) to 'prove' that the conference had been 'participatory'. It seems as if the scientists faced with 'new' traditional knowledge fell back on a reliance on a static frame of reference or exhibited 'single loop learning' (Argyris and Schon, 1974, p.18). The adjustment of organisation action was sufficient to correct for the exclusion of folk medicine from science without questioning the validity of existing scientific norms or scientific conference practices (Bontis and Choo, in press). The problem of bringing folk medicine into science was then solved based on previous experience of how conferences are organised and on proven ways of creating networks (Hatten *et al.*, 2000).

The term 'social relations' is then clearly demonstrated: since these are Conferences organised by scientists in venues like the Holiday Inn Trinidad and Hotel on the Cay U.S. Virgin Islands, the typical practitioners of folk medicine (grannies and great aunts) are represented only by the data they have reported to those presenting research papers. This is an example of exploitation in that scientists commanded data from female herbalists from which they drew significantly increased returns by co-ordinating the lifetime effort of the herbalists into presented papers while excluding the herbalists from conference participation and societal recognition by hosting the conference in such a formal venue and in such a formal way (Tilly, 1998).

The example of CARAPA and the annual Conferences on Herbal Medicine shows that while scientists can be enrolled into a newly created actor-network based on alternative knowledge, previous relationships built on hierarchy, professional norms and bureaucracy have great influence over the direction of the new network and the creation of durable materials³⁸ (Law, 1991). Matrix 3 demonstrates the routine ways in which the categories of 'science' and 'folk medicine' are constituted.

to all grassroots communities. To ensure that there are provisions for protecting the intellectual property rights of all parties including individual persons, researchers, herbal practitioners, communities, and the cultural integrity of local communities.

³⁷ Herbal Medicine in the Caribbean: to restore a Caribbean heritage. Proc. First International Workshop, Port of Spain, Trinidad and Tobago, 6 - 8 April, 1998, CNIRD.

³⁸ One very useful 'durable material' was the compilation of all the resources available on herbal medicine in the UVI library that was prepared for and made available at this 'First International Workshop'.

As in Matrix 2 the terms and definitions are taken from (Law, 1991). Each row in Matrix 3 has a term its definition and the 'real world' or 'scientific world' application of the term and definition.

Matrix 3. Terms and theories of the actor-network concept

Terms and Definition	Application
An actor is any entity able to define and build a world filled with other entities and intermediaries (Callon, 1991).	Intermediaries are texts, funding, instruments and drugs and they evolve and describe their networks (Callon, 1991).
A network is a set of relations of heterogeneous elements. This is constituted and held in place (Callon, 1987). Scientists' networks have conventions of use about materials, goods and standards. It is costly professionally speaking to practice outside these conventions (Star, 1991). Publishing, foreign labs, scientific articles and prestigious journals are networks with standards. Hiring, promotion and tenure are linked to the network.	Because of the network structure agricultural scientists have sought to control nature in order to be regarded as conventional scientists. Scientists think it is normal to concentrate on locality neutral, standardised agriculture, seeking generalisable solutions to problems by testing hypotheses under controlled and replicable conditions (Molnar <i>et al.</i> , 1992), farmers who do the opposite do not fit the norm. Those farmers who resist conventional technology are termed laggards (Flora, 1992).
Translation is the process in which actor networks grow by enrolling other entities. It generates a shared space. Stable relationships in the network come by disciplining or maintaining that translation, so that there is no deviation from accepted theories (Star, 1991). <i>Invisible colleges</i> are informal networks of eminent scientists and groups of lesser or younger scientists propagating their ideas, without deviating (Dolby, 1979).	Professional gatekeeping practices prevent alternative research from appearing in mainstream channels (Spender, 1981). Agency is the conversion of synergy into resources and resources into networks (Foucault, 1979). These networks can suppress research findings or persecute dissidents or deny tenure (Molnar <i>et al.</i> , 1992). Dominant research traditions reduce other perspectives to the status of 'craft' or folk wisdom (Kloppenborg, 1991).
Convergence is a measure of agreement and has two aspects, alignment and co-ordination (Callon, 1991). By using alignment and co-ordination the network becomes an indispensable, irreversible passageway of constraining norms through which all the other entities that make up its world must pass. Definitions, problematisation, codification and publishing in the <i>right journals</i> are some of these strategies. Translation depends on the capacity of the actor-network to work together and to define and enrol those entities, which might challenge the dominant ideas and theories. Successful translation makes a theory self-evident and buries the debates of the initial theory formation stage (Callon, 1991).	There are scientific conventions about whom may speak on behalf of whom (Callon, 1991). If scientists invest with agribusiness and entities at the cutting edge of science and technology they are recognised as standard setters (Star, 1991). Junior scientists enrol in standardised technologies and organised scientific programs which are influenced by industry to benefit from the privileges attached to the network (Star, 1991), rather than branch off into uncharted territory. Social interests and these individual actions shape science. There are structures of dependency like access to funding and equipment that link developed world and Third World scientists (Alatas, 1993) which affects their research choices.
Weak convergence and partial commitments mean that the translations were not durable or robust but unsuccessful. One actor cannot speak for the others. The experts' status is questioned. The expert finds it hard to mobilise other parts of the network like research funds and government support (Callon, 1991).	Those who are non-members of the community of practice, or standard network, suffer (Star, 1991). For example researchers who have no access to labs, funds and equipment cannot take part in the standardisation process. The network as a whole cannot focus its efforts.

The usefulness of the term convergence in Matrix 3 is best illustrated by the debate over dosages in folk medicine. The scientific dichotomy of objectivity vs. subjectivity underpins scientists' claims to status by emphasising the distinctiveness of their working practices from those that they characterise as 'ordinary understanding'. One of the strategies by which the scientific actor-network renders itself indispensable and suppresses dissent is by convergence which involves co-ordination and alignment. The strategies of alignment and co-ordination are constraining norms that make the scientific actor-network an almost indispensable, irreversible passageway through which all other knowledge must pass. For example, clinical anthropologists are sometimes encouraged to participate in medical discourse and drop their anthropological insights which are considered an inappropriate incursion of political ideology into the domain of scientific medicine (Baer, 1993).

The call for standardised dosages is one of these constraining norms as can be seen in the following interview extract. Veterinarian Nunes claims that a disadvantage of folk medicine is the vagueness of the dosages:

"There is some truth in it, but you need to find out what the active ingredient is. I don't believe in 'bush'. There is some truth, but the problem is dosage. In Cotton leaf, [*Gossypium* species] there must be some active ingredient, no one has never tried to formulate it. I tell my clients if you boil three leaves, how do you know the season, the health of the plant, you can't control the dose³⁹. The majority of dogs are still full of worms. Cotton bush might be good for roundworms. Pea pod (*Cajanus cajan*) for worms, that is a recent one, they boil it up."

The consequence of this scientific attitude is that folk medicine remains 'unproven' due to its un-standardised dosages and it needs scientific 'validation' as claimed by Veterinarian Singh:

"Before selling folk medicine you have to validate it with some company."

Another consequence of this attitude is that potent (but perhaps problematic) leads for the development of antidepressive therapeutics and other medicines have not been used (Hasrat *et al*, 1997b). To show that Trinidad and Tobago scientists are as similarly constrained by the actor-network as their foreign counterparts an extract from an editorial written by western scientists is presented below:

Alternative medicine [has] an ideology that ignores biologic mechanisms, often disparages modern science, and relies on [] purported [] ancient practice[s] and natural remedies (which are seen as somehow being simultaneously more potent and less toxic than conventional medicine). Accordingly, herbs or mixtures of herbs are considered superior to the active compounds isolated in the laboratory. And healing methods [] are fervently promoted despite not only the lack of good clinical evidence of effectiveness, but the presence of a rationale that violates fundamental scientific laws ...surely a circumstance that requires more, rather than less, evidence...Therapeutic successes with botanicals came at great human cost. The indications for using a given botanical were ill defined, dosage was arbitrary because the concentrations of the active ingredient were unknown....Now with increased interest in alternative medicine, we see a reversion to irrational approaches to medical practice, even while scientific medicine is making

³⁹ Passreiter and Medinilla Aldana (1998) found that sesquiterpene lactones in *Neurolaena lobata* cultivated in Guatemala differed quantitatively from those in natural populations.

some of its most dramatic advances...It is time for the scientific community to stop giving alternative medicine a free ride. (Angell and Kassirer, 1998)

This extract from Angell and Kassirer (1998) reflects the political processes and the technological 'pushes' that determine what knowledge is considered relevant by the dominant knowledge makers (Juska and Busch, 1994). It is also a good example of how stable relationships in the scientific actor-network come by disciplining or maintaining translations so that there are no deviations from accepted theories. The rhetorical task of upholding one's own construction of science seems to necessitate undermining or ignoring alternative interpretations (Foucault, 1980; Goodwin and Tangum, 1998). Scientific medicine is currently based on evidence based medicine which means that a therapy has been shown to improve well-defined patient outcomes by well-designed, appropriately powered, randomised, controlled clinical trials (Dalen, 1998). All drugs that have been approved by the American Food and Drug Administration (FDA) since the 1960s have met this standard, however many therapies introduced before the 1960s do not (Dalen, 1998). Three of the major antithrombotic agents prescribed by western-trained physicians were introduced prior to the randomised clinical trial, these are wafarin, aspirin and heparin and up to 1998 were still not evidence based (Dalen, 1998). Other medicinal practices adopted before they were subjected to clinical trials according to Dalen (1998) are coronary artery bypass grafts—the efficacy of this procedure based on early reports was described as self-evident. Percutaneous transluminal coronary angioplasty was performed in hundreds of thousands of patients from 1979 until 1992 when the first randomised clinical trial demonstrating efficacy was conducted (Dalen, 1998). Bedside pulmonary artery catheterization has been performed millions of times since 1970 and is still devoid of 'good clinical evidence of effectiveness' (Dalen, 1998). None of these non-evidence based practices or others like them are described as unconventional or quackery because they were introduced from the mainstream of western medicine (Dalen, 1998). In this sense western science is different from Creolization-derived technologies. Good Creolization means that the origin of an idea is not important, only that it works in the local context (Richards, 1996).

Complicated realities and weak convergence

Matrices 2 and 3 demonstrate that networks incorporate many social and economic factors that shape and guide knowledge and actors. In this complex reality professionals assert their dominance and use information control and political ritual to maintain the lay publics' confidence and respect; for few scientists want to acknowledge the uncertainty and unpredictability of science and technology (Kloppenburger, 1992). Folk knowledge exists in (marginalised) parallel to western science (Laguerre, 1987; Lans, 1996). Allopathic practitioners have legal rights but other practitioners are free to work as long as they do not claim to be doctors. The limits placed on who is recognised as a valid health practitioner is one factor that preserves the unequal status between 'western trained' and empirically trained health providers. Extracts from interviews conducted with the veterinarians will be used to illustrate how well-established actor-networks seem to insist on annihilating personal experience; instead Star (1991) claims that scientists behave as if the standardised science network is the only 'valued' reality there is, like veterinarians Ames, Singh and Inniss quoted above:

"The Folk claims are not valid, they are psychological. Seventy-five percent would have healed anyway. They have a false sense of security, clients might bring the animal to the vet too late, after they first mis-diagnose it."

"Maybe if we find that the use of folk medicine seems to have efficacy, we could do trials to see how it works. The use of folk medicine doesn't affect veterinarians. I am not aware that there has been any demonstrated efficacy of folk medicine. Even if they use it, if they are in trouble they call the veterinarian, especially modern farmers. Hindu pundits' jharay animals (conduct a religious ritual for them) then the farmer will call the veterinarian. But I tell them don't call the veterinarian so late, call the pundit after the veterinarian, don't wait so long."

"Science requires years of research, hard work, man has to pay and work. Periwinkle (*Catharanthus roseus*) extracts weren't discovered by accident, Periwinkle was tested by biochemists for years⁴⁰. Drugs are made so patients don't absorb alkaloids when they are ingested, that is why science is important to unlock chemicals and synthesise drugs..... My granny knows about Kojo root (*Petiveria alliacea*). She puts it in the chicken's nests, it is a potent insecticide, it smells very bad and it keeps away snakes. I swear by this folk medicine."

In the interview extract above, the veterinarian showed the dichotomy of having a cultural base in folk medicine and a professional standing in 'science'. Callon (1991) claims that actors and actor-networks are hybrid groups, which are always prone to dissension and internal crises. Matrix 4 does not introduce anything new but builds on Matrices 2 and 3 and shows how the international scientific actor-network impacts on Trinidad and Tobago's scientists and professionals (Lans, 1996). The struggle over science versus traditional is more complex than can be depicted in Matrix 4.

Ramlal echoes the financial and other constraints reflected by the Ministry of Food and Marine Exploitation Annual Report 1990. His views also illustrate the term in Matrix 4 called weak convergence:

"There is no money here to do research. There is no Pharmacology Dept., only Chemistry. CARIRI⁴¹ will only do work if paid, but few can pay. Foreign research is misapplied in the Caribbean."

Weak convergence and the structures of dependency between developing world and developed world scientists (Alatas, 1993) can also be seen in an interview quote from scientist Guardia who has conducted research into poisonous plants.

"[We do] Research here in chemical synthesis with no water, no chemicals, no electrical power, and the chemicals are very expensive or toxic. Others do their chemistry in another place; they go and spend 3 months in the USA, and pay for the facilities to do Chemistry. For [my work in] poisonous plants the first necessary step was to get other people to do the tests. Further tests were done in the United Kingdom. I also have University of Toronto connections. I spent two summers in Toronto, so I had money and equipment."

⁴⁰ Periwinkle was being used traditionally to treat diabetes and became useful to treat cancers. Barsh (1997) points out that no ethnography was done to establish that this property of *C. roseus* was previously unknown.

⁴¹ CARIRI is the acronym of the Caribbean Research Institute, based at the University of the West Indies, Trinidad and Tobago.

Matrix 4. The Trinidad and Tobago scientific and societal actor network

Terms and Definition	Scientist/public response	Consequence
A stabilised network is only stable for those members who form/use/maintain it. Network users who are non-members of the community of practice suffer (Star, 1991). Scientist-communities of practice, have conventions of use.	Scientists often take sabbaticals to do research in other countries so they can publish. Scientific texts are networks for the in-crowd. Social management of trust moves from herbalist to professionals.	Trinidad and Tobago scientists sign on to the standardised technologies in order to gain from already established external scientific networks. This is a network with established norms.
The Gatekeeper standpoint the strategies by which an actor-network becomes indispensable and maintains itself. Eminent scientists become gatekeepers. Gatekeeping influences topic selection and research funding for most scientists.	Folk medicine is not 'modern', or 'progressive'. Research is done on 'poisonous' plants, and 'weed' control.	Peer review and publishing in the 'right' journals excludes folk medicine from animal health science.
An intermediary is anything passing between actors, which defines the relationship between them. Intermediaries describe their networks; they compose them by giving them order and form. Knowledge and funding, scientific articles, drugs, instruments and software are intermediaries (Callon, 1991).	'Foreign' science is more profitable career-wise. Agro-chemical shops and Pharmacies sell drugs to farmers without prescriptions leading to abuse of drugs. There is no monitoring of drug residues at the abattoir.	'Uncertain' folk medicine discarded in favour of 'certain' imported drugs. Discarding of local knowledge as folklore. Foreign technology becomes embedded in local social networks. Institutionalisation.
Every enrolment entails both a failure to enrol and a partial destruction of the world of the non-enrolled (Star, 1991).	Rejection of folk medicine as an actor since some involved in the conventional drug industry are afraid of loss of sales if farmers use their own plant-based solutions.	The joint creation / nullification of knowledge: Farmers and herbalists want to gain some autonomy and prestige for their own knowledge, but are actively discouraged.
Partial signings-on and commitments, no intermediaries, no standardised package, all lead to a Weakly convergent network.	Under-funded actors in the Ministry of Agriculture find their status is constantly in question and it is difficult to mobilise other parts of the network.	Veterinarians do not get sufficient resources from Government. Without money vets have less power so farmers use their own strategies.

Real world conditions constrain the attempts of the professionals to marginalise other healers. These real world conditions result in partial enrolment and a weakly convergent network. Clients and livestock keepers continuously challenge the Trinidad and Tobago veterinarian's claims to be the sole source of animal health knowledge. This is illustrated by quotes from farmers Ganesh and Haskell presented below. These farmers were treating their own animals after the veterinarian had failed to provide solutions. They were confident of their own solutions under certain circumstances.

"My Cow got away, it had a sore that remained for two years. The cow was tied by the horn so that it couldn't lick the sore. The veterinarian said to shoot it. I used a poultice of rchette (*Nopalea cochenillifera*), flour and water. It recovered. "

"My first cow in 1968 gave trouble to make young. The veterinarian said to put it on the table [slaughter it]. My neighbour told me to use Epsom salts and *Aloe vera*. I have had many offspring from that cow since. I have 7 cows now and I gave some to relatives."

Conclusion

The debates between science and non-science presented in this chapter point to an underlying structure in which the actors position themselves. The matrices, clippings and interviews showed the different actors trying to define legitimate health services and health providers, and then trying to persuade others to subscribe to those definitions. The temporarily stabilised outcome of these negotiations is the preservation of unequal relations of power for professionals versus herbalists. The scientific actor-network offers the security of a valued social identity, which is perhaps what some herbalists are seeking. There seemed to be a limited range of socially valued knowledge positions available. To seek entry into existing scientific networks, maintain their status in them, or prevent entry to these knowledge positions, scientific actors invented and re-invented their personal and professional histories and made references to terms such as: efficacy, validation and dosages which were used in self-validating ways.

Star (1991) claims that there is nothing inevitable about the marginalisation of indigenous or traditional knowledge by some scientists and that 'it might have been otherwise'. The marginalisation takes place because non-scientific events and circumstances such as social interests and negotiations shape scientific knowledge (Code, 1993; Kloppenburg, 1992). The norms, values and motivations of scientists and their institutions limit their ability to produce low-external input technology (Christoplos and Nitsch, 1996). Local sustainable technologies can only come from local practitioners in an ideal world in which these practitioners are not already enmeshed in western scientific norms. Ethnography can be useful in a world in which the domination of privileged discourses like western science, amplified by mass media houses, threatens to make other discourses like indigenous knowledge inaudible or unintelligible (Rappaport, 1993). So inaudible that some veterinarians claim they need 'good logic to abandon 10,000 years of civilization' in order to adopt ethnoveterinary practices. Recontextualisation of knowledge systems is an appropriate strategy but does not sufficiently recognise the force of the totalising institutions and knowledge systems which cannot be ignored (Hornborg, 1996). An anthropological approach can make marginalised discourses intelligible, audible and comprehensible to others (Rappaport, 1993). In making discourses audible it is not enough to publish a monograph on the plight of some "other"; praxis is required that introduces information on the problems in a system in such a way that these problems are corrected rather than aggravated (Rappaport, 1993).

Struggling over the direction of Caribbean medicinal plant research

The generation of technology is a social process. New technologies are integral elements within social discourse and practice. They emerge from within institutional settings and serve as foci for intergroup contestation. For this reason the language of technological change is also a moral discourse (the language of 'ought' rather than 'is'). Different groups envisage the future in different ways, reflecting systematic differences in material culture and social organisation. Perhaps for this reason debates about alternative technologies degenerate into dialogues of the deaf (Richards and Ruivenkamp, 1996).

13. Struggling over the direction of Caribbean medicinal plant research

Introduction

This chapter briefly outlines the existing research approach taken to document medicinal plants, an alternative approach promoted by TRAMIL (Traditional Medicine in the Islands), the current bioprospecting environment, the major players and stakes involved and a vision for future research into ethno [veterinary] medicine. The discussion of Intellectual Property Rights is placed at the end of the chapter as an appendix. This chapter like the previous one documents an attempt to create a shared vision of an approach to medicinal plants research and use that is sustainable and equitable to all the stakeholders (Costanza, 2000). The first attempt to achieve a shared vision was to hold workshops and a seminar in the first phase of the research with the respondents, especially with those employed by the MALMR. The workshops were used as 'challenging methods; which means conducting research in ways that create knowledge, but also questions attitudes and behaviours, thus encouraging a different way of thinking; i.e. discussing 'bush medicine' as part of a scientific endeavour (Kelly et. al. 1992). The workshop discussions served not only to corroborate the medicinal plant knowledge but also served as a form of legitimization that some of these practices could be useful.

Challenging attitudes and behaviours is important because the process of legitimization in the scientific world takes place through culturally esteemed opinion leaders in a community like the editors of the top science journals who can be very cautious about publishing new work where the level of rigour cannot be as high as for work in familiar territory (Lawrence, 1999). When submitted research is rejected it can have repercussions because failure to publish can lead to the discrediting of further effort. For example local scientists tell stories of others who have failed to get their research on the 'moon's effect on agriculture' published as justification for not conducting research on this topic themselves. One scientist felt that folk medicine achieved some legitimacy in 1976 when: "[Wesley] Wong brought Trinidad into the scientific literature since he was published in the journal *Economic Botany*.⁴² Shultes⁴³ the ethnobotanist knew the ethnopharmacological work in the region was sparse so he sent Wong here."

⁴² Wong, W. 1976. Some folk medicinal plants from Trinidad. *Economic Botany*, 30, 103-142.

'Experts' who do not enjoy a high degree of cultural esteem like Shultes are not heard (Dissanayake, 1992). A successful, published 'Homeopathic' veterinarian who had been working in the United States of America was given a decent welcome back home, but failed to enrol others into alternative medicine or to legitimate homeopathy. With this experience fresh in their minds supporters of alternative science welcomed the seminar given on ethnoveterinary medicine at the Veterinary School during the first phase of the research and they suggested that the presentation should be 'as scientific as possible'. This seminar thus became one of the cases where the research fitted into the projects of others.

The second attempt to achieve a shared vision was undertaken in the second phase of the research. This was the idea for a participatory workshop to produce a user-friendly manual on ethnoveterinary medicine. This participatory workshop developed (contrary to the vision) into the First International Conference on Herbal medicine in the Caribbean as described in Chapter 12. The shift in beneficiaries from users to scientists demonstrated that the stakeholders who control the strategies of participation used can have a major effect on the process and the result (Middendorf and Busch, 1997). The experience also demonstrated that a necessary aspect in having changes take place in a particular direction is having a clear vision of the desired goal which is also shared by concerned members of the community or relevant organisation (Costanza, 2000). One reason for the success of western science and its replication across the globe is its shared methodology and methods.

The new vision or scenario would have involved a change in direction from putting all resources into what Giarelli (1996) calls research that takes the 'chemical line' in which folk medicines are seen as a raw materials from which chemicals might be extracted for national use. The scenario thought more appropriate was for more resources to be put into the type of research and documentation for public benefit done by TRAMIL. While 'chemical line' research satisfies sceptical biomedical scientists, once indigenous medicines become pills, local people no longer command the meaning of folk medicines and can be made more dependent on institutionalised drugs (Giarelli, 1996).

There was some research being conducted by West Indian scientists that had direct application. For example thirty plants showed acaricidal activity and possible use against the cattle tick (*Boophilus microplus* Canestrini) (Mansingh and Williams, 1998). *Boophilus microplus* transmits several diseases known collectively as 'tick fever' (babesiosis caused by the apicomplexans *Babesia bovis* and *B. bigemina*, and anaplasmosis caused by the rickettsia *Anaplasma marginale*). Members of this genus may also be vectors for several viral haemorrhagic fevers (e.g., Crimean-Congo haemorrhagic fever). Hoping to create a social environment in which more applied research would be undertaken was particularly difficult since there was a long established history of formal scientific research on folk medicine in the Caribbean. The research followed the traditional scientific procedures outlined below:

1. collection, scientific identification and preservation of the biological material
2. preparation of appropriate extracts and preliminary chromatographic analysis
3. biological and pharmacological screening of crude extracts
4. consecutive steps of chromatographic separation, with bioassays for each fraction (activity-guided fractionation)

43 Gentleman explorer, field botanist extraordinary, elucidator of hallucinogenic plants and (the late) father of modern ethnobotany: Richard Evans Schultes.

5. verification of the purity of isolated compounds
6. elucidation of structure by chemical and physico-chemical methods
7. partial or total synthesis
8. preparation of derivatives/analogues and investigation of structure-activity relationships
9. large-scale isolation for further pharmacological and toxicological tests (Cunningham, 1996).

This type of research is necessarily slow because funding is scarce and most plants have multiple uses, and these uses sometimes differ between islands. Examples of Caribbean research are the work of Davis and Persaud (1970) who listed the chemical components of Periwinkle (*Catharanthus roseus*), Consumption bush (*Crotalaria fulva*), Akee (*Blighia sapida*) and Marijuana (*Cannabis sativa*). Asprey and Thornton (1953-1955) conducted a comprehensive review of all Jamaican folk medicine, their common uses, similar uses elsewhere and known chemical properties. Seaforth (1991) has done similar work for Trinidad and Tobago folk medicine. These publications and that by Hammerton (1989) have been or can be shared with the wider public. Seaforth (1991) was originally a research report from a Natural Products symposium funded by the OAS and the Commonwealth Secretariat, that wasn't meant to be put up for sale. The research report was printed by the author in response to public demand.

Less user-friendly research was done under the Organisation of American States (OAS) Regional Scientific and Technological Development Program, which had a sub-regional [Caribbean] project called EBUTROP or Economic Biology of Under-Utilised Tropical Plants. Started in 1982, the Final Report was published in 1990. Under this project scientists in Haiti did phytochemical screening on *Salvia occidentalis*, *Passiflora edulis* and *Achyranthes indica*. Similar work was done in Antigua-Barbuda on *Cajanus cajan*, *Pluchea symphytifolia* and *Leonotis nepetaefolia*. Scientists in Trinidad tested different concentrations of the total methanol soluble extracts of medicinal plants for their lethality toward the brine shrimp larvae⁴⁴ (*nauplii*). Tested were *Asclepias curassavica*, *Catharanthus roseus*, *Cordia curassavica*, *Lantana camara* and *Laportea aestuans*. The first of the five caused the most deaths, followed by the last. The second plant gave no significant results. Jamaica's tropical medicines were studied by Jamaican scientists funded by the British Tropical Products Institute (Lowe, 1972). These studies had a narrow focus and approach but found potential pharmacological potential in *Persea americana*, *Artocarpus altilis*, *Samanea saman*, *Hippobroma longiflora*, *Cuscuta americana*, *Chamaesyce* species, *Phoradendron quadrangulare*, *Spathodea campanulata*, *Piper amalago*, *Stachytarpheta jamaicensis* and *Cissampelos pareira* (Lowe, 1972).

Feng *et al.* (1964) carried out studies on several plants. *Catalpa longissima* leaf extracts caused uterine relaxant activity in rats *in vitro*. *Tamarindus indica* leaf extract was active against *Staphylococcus aureus* and *Escherichia coli*. The extract also showed spasmodic vasodilating effects on rats (Feng *et al.*, 1964). Tetranortriterpenoids were isolated from the heartwood of *Carapa guianensis* (Marcelle and Mootoo, 1975). Steroidal alkaloids were found in *Solanum triste* (Maxwell and Rampersad, 1991). Ecuadorin, a tetranortriterpenoid was isolated from *Guarea kunthiana* (Mootoo *et al.*, 1992). Miller *et al.* (1995) isolated a new glabretal-type triterpene from the roots of *Quassia multiflora*. Matadial *et al.* (1999) found that an extract of *Bromelia pinguin* fruit may have a uteroactive

⁴⁴ Activities of a broad range of active plant compounds are discernible as toxicity to brine shrimp *nauplii*. The method is a general and inexpensive bioassay tool which establishes that a plant has active compounds (Meyer *et al.*, 1982).

compound which inhibits uterine motility in pregnant rats, but the claimed folklore use of the plant as an abortifacient was not supported. A muscarinic alkaloid isolated from *Trophis racemosa* produced ocular hypotension in dogs (Wynter-Adams *et al.*, 1999). Chariandy *et al.* (1999) found that eight of 29 medicinal plant species extracts showed significant activity against one or more micro-organisms. The pulp and peel of *Sechium edule* produced a fall in blood pressure in anaesthetised rats (Gordon *et al.*, 2000). *Boerhaavia diffusa* contains an active antinociceptive principle in the juice of fresh leaves (Hiruma-Lima *et al.*, 2000).

Collaborative work has been taking place with the University of Toronto. Eighteen known and new compounds were obtained from *Swietenia macrophylla* and one from *Swietenia aubrevilleana* (Mootoo *et al.*, 1999). Six tetranortriterpenoids were isolated from the fruits of *Ruagea glabra* (Mootoo *et al.*, 2000). These collaborative studies with the University of Toronto have also looked at the potential of marine organisms in keeping with the latest academic interests (D'Armas *et al.*, 2000).

Reyes (1977) claimed that the findings and conclusions of the research conducted into bush medicine at the University of the West Indies were not generally known... 'Occasionally there will be a veiled warning about the danger of bush medicines, but a sensible, unbiased report is yet to be made available to the public...'. Several years later the unbiased evaluation asked for by Reyes (1977) was developed by enda-caribe in the Dominican Republic. Those scientists associated with enda-caribe in the Dominican Republic undertake applied research in the Caribbean and Latin American region. Since 1982 TRAMIL-associated scientists have promoted an international initiative to identify and investigate the medicinal plants of the Caribbean basin with a goal of writing a Caribbean plant-based pharmacopoeia (Robineau, 1991). TRAMIL operates at both the scientific and non-scientific levels and advises the public on which plants are safe, effective and useful, and which are not. The TRAMIL-based research is based on medicinal plants that have multiple uses. The scientific studies done address one use at a time, making validation a lengthy process.

TRAMIL data collection starts off with the conduction of participative ethnopharmacological surveys, then the participating scientists have a workshop to plan research on the plants identified. This research is then done through a network of collaborators. They also access a data bank to find already performed research. The resulting ethnopharmacology book (Towards a Caribbean ethnopharmacopoeia: Scientific Research and Popular Use of Medicinal plants in the Caribbean, Robineau, 1991) classifies the plants into three groups: Category A are plants from toxic genera or families, whose traditional use is to be discontinued. Category B plants have uses that are indicative of efficacy, but the scientific information is non-existent, insufficient or even contradictory, further research is then required. Category C plants are very frequently used throughout the tropics and have been phytochemically, pharmacologically or toxicologically analysed. This category also includes plants that are known to be innocuous. These are recommended for specific uses.

In 1998, the local NGO the Caribbean Network for Integrated Rural Development (CNIRD) recognised that its client group of micro-entrepreneurs involved in herbal medicines could be helped with a medicinal plant-based project. CNIRD is a locally-based NGO with Caribbean-wide projects whose mandate is integrated rural development. At the first Herbal medicine conference an umbrella organisation the Caribbean Association of Researchers and Herbal Practitioners (CARAPA) was formed mainly of scientists. CNIRD and CARAPA planned to conduct an ethnobotanical project that could also be a public health project.

CNIRD and CARAPA recognised that the official sceptical attitude towards folk medicine in the Caribbean was changing in response to the global trend towards more natural medicines. These attitude changes could be seen in initiatives undertaken by regional Ministries of Health. For example in September 1998 a meeting on "Medicinal plants scientifically validated and their use in primary health care in the Central American region, Cuba and the Dominica Republic" was hosted by the Panamanian Minister of Health. The Health Ministers of those countries were invited as well as the Rectors of the State Universities and also TRAMIL advisers.

In November 1998 the Health Ministers of the 54 Commonwealth member countries held their twelfth Triennial meeting in Barbados. The theme of the meeting was 'Health Sector Reform'; and 'partnerships with traditional health systems' was one item on the agenda. CARAPA was represented at the NGO meeting which was held just prior to the Commonwealth Health Ministers meeting in Barbados (CARAPA minutes 11 November, 1998). The meeting addressed topics associated with traditional health systems and strategies for partnerships between the formal health sector and traditional health systems. One outcome of this meeting was the establishment of a *Commonwealth Working Group on Traditional and Complementary Health Systems* consisting of representatives of the Commonwealth Secretariat, governments of fourteen member countries and NGOs. The activities of the Working Group are co-ordinated by the UK-based NGO, the Global Initiative for Traditional Systems (GIFTS) of Health. A mission, action plan and work plan for this Working Group were to be developed in time for the 13th Commonwealth Health Ministers' Meeting.

The increasing recognition given to folk medicine was influenced by the recent discourses of biodiversity and indigenous knowledge and the escalating controversies over intellectual property rights and biopiracy. Because powerful agents were developing the discourses of biodiversity, global warming and traditional knowledge in international arenas these terms slowly became legitimised in the Third World. (Banuri, 1990; Anonymous, 1999). The discourses of biodiversity, biopiracy etc. produced the paradigm shift that was necessary for Ministries of Health in Latin America and the Caribbean to recognise folk medicine. For example in Trinidad and Tobago a new National Drug Policy was established in December 1998. Within this policy new regulations were being developed by the Ministry of Health to control the trade in all herbal medicinal products in Trinidad and Tobago (St. Rose and Seaforth, 2000). The chief risk-management tool built into these new regulations is product labelling - recognising the difference between a traditional [folkloric] medicine and the finished dosage form of a herbal medicine. The policy also recognises the differences between finished dosages in folkloric medicine and herbal medicine. The herbal medicines are to be regulated in the same way as the allopathic/conventional drugs used in Trinidad and Tobago (St. Rose and Seaforth, 2000). The paradigm shifting was helped by a two-person Fact Finding Mission of the World Intellectual Property Organization (WIPO) to Trinidad and Tobago, Guyana and Jamaica from May 30th to June 9th, 1999. Visits were made to several towns and villages and among the issues discussed were the preservation of Patois, traditional healing and biodiversity (WIPO, 1999). The above illustrates the Caribbean context in which an attempt to have an inclusive vision for future medicinal research was undertaken.

There were two fronts: the CARAPA front which was evolving (but threatening to follow in traditional paths), and the effort to stay one step ahead of CARAPA in order to have a new vision of medicinal plant research taken on board (Lans, unpublished). This new

vision was not considered outside of existing 'scientific discourses' since there was a call by the World Bank for public health research where public benefits exceed the economic returns that traditional investors typically seek (PAHO, 1997). The Pan American Health Organisation (1997) had also called for a science and technology system that dovetailed with socio-economic realities, which entailed linking the scientists dedicated to the production of knowledge and those dedicated to its utilisation.

On the CARAPA front it was suggested that CARAPA prepare a document to be presented to the regional Ministers of Health pressing for the inclusion of a traditional alternative medicine programme into the public health system with TRAMIL as a resource organisation. A suggestion was made for a document to be prepared by CARAPA on alternative medicine to be considered at the next meeting of the Caribbean Community and Common Markets (CARICOM) Ministers of Health and this should be delivered through the CARICOM Health Desk and the Caribbean Policy Development Centre (CPDC). It was anticipated that this document would gain funding and recognition for CARAPA from the Ministries of Health. The document included a plan for the registration of herbalists, i.e. accreditation for technical persons to manage alternative medicinal systems in accordance with national policies and principles. Guidelines for the assessment and use of herbal medicines were to be modified from relevant WHO documents. There should also be an approach to Ministries of Agriculture on culturing and preservation of local medicinal plants with advice to Ministries on available expertise within CARAPA for such projects.

There was also recognition for CARAPA in the form of an approach from the Ministry of Health in St. Lucia for collaboration in order to conduct a National Workshop on the uses of herbal medicine. CARAPA also attended the workshop on National Drug Policy/Implementation of Complementary Medicines held in Trinidad and Tobago, May 12, 1999. At the meeting it was recognised that the use of herbal medicines was one of the opportunities for disease prevention and the need to regularise herbal products was discussed as was the classification and importation of herbal medicines and food products (Robertson, 1999).

Other developments in alternative medicine were also taking place. In October 1999 the Caribbean Association of Complementary and Alternative Medicine (CACAM), based in Barbados, hosted a meeting of holistic medicine practitioners working in the Caribbean. At the meeting it was agreed that local chapters of CACAM should be set up. In the year 2000 the Trinidad chapter of CACAM was established in association with CARAPA-Trinidad and Tobago and was called the Trinidad and Tobago Association of Integrative Healthcare Practitioners (TTAIHP) (St. Rose and Seaforth, 2000).

The renewed interest in medicinal plants was not only influenced by the paradigm shifting discourses; there was also the impression that there was money to be made. In 1990, it was estimated that world sales of medicines derived from plants discovered by indigenous peoples amounted to \$43 billion, with hardly any return to those groups. Kew Gardens had a contract from Glaxo to screen its living plant collection for active ingredients (Cunningham, 1996). The US Developmental Therapeutics Programme (DTP) of the NCI awarded three five-year contracts worth \$2.7 million in 1986 (Cunningham, 1996).

In 1991 these were renewed, with the three contracts valued at \$3.8 million (Cunningham, 1996). The three contractors were based at the Missouri Botanical Garden, Bishop Museum, Honolulu, and New York Botanical Garden together with the University of Illinois at Chicago,

which subcontracts to the Arnold Arboretum (Harvard University). Collections are focused respectively on Africa and Madagascar, Central and South America, and Southeast Asia. These collaborative programmes have resulted in the discovery of several interesting new compounds, including some with anti-HIV properties, from the Ancistrocladaceae, Combretaceae, Euphorbiaceae, and Piperaceae (Cunningham, 1996). A similar five-year contract, valued at \$2.9 million, was awarded to the Coral Reef Foundation for collection of marine organisms to determine their potential as the source of valuable new compounds. These financial deals attracted the attention of Caribbean peoples and especially those involved in CARAPA. In the Caribbean the protection of biological diversity for ethical, aesthetic, or spiritual reasons is little debated, rather ecotourism and utilitarian values (monetary and non-monetary) like chemical prospecting are used to justify the conservation of biodiversity as a form of sustainable income.

The Caribbean and Latin American region has drug industry potential in Cuba, Argentina, Brazil, Mexico, Costa Rica, Venezuela and Columbia (PAHO, 1996). However in the biopharmaceutical business it takes money to make money. Besides the scientific expertise needed, the financial base needed is huge. It is claimed that companies with sales of US \$5 billion can engage in drug discovery (PAHO, 1996). Eighty-seven (87) surveyed biopharmaceutical companies like Shaman Pharmaceuticals lost an average of US \$7.6 million each up to 1992, while the established companies like Eli Lilly made an average US \$1 billion annually (PAHO, 1996). It is estimated that the odds of isolating an active substance from prospected resources are one in ten thousand. Less than one-fourth of the chemicals reaching clinical trials will ever be approved as a new drug. For example, of 50,000 extracts put through an HIV screen in the natural products research program of the National Cancer Institute, only three are likely to end up in clinical trials, and of 33,000 extracts screened for cancer, only five are receiving further study (Reid *et al.*, 1996). It may take ten years to come up with a finished product and financial returns may take decades (Plän, 1996). Only three out of ten products pay for themselves, given overhead development costs of 200-300 million dollars per product. The testing required for FDA approval runs to \$231 million per drug. Estimated profits are estimated at several hundred millions to one billion dollars (Cunningham, 1996).

The first project discussed by CARAPA was the compilation of a compendium of medicinal plants and the establishment of a database of herbal medicines. Herbalists who would be brought together by the relevant ministries in the various countries would provide the information for the database (CARAPA minutes 23 April 1998). However CNIRD as an NGO committed to regional development asked a known consultant with the relevant background to prepare a project proposal on herbal medicines that would provide an overall framework and future direction. The opportunity to use this project proposal to chart a new vision was taken, as was an attempt to have the need for a database discussed more thoroughly (Lans, unpublished).

According to Costanza (2000) one of the most effective ways to achieve change is to present complex issues in the form of a relatively small number of 'visions' which lay bare the conflicts and inconsistencies buried in the technical information. The project proposal (Lans, unpublished) attempted to do this and developed an ethnobotanical project, which involved recording traditional uses of plants and other co-operative studies. A plan of collaboration was worked out for CARAPA, CNIRD and one of more of the following institutions: the US groups responsible for the International Co-operative Biodiversity Groups (ICBGs), ANDES Pharmaceuticals, or Shaman Pharmaceuticals (Lans, unpublished). Conservation

International was also considered. A structured approach was worked out for Shaman Pharmaceuticals that could be adapted if one of the other organisation(s) was found to be more suitable. A more structured relationship was suggested for CARAPA and TRAMIL. It was envisioned that TRAMIL would also benefit from the indirect links to Shaman and/or others created through the planned project, especially in exposure to new ideas and partnerships.

Potential CNIRD/CARAPA partners identified in the project proposal were:

International Organisations

Shaman Pharmaceuticals: Julie Anne Chinnock, Steven, R. King, Katy Moran, Thomas J. Carlson, Rowena K. Richter. Tel +1-415-952-7070. Fax +1-415-873-8367

Andes Pharmaceuticals, Inc. Edgar J. Asebey. Email: andes@access.digex.net

ICBG, Dr. Francesca Grifo, ICBG Program Manager, Fogarty International Center, National Institutes of Health, Bldg. 31, Room B2C32, 9000 Rockville Pike, Bethesda, MD 20892, USA. Phone (301) 496-2516. Fax: (301) 402-2056

Conservation International, Steve Rubin. Email: lobregon@igc.apc.org

Regional Organisations

Centre for Meso American Studies on Appropriate Technology (CEMAT), PO Box 1160, Guatemala City, Guatemala. L.M. Girón

Ix Chel Tropical Research Foundation, Belize, Rosita Arvigo

Instituto Caribe de Antropología y Sociología, Venezuela, Dr. Werner Wilbert

TRAMIL, Dr. Lionel Robineau

A brief overview of four of these organisations follows. This overview also gives an idea of the stakes and the complex issues involved. The discussion of Intellectual Property Rights, which was included in the proposal, is placed at the end of the chapter as an appendix.

Overview of medicinal plant organisations

INBio

In 1991, INBio of Costa Rica, and the US-based pharmaceutical firm Merck, Sharp and Dohme announced an agreement in which INBio would provide Merck and Co., with chemical extracts from wild plants, insects and micro-organisms from Costa Rica's conserved wild lands for Merck's drug-screening program. In return, INBio received one million in cash and a two-year research and sampling budget of \$1,135,000 in the form of lab equipment, and royalties on any resulting commercial products. INBio agreed to contribute 10% of the budget and 50% of any royalties to the government's National Park Fund. Merck and Co., also agreed to provide technical assistance and training to help establish drug research capacity in Costa Rica (Müller-Jung, 1996). In 1994 the agreement was renewed along similar terms including another million-dollar advance and more equipment. This one million in cash, received twice, can be considered small in comparison with the US\$4.6 million INBio received in debt-for-nature swaps (PAHO, 1996).

INBio provides employment for rural people as technicians, "parataxonomists", who after training do the collecting of the specimens in the field. While this INBio agreement has been hailed as a progressive step forward for Third World countries involved in

bioprospecting, NGOs complain that indigenous peoples will not share in any future revenues since all the bioprospecting by law is only possible in national parks (Müller-Jung, 1996). In addition, Costa Rica's neighbours like Nicaragua and Panama feel that they have lost the opportunity to supply their own genetic resources to the pharmaceutical companies, since these would be similar to those of Costa Rica (Plän, 1996). These countries feel that when the pharmaceutical company patents various active substances throughout the world, the development possibilities for them is reduced (Plän, 1996). They also feel that bioprospecting competition between neighbours will destroy habitats and endanger species (Nader, 1996). The Merck-INBio agreement has been called an "indecent proposal" by Latin American scientists⁴⁵ (Feinsilver, 1996).

The International Co-operative Biodiversity Groups (ICBGs)

Three US bodies – the National Institutes of Health (NIH), the National Science Foundation and the US Agency for International Development (USAID) – established a programme in 1992 to build a four-way partnership between industry and science in both the US and the donor country (Macilwain *et al.*, 1998). These are called International Co-operative Biodiversity Groups (ICBG) and five have been established as models of drug discovery, four in Latin America; Suriname, Peru, Costa Rica and a group project in the dry land areas of Mexico, Chile and Argentina (PAHO, 1996). The fifth ICBG involves Maurice Iwu⁴⁶ in Nigeria/Cameroon. Each project receives about US \$ 500,000 a year. The ICBG program incorporates biodiversity conservation, drug discovery and sustainable economic activity (PAHO, 1996).

Each project involves collecting samples of medicinal plants by negotiating access with various agents. Healers are paid a fee and advised on primary health care, offered help with setting up apprenticeship schemes in traditional healing and with testing the ingredients in their remedies (Macilwain *et al.*, 1998). Other possible benefits are training opportunities, equipment donations, fees for samples, and recognition on patents (PAHO, 1996). If a compound were to lead to a successful drug, the bulk of royalties would be invested in the host country. In Nigeria and Cameroon, 20 per cent would go to the inventors, 50 per cent into a community development trust fund run by local people and 30 per cent towards research into tropical diseases at the Walter Reed Army Institute (Macilwain *et al.*, 1998). In Latin America private-sector companies are involved, and local labs are used to analyse plants for potentially useful compounds, and for fractionation to isolate those compounds. Further analysis and clinical trials are done in the US. In Nigeria and Cameroon, government labs do the work. Two US research institutions and 13 in Nigeria and Cameroon are involved in the African agreement. This ICBG is set up to look for plant-based drugs that can be used for priority diseases in the US such as AIDS, cancer, cardiovascular diseases and those of the central nervous system (Masood, 1998)

⁴⁵ One FAO idealist estimates that if INBio sold Costa Rica's 4 % share of the world's biodiversity for US \$ 1 million, this implies that the entire tropical countries biodiversity worth is a mere \$20 million (PAHO, 1996).

⁴⁶ Prof. Iwu was known to members of the School of Veterinary Medicine and invited by them to participate in the First International Workshop on Herbal Medicine in the Caribbean.

Shaman Pharmaceuticals

Shaman Pharmaceuticals started in 1989, with a vision of combining capitalism with a commitment to world health, developing novel pharmaceuticals for unmet health needs, and a dedication to sustaining global biocultural diversity (Conte, 1996; Chinnock, 1997). In March, 1995, Shaman had 83 employees, 75 of who were in research and development, including 26 Ph.D.s and two M.Ds. Shaman is dedicated to returning benefits to the peoples who gave them the knowledge on medicinal plants; to establishing new models of reciprocity between indigenous knowledge-holders and scientists; and to creating models for the sustainable harvesting of non-timber forest products (Richter and Carlson, 1998). Shaman measures its success by traditional financial means, as well as by creating industries that are owned by indigenous-knowledge holders, and by creating positive environmental impacts in the tropical world's rain forests.

Shaman Pharmaceuticals develops new therapeutic agents by working with the people who hold traditional medicinal knowledge in developing countries (Oubré *et al.*, 1997). They ensure that the partner country benefits from any products developed in future based on their traditional knowledge (King, 1994; King *et al.*, 1996). A portion of the profits generated by any commercialisation of plant-derived compounds is delivered to countries that have collaborated with Shaman in plant collection and other activities. The profits are delivered through an independent non-profit foundation, founded by Shaman, called the Healing Forest Conservancy (King *et al.*, 1996). Compensation is delivered in the form of projects that help to conserve biocultural diversity, largely framed through consultation with representatives of collaborating countries. Shaman Pharmaceuticals abides by the United Nations Convention on Biological Diversity and by the protocol set forth by the International Society of Ethnobiology.

Shaman has established a system of reciprocal benefits to local communities and agencies that span over the short, medium and long-term. Short-term refers to immediate benefits to the communities each time they host the field research. Medium-term projects transpire in several months or years and include technology transfer and sustainable development, capacity building in medicinal plant technology and know how, and bulk plant collections. These projects involve working with local universities, governments, associations and other groups for the benefit of the community. In the long-term, when Shaman successfully markets a drug, they return a portion of the profits of this product, and other developed products to all of the countries and communities in which they work. This system of remuneration spreads the risk and assures a more rapid return of resources for all the collaborators, since only a small, unpredictable percentage of products ever reach the market (Chinnock, 1997). After drugs have been developed, Shaman sources plant materials from its collaborating countries but insists that all plant collections are conducted in a sustainable manner, including replanting. Shaman has made several claims of successful benefit sharing, but one recent study in Tanzania has found that these claims are overdrawn; while local people who have strong feelings that the relationship is exploitative are also unjustified (Svarstad, 2000).

ANDES Pharmaceuticals

ANDES Pharmaceuticals was founded in 1993 by a group of scientists and professionals from the North and South. It is a development-stage technology transfer and

biodiversity prospecting company (PAHO, 1996). The company transfers bioassay-guided fractionation technology, expertise, know-how, and technical support to joint-venture partners. ANDES would like to establish a worldwide network of joint-venture companies (PAHO, 1996). Extraction and bioassays are conducted in the source countries, who do more of the value addition, but also share more of the risk of commercialising bioactive compounds (PAHO, 1996). ANDES has signed collaborative agreements with five universities and two NGOs representing indigenous peoples. In Ecuador ANDES has signed a collaborative agreement with a university. Negotiations are taking place in Columbia with several bodies (PAHO, 1996).

ANDES has a consulting service called the Biodiversity Technology Group (BTG). In exchange for providing technology and equitable royalties, ANDES receives access to natural products and knowledge. Compensation agreements are negotiated with each country. Joint venture partners in developing countries are selected if they have the following capacities to: assist in negotiating prospecting agreements, effect collaborating agreements with local agencies and mobilise local funding.

The way forward

In order to develop a fair business relationship with Northern countries and companies, Southern countries would need to know the world market for genetic resources, the research and development processes of the pharmaceutical and agrochemical industries, and contract and international patent law. If the source countries do not have this expertise and cannot carry off the lengthy technical negotiations needed to achieve a fair business relationship they could find themselves limited to supplying low cost raw materials (Plän, 1996). In the next decades it is expected that a few specialised suppliers of raw materials will share the world market among themselves. Through competition these suppliers will drive down the market prices for biological resources to the level of labour costs. Cell culture and gene transfer in the labs of Northern countries may limit the length of time that a continuing supply of these raw materials is needed by the pharmaceutical companies (Plän, 1996). This means that CNIRD and CARAPA need to develop a working relationship with a bioprospecting company that has a strong ethical commitment. The realities detailed above suggest the following plan for long term collaboration as one possible option.

CNIRD-CARAPA Folk medicinal knowledge collaborative plan

The project can use the motto of Costa Rica's Instituto Nacional de Biodiversidad (INBio) which is Save, Know and Use (Nader, 1996). This means that products are developed from Nature's biodiversity through fundamental and applied research, and part of the benefits from their sale or use is re-invested in biodiversity conservation. It is anticipated that biodiversity conservation can result if this project succeeds in enhancing the safety and profitability of existing herbal remedies. This outcome can provide rural people with the financial incentives⁴⁷ to conserve forests and to plant herbal products, if they are trained in this approach rather than in an indiscriminate harvesting approach. INBio's motto reflects the

⁴⁷ Cragg *et al.* (1998) claim 35,000 samples from 12,000 species, yielded Taxol, Topotecan, Irinotecan and Homoharringtonine. They calculate the success rate as 1 in 4,000 species.

idea that disregarding KNOW leads to ignorance. SAVE and KNOW without USE is the ivory tower of pure science. KNOW and Use without SAVE leads to extinction and exploitation. A balance of all three elements is needed for sustainable rural development.

The envisioned role for CNIRD/CARAPA

Shaman Pharmaceuticals, and the other agencies mentioned, appreciate developing world institutions that are proactive in writing and asking for collaboration. CNIRD and CARAPA will need the legal, technical, social, political expertise and power to effectively structure the collaboration with external agencies in a way that will benefit the nation and entire region, rather than individual scientists or businesses. By establishing the framework for reciprocity at the outset, before these agencies are contacted, CNIRD seeks to forestall a situation where the project does not provide long-term benefits to the Caribbean region. CNIRD thus recognises the individualistic culture of Caribbean peoples and is taking a proactive approach in ensuring that reciprocity works towards the establishment of a primary health care system partly based on medicinal plants that have been scientifically tested.

Intellectual Property Rights will have to be negotiated with any external partners that CNIRD/CARAPA seeks to negotiate with. Specialised expertise may have to be hired. The Intellectual Property Rights aspects of the INBio agreement with Merck and Co. can be taken as a guideline. INBio sells its biodiversity-prospecting service but not any IPR that it holds. This is possible because Costa Rica has established the appropriate Wildlife Conservation law (1992, 1993) for its National Parks (Reid *et al.*, 1996). INBio has established a team of environmental lawyers from Costa Rica who work together with consultants and *pro bono* lawyers from the US and UK (PAHO, 1996). Societies can establish the legal frameworks necessary but the patent holder must be able to identify infringements and challenge the infringing party. For example the Indian government has challenged W.R. Grace & Co. of New York who applied to patent Azadirachtin from the Neem tree (Wolfgang, 1995). For countries that cannot afford to make these challenges, a reciprocity agreement that returns in-kind benefits might be more appropriate in the short term.

Sample Reciprocity agreement/Agreement of Principles

This sample agreement is worked out for Shaman pharmaceuticals but will need to be modified if one of the other bodies is chosen.

SHORT TERM BENEFITS

- Shaman should provide several copies of *Rainforest remedies: one hundred healing herbs of Belize*, (Arvigo and Balick, 1993), for designated individuals, libraries and bookstores. This publication is likely to have many plants that also exist in the Caribbean and is written for the general public.
- Shaman should also provide several copies of any available English language publications that they possess on the medicinal plants of Latin American, Asian and African countries that are written for the general public. These should be lodged in the libraries of the participating regional institutions. Copies of the thirteen Sustainable Harvesting Studies commissioned by Shaman should be housed in the in the libraries of the participating regional institutions.

- Funding should be provided so that several photocopies of all the Caribbean Studies Theses on traditional medicine at UWI, St. Augustine, could be made. These Studies are currently housed in the West Indian collection, which means that they are not readily accessible to non-UWI staff/students, and cannot be easily photocopied for research purposes. The copies should be lodged in the general collections of the libraries of the participating regional institutions. All Caribbean 'grey' literature that is not already available in each participating country should be copied and disseminated to all participating countries. All the above literature should be evaluated for future 'official' publication so that the student/ lay authors can be recognised for their work.
- Funding and technical expertise should be provided so that all interested regional libraries can have access to the most appropriate existing databases listed in Box 2.
- Funding should be requested in order for CNIRD/CARAPA and Shaman to collaborate with TRAMIL. The first output of this collaboration should be funding in order to translate TRAMIL 7⁴⁸ into English, and to subsidise the price for the general public.
- Visiting lecturers, with at least Ph.D. qualifications or equivalent; who have done considerable ethnobotanical field work, conducted participatory workshops and have substantial lists of publications; should be recruited to sensitise all interested regional institutions and members of the public on ethnobotany and alternative medicines. Each individual visiting lecturer will bring fresh new ideas, approaches and knowledge, and should be sourced from all the countries that produced the Caribbean peoples.
- Half-yearly visits of TRAMIL and other partner staff to CNIRD/CARAPA should be held to plan joint activities and ensure that there is no duplication of services.
- The establishment of medicinal plant reserves on suitable grounds in participating countries, for two reasons. Firstly students, faculty and the interested public can be taught plant identification, and secondly to guard against genetic erosion. The need for additional forest reserves to be established for biodiversity conservation should be explored with the appropriate authorities.

MEDIUM TERM BENEFITS: WORKSHOP EXCHANGE AS TECHNOLOGY TRANSFER

Medium term reciprocity will take the form of capacity building for CNIRD, TRAMIL and CARAPA to manage the thrust into the use of medicinal plants. CNIRD/CARAPA will acquire the capability to access and channel information on medicinal plants from the scientists to the rural communities and vice versa. CNIRD/CARAPA will also organise herbalists and researchers into groups or entities that can respond appropriately to this initiative. In the medium term funding should be provided as follows:

1. Provide funding to explore the various options for Intellectual Property Rights. One option could be a Commonwealth or South-South Network that will hire individual lawyers or NGOs such as RAFI⁴⁹ or the Foundation on Economic Trends (FET), to negotiate IPR rights, monitor patent infringement and mount legal challenges to patents being sought on South-based medicinal plants.
2. Ethnobotanical training should be conducted in the Caribbean and at least 80% of all training must be geared for and open to the general public. Some of the training should link public health issues to forest conservation.

⁴⁸ Germosén-Robineau, L. 1995. Investigación científica y uso popular de plantas medicinales en el Caribe. *Farmacopea Caribeña*. Enda-Caribe (Ed.), Tramil-7. Pp. 420 - 424.

⁴⁹ Rural Advancement Foundation International (RAFI). Ottawa, Canada. Executive Director, Pat Mooney. FET is a non-profit group headed by Jeremy Rifkin, USA.

3. Workshops for wider Caribbean staff and students should be conducted that describe Shaman's ethnomedical interview methodology, addressing preparation of plant products, public health issues and botanical identification. These workshops and the ones below should also discuss Shaman's projects in other countries, particularly those in South America.

4. Community-based public health workshops should be held as part of a CNIRD/CARAPA Herbal Medicine Program. This will consist of education and training for male and female herbalists (in separate workshops, since some remedies like 'Bois bandé' are for sensitive health problems) which will enable them to add value locally to their businesses. These herbalists who are generally operators of micro-enterprises will have to be interviewed in advance by someone with no conflict of interest to ensure that they are willing to take part, have the time to participate and are suitable candidates. These interviews will also determine the contribution of these micro-enterprises to their respective rural communities. The workshops will involve participatory documentation of the herbal remedies used by these practitioners. This participatory documentation in the form of workshops is an appropriate method to develop a list of safe medicinal plants, since these same herbalists may not have access to the planned computerised database. It has been recognised by the *Commonwealth Working Group on Traditional and Complementary Health Systems* that consumers need greater access to reliable information on healthcare options available in ethnomedicine.

At these workshops, Shaman physicians will first attempt to diagnose the conditions described and treated by the healers. Then Shaman scientists will conduct a non-experimental evaluation of the plants that were used for each condition. Finally, Shaman staff and physicians will make a preliminary evaluation of the packaged remedies sold by these herbalists. The results of this comprehensive evaluation will then be conveyed to CNIRD/CARAPA and by CNIRD/CARAPA to the herbalists. Participants will receive certification of their attendance. Workshops will also evaluate the herbalists' plant harvesting methods and their storage techniques. Information from the interviews with the herbalists and from the workshops would be incorporated into CNIRD's radio program and newsletter. Use of these channels will facilitate the dissemination of information on safe and effective medicinal plants to the general public.

LONG TERM OPTIONS

- Unit Trust/Credit Union/CARAPA venture to buy shares in Shaman, Eli Lilly and Merck & Co. Ltd. This option will ensure that some benefit is derived from regional medicinal plants regardless of IPR issues. Involvement of the Pan American Health Organisation (PAHO) in crude drug standardisation and monitoring of herbalists. Debt for nature swaps

OTHER ACTIVITIES FOR THE SHORT, MEDIUM AND LONG TERM

Scientific visits to Shaman Pharmaceutical's company, or the labs of other agencies

Provision of equipment or drugs for pharmacological studies, inventories, screening or bioassays. Establishment of Databases (see attached report), Scientific conferences.

Results

Results can be automatically communicated to traditional practitioners. These practitioners would then be encouraged to use only efficacious and safe medicinal plant practices when they provide low cost botanical/herbal drugs to local communities. This low-

cost, community-based, medicinal plant, health care system; controlled at the grassroots level, would depend on the sustainable management and use of the Forests, and marginal or abandoned land where many medicinal plants grow. CNIRD will also fulfil its mandate of integrated rural development since many rural people are involved in the production, marketing and processing of herbal products, which are both medicinal and culinary. This project will help strengthen the micro-entrepreneurs involved in herbal medicines, and will ultimately lead to the increased health and economic welfare of rural dwellers.

The author of the proposal above knew of the plan of some in CARAPA to set up a database of medicinal plants (see inset below). Therefore a summary of existing databases was included in the collaboration plan so that a clearer idea of the 'pressing need' for a database could be established by CARAPA members (see Box 2). This was done because it was not clear that herbalists would have access to the planned computerised database, or that the database was economically justifiable given the existence of so many others. The planned database was seen as the creation of another gap between expert knowledge and the public – or the introduction of the culture of technical control into folk medicine which would mean that information would be compartmentalised and controlled by various technical élites who do not always communicate with each other (Costanza, 2000). On the other side traditional healers would continue talking about vision and dreams. This kind of knowledge can be used in a way that Hawkesworth (1989) calls an 'authoritarian trump' that precludes the possibility of rational debate between competing intuitions.

A database subcommittee of CARAPA met from June 1 to October 9, 1998 to consider the need for a database of medicinal herbs. Needs expressed: a) proper identification/authentication of medicinal plants, b) information on known constituents, c) information on therapeutic uses and side effects, d) information on relevant farming practices and processing. Available information sources:

1. Farmacopea Caribena (TRAMIL, 1996) in Spanish with line drawings, restricted to 91 plants omitting several like Aloe and Soursop. Not commercially/agroindustry oriented.
2. NAPRALERT and other electronic databases mainly on published data for medicinal plant products from temperate countries. MEDFLOR was established for Caribbean plants but is not currently a viable database. With the identified deficiencies in existing databases, the subcommittee recommends the development of an electronic database for CARAPA users. Initial efforts will focus on development of a Sample Relational
3. Database of 25 Medicinal Herbs using WINISIS software to be housed either on the BIREME Network in Brazil or at UWI. Budget US\$21,000.00 (Report of the Database Subcommittee to the Core Committee of CARAPA October 14th, 1998).

Conclusion

This chapter describes an attempt to 'impose' a particular vision. The 'imposition' took the form of a project proposal (Lans, unpublished) and was based on the recognition that whoever controls the strategies of participation to be used can have a major effect on the process of participation and the end result (Middendorf and Busch, 1997). The imposition attempt was based on a fear that directions would be taken that would be made to appear to represent a broad constituency, but would turn out to be highly unrepresentative (Middendorf and Busch, 1997). The project proposal was used to try and enrol the CARAPA actors into a different vision or 'design' for the future. Researchers' 'self-reflexivity involves a realistic appraisal of the limits of research as a locus for authentic political activity' (Glucksman,

1994). However this does not mean that researchers should not strive for an outcome of greater awareness that leads to social change (Mies, 1983).

Box 2. Listing of medicinal plant databases

	NAME	ACRONYM	COVERAGE	CONTENT/STATUS	Email ADDRESS
1	Medicinal and Aromatic Plants Abstracts	MAPA	Global medicinal and aromatic plants	55,000 & 30,000 abstracts on CDROM	Dr. K.S. Krishnan Pid@simetd.ernet.in
2	Cab Abstracts	CAB	Global	60,000 records	Marketing Dept. Cabi@cabi.org
3	International Info System for Agric. Sci. and Tech. Agricola	AGRIS	Global	See note 1 below	FAO-Agris-Caris@fao.org
4		AGRICOLA	Global & US agriculture	See note 1 below	http://www.nalusda.gov/general_info/agricola/agricola.html http://www.inist.fr
5	Pascal	PASCAL & FRANCIS	Global & French lang. Coverage	See note 1 below	
6	Biosis Previews	BIOSIS PREVIEWS	Global, biological incl. Medicine	See note 1 below	http://www.biosis.org
7	Chemical abstracts	CHEMICAL ABSTRACTS	Chemistry and chem. Eng.	16 million chemical substances	http://www.cas.org
8	Medline	MEDLINE	Medical literature	Limited info	http://www.nlm.nih.gov
9	Embase	EMBASE	Medical literature	Limited info	http://www.elsevier.nl
10	The Asian Health, Environmental and Allied Databases	AHEAD CD-ROM	Medicinal and aromatic plants of Asia	CDROM series of 3 disks	Email:pid@simetd.ernet.in
11	Phytochemical constituents of GRAS herbs and other economic plants	*	Dr. James Duke database	GRAS-safe plants GRAF-food plants GRAP-med. Plants 1000 plant species, 3000 phytochemicals	http://probe.nalusda.gov:8300/cgi-bin/query?dbname=phytoc hemdb
12	Brazilian medicinal plants database	*	Brazilian medicinal plants	Use, biological activity for 1000 species	http://www.ciaagri.usp.br/pla nmed/planger.htm
13	Dictionary of natural products	DNP	36,000 entries	113,000 natural products	http://www.thompson.com:8866/chaphall/default.html
15	Hopkins Tech CD-ROMs	*	Botanical, medical, pharmacological info	170 Western plant species, 322 Chinese herbs	http://www.hoptechno.com/
16	Indian Medicinal Plants National Network	INMEDPLAN	Network on medicinal plants	See note 1 below	http://ece.iisc.ernet.in/ernet -members/friht.html
17	Major Aromatic Plants of India	MAPI	Indian-based	45 major aromatic plants	http://www.sunsite.sut.ac.jp/asia/india/jitnet/india/csir/ci map.html
18	Natural PProducts ALERT	NAPRALERT	Global, Natural plants	110,000 natural products and 120,000 organisms	http://pcog8.pmmp.uic.edu/mcp/MCP.html
19	MEDicinal FLORa	MEDFLOR	OAS countries	??????	http://pcog8.pmmp.uic.edu/mcp/MCP.html
20	DEREPIcation	DEREP	Physical constants of natural products	Recently initiated	http://pcog8.pmmp.uic.edu/mcp/MCP.html
21	Plant Resources of South- East Asia	PROSEA	Useful plants of South East Asia	6,000 plants	http://www.bib.wau.nl/prose a/home.html

Note 1: Has abstracts on medicinal plants research but the exact number of abstracts that contain information on medicinal plants is not available. Source: FAO, 1997.

Chapter appendix

Intellectual Property Rights (IPR)

Collectors of plants for screening take three basic approaches to obtaining samples. First, with random sampling, material is collected from the largest possible number of identifiable plant species within a habitat, with the emphasis on plants that are flowering or fruiting, so that good voucher specimens are obtained (Cunningham, 1996). A second approach is to focus collecting on certain plant families that are known to be rich sources of interesting, biologically active compounds. Thirdly collecting is guided by a knowledge of traditional uses of plants; this has been termed 'ethnodirected' sampling (Cunningham, 1996). The second approach is only one-fourth as effective as ethnodirected sampling, implying that folk medicinal knowledge is derived from objective and empirical bases (Barsh, 1997).

Laboratory scientists and patent applicants often feel that the value added in purification of and synthesising of plant-based drugs is more important than the centuries of un-documented experimentation that comprises indigenous knowledge (Gupta, 1990). Financial benefits go mainly to the patenting country or company, with little to the original knowledge holders (Elisabetsky and de Moraes, 1990; Waters-Bayer and Bayer, 1994; Cunningham, 1996). Groups and organisations involved with indigenous knowledge must assess the benefit of codifying this knowledge to facilitate sharing, documenting and validating, against the risk of increasing its mobility and likelihood of being appropriated (Bontis and Choo, in press). Scientists are the only judges of what is significant and important in the scientific arena and they legitimate and distribute knowledge (Smith, 1978), the original knowledge holders have no control over their knowledge when it enters the scientific arena. When knowledge is published scientifically it helps legitimise the knowledge internally and its internal / local dissemination. However since explicit knowledge is transferable, this dissemination ability is important when organisations need to accelerate the development of complementary products or adopt common standards for medicinal plants (Bontis and Choo, in press).

The World Bank has stated in its report *Knowledge for Development* that developing countries should take a more proactive and hard-line stance on Intellectual Property Rights negotiations. However this document provides no guidelines or solutions to the current Intellectual Property Rights situation. International debate on local knowledge, farmers' rights, and equity in the distribution and control of genetic resources from crop plants has been ongoing since the 1980s (Mooney, 1983; Kloppenburg, 1988). Brazil is currently designing legislation to ensure that its citizens share in any profits from crops or medicines derived from its borders (Pennisi, 1998). India is drafting biodiversity legislation that will regulate access to the country's biological resources by foreign researchers and pharmaceutical companies. Indian companies who transfer commercially exploitable research results to outsiders without official approval will be punished (Jayaraman, 1998). The Organisation of African Unity (OAU) is drafting legislation to penalise those who engage in bioprospecting without government permission. It also proposes to refuse patent recognition if those patents do not recognise the ownership and contribution of indigenous peoples (Masood, 1998).

Even though the United Nations Convention on Biodiversity guarantees the sovereign rights of each country over its natural resources, most regional countries have not put the

necessary national laws in place in order to protect themselves from biopiracy. UNCTAD has made attempts to police the global genetic resource network and has called for a binding international protocol for the protection of developing countries against biopiracy (Plän, 1996). Pharmaceutical industries are comfortable with the current legal vacuum, since they can operate without legal and governmental restraints. These pharmaceutical companies view medicinal plant knowledge as the product of guided innovation and a private asset to be secured against appropriation by others, but shared with colleagues and licensees (Spender, in press).

Privatisable knowledge is always embedded in contexts of systemic or system-specific 'public' knowledge (Spender, in press). The first system to govern ownership and access to genetic and biochemical resources was the common system. This fit the framework of those who see knowledge as an inherently public good, infinitely extensible and of a different theoretical type (Spender, in press). "Unimproved genetic material", or wild species and traditional varieties of crops and livestock grown by farmers, is treated as an ownerless, open-access resource or global common property (Reid *et al.*, 1996). The global commons viewpoint was useful to bioprospecting firms who sought plant materials in the "wild" with commercial potential that could be patented. Gupta (1990) writes that 'if knowledge were truly a common property, the academic discussion about rights to it would be trivial. But if knowledge can be expropriated by free riders or rent seekers, rules of the game need to be evolved'. The first relevant resolution to establish rules of the game and move away from the commons approach was that adopted in 1989 by UNESCO on the Safeguarding of Traditional Culture and Folklore (Cunningham, 1996). In 1991, the FAO Commission on Plant Genetic Resources (PGR) produced a draft International Code of Conduct for Plant Germplasm Collecting and Transfer (Cunningham, 1996). This was a voluntary code of conduct recognising farmers rights and setting guidelines for the exchange of germplasm. The code of conduct was addressed to FAO, UNEP, UNESCO, IPGRI, CGIAR, and other international and national agricultural research institutions. In 1992, these issues were highlighted at the UNCED meeting in Rio de Janeiro, and through the Global Biodiversity Strategy (Cunningham, 1996). The Commission on Plant Genetic Resources (PGR) revised the FAO Undertaking for PGR to recognise both plant-breeders, and farmers rights (Cunningham, 1996).

IPR regimes were established based on the utilitarian belief that biodiversity is only relevant to Third World national governments or local people if a fair share of benefits from new natural products is returned to the region of origin (Cunningham, 1996). Intellectual Property Rights (IPR) regimes, including patents, Plant Breeders' Rights (PBR), and trade secrets established ownership for new varieties of plants and animals developed by commercial breeders and chemicals isolated and developed by pharmaceutical firms (Reid *et al.*, 1996). The 1994 agreement on trade-related aspects of intellectual property rights (TRIPS) has created a global regime that sets minimum standards for Intellectual Property Rights protection. The World Trade Organisation is responsible for dispute settlement procedures.

The debate over Intellectual Property Rights did not end with the Convention on Biological Diversity, but this Convention does contain mechanisms to protect developing countries. In 1994, Trinidad and Tobago signed an Intellectual Property Rights Agreement with the United States that, along with Trinidad's commitments under the WTO TRIPs Agreement, required revisions of most IPR legislation. While the government's awareness of the need for IPR protection has improved, enforcement of existing regulations remains lax.

The 1997 Copyright Act, which took effect October 1, 1997, was written with the assistance of WIPO and was forwarded to the United States for comment in compliance with the U.S.-Trinidad and Tobago Bilateral Memorandum of Understanding on Intellectual Property Rights. The new Act offers protections equivalent to those available in the United States. However, enforcement of IPR laws remains a concern under the new Act. Although the Copyright Organisation of Trinidad and Tobago has stepped up its enforcement activity since the law took effect, it has primarily targeted unauthorised use of locally produced music products (US Department of Commerce, Bureau of Economic Analysis, 1999).

The IPR debate has been taking place in the Caribbean⁵⁰ but it should first be recognised that Caribbean folk medicine is based on knowledge from other continents. This does not mean that nothing is unique to the Caribbean, but that there will be many other countries who use similar remedies (Morton, 1981).

The Bioprospecting Environment

Bioprospecting firms have made permit applications without indicating their commercial intents. Local botanists or foresters are paid privately to collect samples for industrial companies or other sponsoring organisations. These people often do not understand the full implications of their work and their payment bears little relation to the potential value of the resource. Since hard currency is hard to get, it is understandable that this occurs (Cunningham, 1996). Although Germany has been in the forefront in the use of herbal products, up to 1996, no German pharmaceutical firm had established any agreement with obligations for royalties and technology transfer with source companies and countries (Nader, 1996). Glaxo in the UK has a voluntary code of conduct, as does Sandoz in Switzerland. Cunningham (1996) and others have called for the creation of equitable partnerships in the development of new natural products. These partnerships should:

- recognise and compensate for the use of indigenous knowledge and natural resources
- facilitate international co-operation in the collection, conservation, use, and development of new natural products
- ensure that any collecting for export and use outside a country has the full approval of the competent authorities, and is carried out with the co-operation of the host country and representatives of the local communities involved
- ensure that these collections comply with conservation and quarantine regulations in the countries of origin and destination
- outline the general principles that will facilitate the development of national regulations by governments or agreements between organisations.

Cunningham's code of practice contains a code of professional ethics to ensure that: research participants (e.g. traditional specialists) and members of relevant local organisations (e.g. herbaria) are fully informed of the objectives, commercial aspects, and possible results of research and confidential information and research participants requests for anonymity are respected. Equitable compensation is made for assistance by individuals, the relevant national or regional organisation receives fair royalty payments, and national requirements for plant collecting, including collection with local counterparts, are observed.

⁵⁰ One respondent claimed that a local conglomerate had bought out all the plants of *Lapsogen* (*Spiranthes acaulis* Orchidaceae ?) in Paramin. This plant was then used in its secret Bitters remedy.

Maximum use of local expertise within developing countries, or at regional level, to undertake extraction and screening of important compounds should be made. This should apply equally to compounds of regional significance (e.g. antifungus, or anti-parasite) and global significance (e.g. antiinflammation, antiviral, anticancer). This will involve a commitment to training, technology transfer, and the development of practical, initial screening techniques. It will also require government support for local scientists and research organisations. Supply agreements should only be made with reputable organisations, not with individuals whose primary interest may be personal gain (Cunningham, 1996).

The New York Botanical Garden has an official policy that half of all net royalties go to the original location of the plant from which the product is derived, however it is recognised that botanical gardens are currently a loophole for bioprospecting companies (Dove, 1998). The US National Cancer Institute has a Letter of Collection that guarantees a share of the benefits of future products with source countries (Nader, 1996). However all of these agencies will not get involved in the type of collaborative research that CNIRD and CARAPA are seeking, but prefer to work through Northern-based research institutions and Botanical Gardens. Their method of collaboration is typically for Southern-based scientists to make visits to their labs, and they will return data to southern scientists that these scientists have to keep confidential until drugs are developed and patents are approved. They also return royalties to the source countries, and if drugs are successfully developed, they ask source countries to supply raw materials. Royalties are typically 1 – 5% of net sales, which means that a drug generating \$10 million net annual revenues developed from a natural product will generate \$461,000 at a 3% royalty (Reid *et al.*, 1996).

Becoming Creole

It is certainly dubious sense to write as if all peoples equally desired to have their own history intact (whatever that might mean). People may prefer to live in the present or to skip bits of their history. It is usually wise to leave bygones to be bygones. If doing without history is the path of forgiveness, it is also true that forgetting on one's own behalf is easier than forgetting injuries done to the dead (Douglas, 1995).

14. Becoming Creole⁵¹

Introduction

This chapter addresses the research question of whether Trinbagonian folk medicinal knowledge fits a theory of [ethnomedicinal] agrarian creolization. First the historical past is described to give the societal setting for folk medicine. Then the concepts Creolization, hybridity and passing will be discussed, and these will be applied to folk medicine. In Trinidad and Tobago like in other modern societies cultural meanings are volatile, plural and fragmented. New knowledge in all knowledge cultures is always (re) interpreted in terms of the available frames of reference of the cultural system. This cultural system is in turn porous, and as such influenced by the borrowings from external influences especially transcultural scientific knowledge (national health care services, school education, etc.) and the international mass media (Stewart, 1999). The domination of privileged discourses like western science and medicine, amplified by mass media houses, silences other discourses but they are not speechless yet.

The struggles described in Chapter 12 between scientists and herbalists illustrated by heart specialist Kenroy making warnings in the newspapers against vague and unproven [herbal] remedies (Express July 3, 1999; Newsday July 5, 1999 pg. 24), and the discussion that this generated (Express July 18, 1999 pg. 7; Express July 20, pg. 21) is only partly about science versus 'nonsense'. The deeper issue is the desire to forget all history and leave the colonial past behind. The Caribbean was colonised by western powers for more than five centuries. This history has produced a dilemma in that progress is associated with the colonisers but is still considered desirable. The languages spoken belong to the West and the historical past is difficult to face (Price and Price, 1997).

The historical past

Under the Cédula de Población 1783, local people of all races were granted certain rights. Under the Articles of Surrender of 1797, the British accepted these rights, which allowed all people to inherit property, hold commissions in the local forces, practice professions, to have exemption from certain taxes, and to apply to the crown for grants of land. Article 5 of the Cedula gave all settlers citizenship after five years of residence and it made few distinctions between whites and coloureds, which was unique to Trinidad. The

⁵¹ 'Creole Remedies' is a local term with a literal historical, 'local parlance', pre-academic meaning. The term is reclaimed as a positive force, with strong female elements (grandmothers, old aunts). Throughout the book European and Amerindian elements of the folk culture are included alongside and equal to those of Africa and India as a validation of the Creole past which can be seen as a quilt of diverse patterns.

Cédula de Población 1783 offered incentives to all settlers. The free blacks and coloureds received free grants of land: 16 acres for each man, woman and child and half of that for each slave brought. This was about half the grant of a white settler (Joseph, 1837). Due to the Cédula some free blacks were slave-owning proprietors of large sugar estates. They had come to Trinidad from Martinique, Guadeloupe, Ste. Domingue, Grenada and St. Lucia as educated and professional people or military men. They developed a black middle class. Sometimes their sons were educated in Europe or took the grand tour of Europe and they adopted the style of European élite's of equal education and wealth. Some young sons had blood ties to titled people of a previous generation, which provided some mobility in the social stratification system⁵². The snobbishness of the times are illustrated in this local rhyme: "and this was sweet old Trinidad, land of the sugarcane and the cocoa pod, where the Ganteaumes spoke only to the de Verteuls, and the de Verteuls spoke only to God" (Besson, 2000).

However these free blacks did not enjoy their prosperity for long. The new British Governor Sir Ralph Woodford felt that the non-white Creoles were upstarts not in their 'proper place' who had been given too much freedom and privileges by the former Spanish government. The local whites were also foreign to Woodford (French, Irish, German and Spanish). Woodford, the first civilian governor decided to civilise all of Trinidad's 'disorder'⁵³ which came from the vicarious origins of its people by replacing military force with the institutionalisation of a settled society graduated in terms of social rank, which paralleled racial stratification (Besson, 2000). In the 1820s Woodford started to put social pressure on the free blacks and he prevented their advancement wherever he could. Local white Creoles changed their former cordial attitudes and adopted Woodford's prejudices to enhance their own social standing because as 'inferior colonials' they were excluded from the top administrative posts which were reserved for British expatriates (Barnes, 1998; Besson, 2000). After 1876, the English monopoly over government came to an end but the English influence continued (Besson, 2000). The racial and social stratification in Trinidad lasted in modified form until the 1970 Black Power movement forced social changes.

Despite the efforts of Woodford and others to prevent the advancement of the coloured population, agriculture played a role in shaping the society. By the 1950s cocoa had become a staple in Trinidad's export market (Besson, 2000). Whereas sugar cane is only viable with vast acreage's, people with small plots of land were able to participate in cocoa cultivation so the middle classes of all races became comfortable between the 1860s and the 1920s. The French Creoles had become both cocoa planters and exporters-importers (Besson, 2000). The Hispanic-Amerindian population (cocoa panyols) was the poor but hospitable backbone of the cocoa economy, clearing the forest and cultivating the cocoa fields. Many families of the coloured lower and middle classes alongside the Madeiran, Chinese, Syrian, Lebanese and East Indian immigrants were able to own small cocoa estates, own/operate small and medium-sized businesses, live comfortably, and educate their children to become professionals (Mohammed, 1995; Besson, 2000). These new middle classes strove to maintain the values and morals of the colonial society (Besson, 2000).

⁵² Maryse Condé explores the quest for identity of the 'fatherless bastards' of elite men and domestic servants (Rosello, 1995).

⁵³ Trinidad was a British crown colony, with a French-speaking population and Spanish laws (Besson, 2000). Moore-Gilbert (1997) claims that colonials used the existing hybridity in their colonies as an excuse to impose central power as a unifying force.

Gender roles: Man better man

The historical dilemmas of slavery and colonialism have produced anticolonial counter discourses like antillanité and Négritude. These discourses have masculinist overtones; only male talent and pursuits are permitted and anything with female overtones like folk medicine is pushed into the background (Arnold, 1994). The underpinnings of these anticolonial discourses are that western imperial discourse had feminised those cultures, which it had subjugated, in order to justify that subjugation. This feminisation process is intolerable to all colonised men since the role of the real productive man is occupied by the European or American white man (Arnold, 1994). One theorised reaction to this dilemma was the early anticolonial discourse of Négritude which established the ideological dogma that only African contributions to Caribbean culture could be counted⁵⁴ and held the escaped slave or Maroon as the super male but absent hero (Arnold, 1994). The absence of the hero was important because of the real presence or role occupation of the western man. Négritude inverted the racist stereotype but left the underlying racist structure intact (Arnold, 1994).

The newer discourse of créolité created by Jean Bernabé, Patrick Chamoiseau and Raphaël Confiant shifted the theoretical focus to the plantation and the joint Afro-Creole culture of cultural and biological métissage between white masters and black female slaves. In this account the black man still has no creative or procreative role in society but is a male story teller, a docile slave trusted by the master who uses words to spread a subversive message similar to that of the calypsonian⁵⁵ of today (Price and Price, 1997). What both discourses have in common is the absence of women. This is more important in the discourse of créolité since it silences the grandmothers, great aunts and village midwives who are recognised by most others as the transmitters of folk tales, folk medicines and oral culture (Herskovits and Herskovits, 1947; Weniger *et al.*, 1982; Kainer and Duryea, 1992; Milliken and Albert, 1996). Arnold (1994) suggests that intellectuals who think that cultural production is solely a masculine activity created the masculinist anticolonial discourses. In the struggle for recognition between Caribbean males and western males folk medicine may be too closely associated with the denigrated female role to be considered a suitable inclusion into modern development.

The dilemmas of history, language and western-derived gender roles that are said to be not economically realistic have shaped a continuous struggle over origins and whether Creolization is preferable to maintaining separate ethnic identities. It has been claimed that Creole subjectivity is dependent on the structures and ideology of European colonialism and becomes unravelled in a postcolonial Caribbean (Barnes, 1998). Added to this is the pull between the colonisers Eurocentrism and the colonized's Afrocentrism. Price and Price (1997) criticise the French West Indian intellectuals Bernabé, Chamoiseau and Confiant for understating the diversity of the African origins of the French West Indian islands. The West Indians are also criticised for tracing links from the Martiniquan Creole language to the French language of 1652 in Normandy and Anjou. Price and Price claimed that France was

⁵⁴ In Brathwaite's concept of creolization the Asian contributions are considered secondary because they are more recent arrivals than the planters and slaves (Moore-Gilbert, 1997).

⁵⁵ Latour assumes this subversive storyteller role and claims that he is seeking 'weaker explanations and accounts that could defeat the strong scientific ones (Elam, 1999). Latour's storyteller role like that of créolité can only be occupied by a few specially gifted men 'all-seeing' men (Elam, 1999).

pushing this ideology of European linkages to hasten the assimilation of the French West Indies into the metropole.

This assimilation process is an indication that the French West Indian islands are perhaps more actively fathered than the former and current British West Indian islands assuming that the Caribbean islands and their populations are what Latour calls 'hybrids' (Elam, 1999). These hybrids are the mongrel miscegenations of the West, the creations, 'outside children', the responsibilities of the West (still to some extent) (Elam, 1999). The West may not give these mongrel hybrids enough love and attention, but has not abandoned them either. When Indo-Trinidadians accuse Afro-Trinidadians (the academic élite of whom they call Afro-Saxons) of attempting to Afro-Creolize all Trinidadian culture the implication is 1) that they are trying to take over the role of the original 'bad Western fathers' and trying to create more 'mongrel' children (Afro-Indo mixtures are called 'dougla') and, 2) that they are showing racial self-contempt by wanting mixed-race children. Indo-Trinidadians in return are accused of clinging to their traditions and refusing to Creolize⁵⁶. Underlying the debate is which ethnic group should assume the role that the Western colonising male previously occupied. Mohammed (1995) has claimed that in 1917, Trinidad and Tobago had three co-existing and competing patriarchal systems. These were the dominant white system which in those days controlled state power, the 'creole' patriarchy of mixed race and Afro-Trinidadians functioning in and emerging from the white group and the Indian form which was at the bottom (brought to do the labour the emancipated slaves refused) (Mohammed, 1995). As stated above, the discourse of *créolité* silenced the female healers in the struggle for recognition between Afro-Caribbean males and western males. In the triple patriarchal system of Trinidad and Tobago the association of folk medicine with the denigrated female role may have been even more difficult to overcome.

Trinidad is a complex society where authority and values have traditionally been contested. Also playing a role was the competition for economic, social and political power among the three patriarchal groups. Colonialism and the first post-Independent governments were based on Christian values. The predominantly Hindu current government does not accept these values as the norm⁵⁷. This reassertion of Hindu values was a surprise to those long accustomed through school and work relationships to the élite sub-group of westernised, Christianised middle class Indians. It has now become apparent that some in this sub-group had only temporarily jettisoned their Hindu traditions in order to gain political and social power through state education, and that the ones who remained Christian did not represent the larger Hindu group. This larger group consisted of Indo-Trinidadians who had reconstituted their institutions and culture in rural villages and have historically been represented by religious leaders (Mohammed, 1995). In an ironic twist this argumentative Trinidad and Tobago⁵⁸ resembles what Elam (1999) calls the Victorian definition of hybridity: different races continue to live separate lives and promote diverse cultural identities within the body of the hybrid state in a form of internal apartheid.

Many musical forms have been Creolized. The Spanish Catholic and religious Parang has been Creolized into Soca-Parang with profane themes. Likewise Indian chutney music formerly the domain of women before marriage ceremonies has become a more public Creolized Chutney-Soca in a comparatively natural and generative way. The development of

⁵⁶ Brathwaite (1971) leaves East Indians outside of Creolization processes in Jamaica. His reasoning could be linked to their small population in Jamaica.

⁵⁷ Respecting the principle of cultural difference generates problems and issues for discussion (Moore-Gilbert, 1997).

⁵⁸ One long standing and respected journalist calls this bickering "The guava season of our discontent" (Pantin, 1999).

Chutney-Soca troubled the conservative Hindu leaders who did not want these formerly private sensual dances exposed to the male Creole gaze. Cultural hybridity is generative and fertilising (like Chutney Soca) or disruptive, anxiety producing and transgressive depending on the view of the audiences (Friedman, 1999; Werbner, 2001).

Ethnicity implies the maintenance of social boundaries (Friedman, 1999). Ethnic identity seems to require socio-cultural contrast for its validation (Hastrup and Elsass, 1990). This contrast is sometimes artificially created especially in the 'silly season' between 'Indian Arrival Day' in May and 'Emancipation Day' in August. A few examples of this are given. These examples were taken from newspaper debates that generated numerous letters to the editor and comments on radio talk shows. The belief that Carnival in Trinidad has roots in France and Spain and includes African-based additions among others was called Eurocentric. Carnival's 'true' roots were traced to West Africa and the European Carnival tradition was traced to Egyptian fertility rituals (Gilkes, 1999). Serious attempts are being made to have a Park in an élite residential area turned into a memorial for slaves based on the contentious claim that slaves were buried there. Slaves were obviously buried all over the country. No one taking part in the debate over the Park contested the need for a memorial, the choice of site is the discussion point⁵⁹ (Anthony, 1999; Shah, 1999). The small brick enclosure left behind after a Port of Spain store was looted and burned in the 1990 coup was labelled as a slave cell and a ceremony was conducted. The enclosure was built and used as a safe by the Portuguese-origin storeowners (Besson, 2000). These struggles can be interpreted sympathetically as 'dramatised' rituals or transgressive performances in which the performers' aims are to get the blessings of the community (Werbner, 2001). A less sympathetic interpretation is that the performers' unconscious or conscious strategy is to create hyper-Creolized forms in the expectation that these hyper-forms may eventually become accepted as correct (Jackson, 1989).

'Survivals, retentions, adaptations and so on'

Brathwaite⁶⁰ (1971) writes in his chapter 'The 'Folk' Culture of the Slaves' that he does not intend to enter the argument about African 'survivals', 'retentions', 'adaptations' and so on. He then quotes slave customs that are very similar to the one quoted below for Trinidad:

1. Boiling milk bush roots to make a tea which is given to the expectant mother to drink on 5 or 9 successive days 'it cools down the body.' they say for this medicine. The scissors used to cut the umbilical cord are put beneath the place the baby's head is to lie, and left there for 9 days when mother and child first emerge from the house. The new mother can assume full household duties after 9 days. When the baby and its mother emerge from the house 9 days after the birth, a ceremony is held to present the new member of the family to relatives and the family dead. (Herskovits, 1947)

2. A special bath is given eight or nine days after childbirth to the mother and another to the newborn infant. Plants used in the mother's bath are framboisin (*Ocimum micranthum*), coton noir (*Gossypium vitifolium*), rokou (*Bixa orellana*), verveine (*Stachytarpheta* species), semen contra (*Chenopodium ambrosioides*), sou marque (*Cassia bicapsularis*), pistache

⁵⁹ Previously existing sites are renamed rather than new sites being created.

⁶⁰ Edward Brathwaite, *The Development of Creole Society in Jamaica 1770-1820*, Clarendon Press, Oxford.

(*Arachis hypogaea*), and bouton blanc (*Egletes prostrate*). (Taylor, 1950; Hodge and Taylor, 1957)

The second quotation refers to the Caribs in Dominica. The first quotation resembles the Amerindian practice of Couvade in which the underlying belief is that the souls of babies are weakly attached to their bodies and the practices of rest and dieting protect the baby's soul for the first nine days after birth (Butt Colson and de Armellada, 1983). However Herskovits and Herskovits (1947) refer to these practices as African survivals. Voeks (1996) claims that the African slaves who became herbalists played a limited role in introducing plant species from Africa but recognised some of the African species that did arrive opportunistically. There were also similar taxa in South America to medicinal plants in Africa. Creolization took place between the new arrivals and the Amerindians during the early years of contact. The role played by the Amerindians has been marginalised by social scientists like Richard N. Adams⁶¹ (cited by Brathwaite, 1971) who considered the natives to lie outside the process of Creolization. Therefore most folk culture was assumed to be African 'survivals', and 'retentions', rather than 'adaptations' of a preexisting New World culture.

M.G. Smith (1957) critiques the theoretical claims of Herskovits and Herskovits (1947). Mintz (1974) claims that social scientists attribute African origins to traditions because they are frustrated by the painstaking and inconclusive research required in order for origins to be traced. Mintz also claims that survivals are considered interesting because they reflect the resilience of the human spirit even under slavery. The ubiquitous Caribbean dish of rice and peas is not so interesting because as a creole cultural form arising from slavery it is treated as cultural defeat rather than capacity. Brathwaite (1971) claims that there was a tendency for Caribbean people to depend on the mother countries for normative value-references rather than using residential Creole traditions and the Amerindian heritage has been poorly documented.

Subaltern politics

Culture⁶² has become a site where an attempt is being made to establishment a new set of values and ideologies over the existing colonial and black Creole values (Dissanayake, 1992). Indo-Trinidadians claim that black Creole culture was pushed as national culture after national independence in a hegemonic way and Indians (self-described social and cultural subalterns) who did not play along were called the "recalcitrant minority" by the first Prime Minister Dr. Eric Williams (Ryan, 1999; Ryan, 2001). Controversy erupted when May 31, 1999 was created as a new public holiday called 'Indian Arrival Day' since other ethnic groups made counter claims that all Trinidad and Tobago's ethnic groups 'arrived'. There are two vocal camps⁶³ pushing what they call African and Indian culture. Ryan (1999) claims that both of these identities are built on half-forgotten collective memories or myths spun or resuscitated by political and cultural interest-seekers who are

⁶¹ Richard N. Adams, 'On the relation between plantation and "creole cultures" ' in *Plantation Systems of the New World*, Social Science Monographs, VII, Pan American Union (Washington, D.C., 1959).

⁶² The Ministry of Culture and Gender Affairs was called the Ministry of Black Culture and Gender Affairs by Indo-Trinidadian spokesman Kamal Persad as part of a larger claim that Indo-Trinidad festivals are underfunded and that Carnival is not truly national but gets the largest amount of funding (Persad, 1999).

⁶³ "A cacophonous din of spoilers and dividers.. opportunistic carrion crows...[responsible for] a hysteria of racial and religious bigotry spreading like maljo" (Pantin, 1999).

using them to bolster their political, social or economic agendas.. political ethnicity. The debates centre on whether the so-called African-based cultural forms are given more state financial support than those considered Indian-based, and the debates are part of a wider discussion on what it means to be Trinidadian (Munasinghe, 2001). The debate centres on which group can claim to represent the nation and thus legitimise their control over the state (Williams, 1989). The contestation over which culture is funded (dance, music, Carnival, and other 'feathers and flourishes') means a neglect of un-funded culture (folk medicine, patois).

These ethnic 'pushes' along with the rush to 'modernity and the determination to forget everything associated with the colonised past are perhaps strategic. These strategies are undertaken in recognition that culture does not exist in and of itself but evolves through borrowings, appropriations and inventions (Werbner, 2001). If 'forgetting' is a strategic amnesia, if the 'real' history is erased, then another historical narrative⁶⁴ can be created. In one of these new narratives the dead slave becomes the absent hero, venerated in a public park strategically located in an élite residential area, and the élite location perhaps represents another attempt to occupy the role of the western man (King George V Park) by the Afro-Creole man (Emancipation Park).

Cultural integration

Assimilative cultural integration exists when acceptors take the values of the giving culture as a point of departure. Incorporative cultural integration exists when the acceptors' own system of values is the point of departure (Tan, 1989). Assimilative cultural change describes the newly emerging coloured middle class. After 100 years of British rule they had assimilated English Victorian - values (Christianity, politeness and respectability) (Besson, 2000). The original ties to France and Spain had been lost by this time so instead of the tour of Europe, some middle class sons became scholarship winners at the best universities in England and Scotland. Many became professionals, lawyers and doctors, schoolteachers and civil servants. Others, like L.O. Inniss, owned pharmacies (Besson, 2000). In 1910 L.O. Inniss was the head of the pharmacological society in Trinidad and Tobago. It is in the context of the move away from the lower classes towards a professional life style imbued with British values that one can re-read the address Inniss made to the Pharmacological society in 1910:

.....One wonders what those Creole remedies are, which succeed, when duly diplomaed scions of AEsculapius have signally failed... Having been trained as a druggist and having had to pass many hours before my examination, learning the doses of medicine, I can't understand the fast and loose way in which these Creole remedies are prescribed (Inniss, 1910).

The expanding middle class fuelled by education and desirous of social mobility and acceptance, disassociated itself from its background in agriculture and traditional medicine (Rollocks, 1991). This disassociation was then reinforced in and by the British-based educational system which reinforced transcultural scientific knowledge and did not teach alternative approaches at either the Eastern Caribbean Institute of Agriculture and Forestry (ECIAF) or at the University of the West Indies (UWI). Wilson (1961) alluded to the minimal

⁶⁴ 'One of the past's greatest strengths is its power to change' (Shannon, 1998).

prestige agriculture had (still has) as an academic subject, this reflects the marginal position of agriculture in the economy, but it also reinforces that very marginality.

Trinidadian doctors trained abroad in the 'mother country', discouraged the use of folk medicinal practices⁶⁵ because they "smack of pagan Africa, and are no longer necessary in the light of Trinidad's medical progress" (Mischel, 1959; Laguerre, 1987). Dispensary nurses in Dominica still denigrate women's traditional healing expertise with bush teas and obeah (Krumeich, 1994). These attitudes were also present in academia as in the UWI sociologist quoted by Pereira (1969) who claimed that 'a study of folk medicine has no sociological significance'.

Despite the social aspirations of the early pharmacists, doctors and nurses, folk medicine was resorted to for emergencies. For example large quantities of *Momordica charantia* were harvested and sold during the severe influenza epidemic in Barbados in 1938 and even pharmacists bottled and sold infusions (Bayley, 1949). In the 1930s the impact of western medicine was that of a dominant paradigm that was not totally accepted, but which offered elements that were selectively appropriated in a process of indigenization. The concepts of 'structural superiority' and 'functional strength' imply that western medicine acquired élite status because of its ability to control diseases (or suppress symptoms), while the folk medicinal system retained functional strength because it was more accessible and available to those isolated communities that existed well into the twentieth century (Brereton, 1981).

Diachronic and synchronic analyses can be used to explore transactions in social networks which help to explain how one explanatory model, like western medicine, becomes dominant in a medical system (Tan, 1989). In the Cayman Islands folk medicine was once a robustly functioning set of beliefs and practices that served the social and physical needs of the community (Buchler, 1964). In the 1960s Caymanians believed that liquids (like tisanes) were more potent than pills. Inaccurate prognoses and occasional deaths were explained in terms of the system and rarely resulted in a questioning of the basic axioms of the system. However, increased educational opportunities, economic mobility and the expansion of communication networks left Caymanians stranded between folk medicine which is increasingly ridiculed and western medicine (Buchler, 1964). A parallel system developed in Dominica where women eagerly accept modern biomedical services for their children. Culturally women are solely responsible for their children, including their health, so women try to master a range of therapeutic skills. High technology biomedical care is appropriated as a missing element from women's own repertoires of herbal and religious healing (Brodwin, 1998).

In the Spanish-speaking Caribbean Cuba's medical diplomacy and investment in biotechnology generates symbolic capital: intangible qualities (like honour, prestige, and reputation) which appear opposed to strictly economic interests, are in fact convertible back into material capital (Brodwin, 1998). The Cuban policy is to demonstrate that its socialist state can provide a modern health care system and need not settle for small-scale technologies or China's barefoot doctors (Brodwin, 1998). Cuba's biomedical service with its massive ideological weight may be considered a modernising vanguard that undercuts local therapies and conceptions of illness and suffering (Brodwin, 1998). When a modernising

⁶⁵ Part of the development discourse was to remove populations from the domain of folk wisdom, domestic remedies and non-modern healers (Nandy and Visvanathan, 1990).

vanguard like biomedicine is introduced into a rural or poor community, its clients are forced to adopt certain perspectives and learn new scientific phrases (Brodwin, 1998). People then detach themselves from or modify local contexts of meaning when they accept western-derived biomedical treatments (Brodwin, 1998). One instance of this process was seen in one interview in northern Trinidad. The respondent whose puppies had parvovirus used aloes (*Aloe vera*) to purge her dogs for the first day. Then she used store-bought golden seal and myrrh (*Commiphora myrrha*) and gave this for five days. The respondent interpreted the western-derived golden seal in both western and Creole terms: "golden seal is a kind of antibiotic, a blood purifier".

Colonially derived attitudes are also seen in non-academics as depicted in a Jamaica study of 125 pregnant women (Landman and Hall, 1983). Eight-two percent of the women reported drinking bush teas during their pregnancy (Landman and Hall, 1983). These women claimed that drinking *Momordica charantia* would make their babies' skin attractive (brown, fair, and clear). Patricia Mohammed (2000) has described how 'brown' skin has become stereotyped and coded as more desirable. The colonial bourgeois cultural model, and social aspiration are also seen in the phenomenon that a preferred item, usually imported and more expensive, replaces cheaper, more traditional, locally-produced foods when funds are available (Mintz, 1983; Purcell, 1983). As mentioned before the emphasis given to import substitution in manufacturing in the 1950s and 1960s led to shoddy manufactured goods and to the perception that everything foreign is automatically better.

This perception is manifested in the tendency to label local medicine 'bush' and imported medicines 'herbs', these latter are considered superior and consumers ask for them⁶⁸ (Express Newspaper April 1986; Express Newspaper June 1986). The interaction of folk medicine with formal medicine in Trinidad and Tobago can be described as tolerant scepticism, it is 'less than' western medicine (Laguerre, 1987). Allopathic practitioners have legal rights, but other practitioners are free to work as long as they do not claim to be doctors. Tolerant scepticism leads many Caribbean people to rely on the more progressive 'foreign market' for answers. In this context one respondent told a story about Canadian healing oil, a joint/limb healing ointment that is produced in Guyana but is called Canadian Healing Oil because "the people know their market"... "one woman I know sent all over Canada for it, but they never heard of it over there".

These attitudes towards folk medicine fit the concept of ethnic ideology (Serbin, 1981). A series of colonially derived, diffuse ethnic ideologies were developed about the dominant European group and the other subordinated ethnic groups. These ideologies were generated from various factors: the survival of ties in the colonial society and the impact of the dominant ideology and culture on the pattern of each group's differing process of acculturation. These ideologies then gel to become what Balutansky (1997) has described as the Caribbean colonial bourgeois cultural model with its distinct dualisms of head/body/reason/instinct: intellectuals don't play sports, scholarship winners don't read for discovery only to pass examinations. Creolization is then personified as the West Indian love for the vitality of Caribbean life coupled with the need to leave the Caribbean; to be trained in the classics yet argue for socialism, and to refuse to replace the colonisers Eurocentrism with the colonised's Afrocentrism (Balutansky, 1997).

⁶⁸ Most of the Trinidad and Tobago herbal shops sell foreign herbs in conjunction with Kloss's book, (Kloss, J. 1992. *Back to Eden*, 2nd Ed, Back to Eden Books Publishing Co. Loma Linda, California). Plants discussed have similar common names to local plants but are different botanically. Several of the respondents referred to this book or showed the book during the interviews in the first phase of the research.

Crab antics

Wilson (1969) has drawn parallels between Mediterranean concepts of 'honour' and 'shame' in his theorisation of Caribbean concepts of 'reputation' and 'respectability'. Respectability or 'social worth' can only be obtained by adhering to the Eurocentric colonial system of social stratification based on class, colour, education, and propriety based on church-going and marriage (Besson, 1993). Wilson claims that Caribbean women value respectability. Reputation is derived in opposition to the values of respectability and is based on 'personal' worth and is valued by young Caribbean men. Groups of men meet in bars and recreate their reputations based on their recounted boasting of sexual conquests, fathering many children, being able to use words impressively in arguments or debates, participating in Rastafarianism, and having skills like music, hunting, healing, obeah, etc. As men age and become less able to compete on 'reputation' and more concerned with careers and the after-life they become more interested in 'respectability' (Besson, 1993). The reputation/respectability dialectic is indigenous to the Caribbean in the form that it takes and the long-term implications of the everyday practices.

Wilson's concepts are important because folk medicine, village midwives and obeahmen are firmly lodged in the 'reputation' realm, while medicine and pharmacy are located in the 'respectability' realm. This dialectic may have influenced the formality of the first and succeeding international workshops on herbal medicine which sought to pull folk medicine into the realm of 'respectability'. The veterinarians' response to their homeopathic colleague first raised in Chapter 13 can also be analysed in terms of reputation and respectability. It may be that scientists involved in controversial research at the research frontiers, [like Homeopathy], are expected to be located in 'Ivy League Universities', and not struggling in, or re-migrating to Third World countries (Collins, 1981). 'Emigrated crabs' once out are not expected (or welcomed) to return and compete economically with the crabs who stayed behind.

The dialectic between reputation and respectability is manifested in 'crab antics' behaviours which are designed as status levellers (Wilson, 1973). If one crab is placed in a bucket it climbs out and escapes easily. If there are many crabs in the bucket each one will prevent the others from escaping 'in order to retain a community of the impoverished' (Lewis, 1998). Ridicule and gossip are everyday 'crab antics' (Besson, 1993). 'Crab antics' are also found in medicine and agriculture in that pharmacists are accused of altering veterinary prescriptions so that they can obtain drugs to sell without prescriptions. Agrochemical shops are accused of selling the wrong drugs with sometimes fatal effects to livestock and pets. When veterinarians complain about these practices: "we get threats about interfering with a man's ability to earn a living".

Veterinarians were accused similarly by agricultural officers: "[if you tell farmers to use 'bush'], veterinarians take you up on it.... they cannot make money if bush medicine is being used, they say that you are encroaching on a man's power to make a living." Praedial larceny of crops and livestock are 'crab antics' that undermine the viability of the agricultural sector, while petty business thefts and deliberate unproductivity undermine the small business and entrepreneurial sectors. The irony is that these two sectors if vibrant, could provide the lifestyles desired by those engaged in 'crab antics'.

Crab antics can manifest itself as the 'politics of disappearance of local knowledge' (Shiva, 1993). As stated in chapter 12 the scientific actor-network offers the security of a

valued social identity and some herbalists are seeking to occupy this privileged space. A seminar (see Box 3) was planned that can be seen as an attempt at legitimisation in two ways. A recently departed and well-known herbalist C.H.B. Chadband was being honoured, and a Canadian expert (a local boy made good) had been invited to speak. As the time for the evening seminar to begin approached, the Police came from their section of the building to tell the public to leave because there had been an early morning phone call about a bomb. The police and the public (exercise classes and other activities) had been in the building for the whole day but the police had not yet checked the building. The alleged bomb had not been an issue prior to the seminar however. The speaker returned to Canada without sharing his views. The crabs who sought legitimisation were pulled back down into the bucket.

Box 3: Information control in folk medicine

Director: Francis K. Morean,	H.E.R.B.S	B.Sc. Botany/Zoology
Herbal, Educational, Recreational and Biological Services		
in conjunction with the family of the late CHB Chadband		
cordially invites the Public to the Inaugural CHB Chadband Memorial Lecture		
At City Hall, Port-of-Spain on Thursday August 17, 1995 at 7.00 p.m.		
Feature Speaker: Dr. Dennis C.V. Awang		
Topic: The Potential of Traditional Medicinal Plants Preparation		
For further information contact:		
MR FRANCIS MOREAN. TEL/FAX:667-1889/2115		

There are other ways of creating 'disappearance'. Power can be used strategically over women and their subjugated [traditional] knowledges through researchers defining objective knowledge as superior to personal experience⁶⁷ (Holland and Ramazanoglu, 1994). One veterinarian for example knew of ethnoveterinary practices but when pressed for details claimed that they were 'anecdotes that were more amusing than factual'. One more detailed example of this strategy is given below; the scientist involved is one of the few publicly known Trinidad scientists involved in medicinal plants.

Scientist D: "Pavy's book should never have been published. Her heart was in the right place, left alone she would not have written a book. I am not a healer; I am interested in useful knowledge. From Pavy's writings there was no clear set of statements, she doesn't know how the human body works that some parts are frailer than others. There are misleading and harmful things in the book. I read to get news, information, and how to treat illnesses. The book fails on all three counts. Pavy's book should not get as much publicity as mine. One good thing about Pavy's book is that it is of great interest to see how folklore is established and proliferated. Jethro Kloss' book, *Back to Eden*, is full of garbage, it is most misleading. Our common names are poisonous plants, but these names are similar to the foreign plants in *Back to Eden*. *Back to Eden* is pseudo-pharmacognosy, it is about promoting without criticism the use of herbs".

A critique of this scientific attitude is found in Lave (1996). Foucault (1980) claims that those who declare, 'I who conduct this discourse am conducting a scientific discourse, and I am a scientist', diminish other subjects of experience and knowledge.

⁶⁷ In a fertility survey (Anderson and Cleland, 1984) women who said they used herbs as contraceptives (93.5 % of women in Bangladesh) were placed in the category 'not using'.

The exact circumstances are not known but perhaps the changes put in place by Woodford could be seen as the unleashing of 'crab antics'.

Hybridity

Hybridity has been suggested as a useful postmodern tool for this study. It has been claimed that postmodern theorists stave off their anxiety that the ground is beginning to shift below their feet by questioning the basis of truths that they are losing the privilege to define (Masica-Lees *et al.*, 1989). Hybridity has its origins in a 'post' ideology that Williams (1997) claims has been 'relegated to the warehouse of unclaimed mail with all the other post[]isms'. The legitimacy of the term has been questioned: 'an intellectual labelling device for sophisticated cosmopolitans (postmodern tourists who accumulate difference) to define the current state of globalisation and nomadism' (Friedman, 1999).

Hybridity suggests a greater academic consciousness of mixing rather than a greater quantity of mixing which has always existed (Friedman, 1999). Hybridity has conceptual force only if there are non-hybrid cultures (Moore-Gilbert, 1997). The idea that hybridity (as cultural flows coming together in a given place) is new and that cultures were previously whole entities with no passing back and forth suggests unfamiliarity with history. The oldest known sale of *Aframomum melegueta* as a spice from Africa to Lyons was in 1245 AD (van Harten, 1970). Plants introduced to Spain before the seventh century were sugar cane (*Saccharum officinarum*), citron (*Citrus medica*), mulberry (*Morus* species), cotton (*Gossypium* species), ginger (*Zingiber officinale*) and purslane (*Portulaca oleracea*) (Hernández-Bermejo and García Sánchez, 1998). All of the important Old World food crops had been introduced into the Americas by 1600 (Bennett and Prance, 2000). Spanish colonists introduced crops like *Musa* species and *Citrus* species to the West Indies, while British colonists introduced food crops like breadfruit (*Artocarpus altilis*), dasheen (*Colocasia esculenta*) and Mango (*Mangifera indica*) (Mintz, 1974). The trade in food and spices was responsible for the development of several Creole languages (Richards, 1996). A definition of hybridity that goes beyond cross cultural mixing is that it is the situation of being neither inside or outside a culture, but in a third space on the borderline, where one [in terms of social identities and affiliations] is inside and outside at the same time (Friedman, 1999). This inbetween state will be examined but using the term 'passing' rather than hybridity.

Passing

The terms 'passing' and 'role occupation' are terms and phenomena that can be easily recognised by Trinbagonians. Passing as someone you are not carries the constant danger of being caught out, the constant feeling of being inauthentic, and the real danger of becoming confused (Ahmed, 1999). Feeling that you are not adequately filling the role that you are trying to assume often implies that you have unrealistic projections about the role you are trying to occupy. What a 'real man' is for example. Passing as white, or 'passing as foreign' implies renouncing blackness, or being Trinidadian and everything associated with being black or local (like folk medicine). Passing is not confined to blacks. The white Creoles renounced their coloured counterparts in order to 'pass' as the equivalents to the British expatriates. Passing can be an offshoot of the colonising mission which assumes that the colonised-hybrid subject can reflect back the values and practices of the coloniser without

ever assuming the colonisers role (mimic men⁶⁸) (Moore-Gilbert, 1997; Ahmed, 1999). As part of the colonising mission, institutional structures like schools and universities, and key actors like scientists and other professionals played a role in the process of colonial cultural construction. It may be that the British origins and early teachings of UWI succeeded in alienating some staff and students from local traditions and culture. This alienation was increased when Britain relinquished control of newly-independent countries to the colonised-hybrid-mimic-men, who chose to prove themselves up to the task in western terms. A post-independence UWI, though somewhat alienated from the colonial institute still operates within its traditions because the passing subject desires to become like the other (Ahmad, 1999). Perhaps demonstrated in the caricature one UWI-staff member painted of fellow UWI staff:

"I have been here since 1963 and they [UWI staff] haven't changed their attitude. England in the tropics... University in the West Indies Not University of the West Indies, the institution is used as a transit point. There is an identity problem, a lack of self-confidence to handle situations. One UWI Registrar went 'home' to Britain after retirement, he was born in Barbados."

Creolization in folk medicine

The term Creole has become a metaphor for Caribbean peoples, language, habits, cuisine and culture (Mohammed, 1998). Creolization distils the degrading experiences of Caribbean history into a self-consciously de-centred, subversive and transformative creative Caribbean identity (Balutansky, 1997). Local indigenous agricultural practices derived from Creolization are context-specific improvisational capacities, in which successful use and indigenous theory-based logic, conditions belief (Giarelli, 1996; Escobar, 1999; Richards, 1993).

Creolization in folk medicine takes place in practice when culturally based cures are shared between neighbours of different ethnic groups (Niehoff and Niehoff, 1960). Perhaps Creolization based on the ethnomedicinal data would include the story of Gokool, an Indo-Trinidadian, with a Hindu temple and the plants used in religious ceremonies (*Ocimum sanctum*, *Datur stramonium*) in his yard. Gokool has a black polished stone called a 'Belgian black stone' that is used as a snake bite cure. The stone belonged to his grandfather who lived in Arima and carried fresh milk and 'wildmeat' for the Catholic nuns stationed close by. These nuns gave his grandfather the stone. The stone sticks to the bitten spot 'like a magnet' and comes off when it has drawn out the poison. It is then washed in milk and replaced in its container.

Creolization is a difficult analytical tool to use because the fish does not normally analyse the water. There are two perceptions about Creolization. In the first perception 'new' Creolized technologies like folk medicine develop from the synergy between the local knowledge of the Amerindian population and the external knowledge of the immigrants (Richards, 1996). Applying this idea to folk medicine is problematic since the majority of the plants and their uses can be traced backwards to Africa, Europe, India and South America. This implies that the main outcome or synergy in folk medicine is that all the knowledge is

⁶⁸ Naipaul's concept of mimic men means the loss of an inner self due to colonialism, hence you adopt whatever role is imposed upon you from the outside (Rohlehr, 1980).

available to all ethnic groups in a kind of 'melting pot'. An example of the melting pot would be the slave gardens/provision grounds that became the peasant gardens of today (Mintz, 1974; Tobin, 1999). African crops like pigeon peas (*Cajanus cajan*) and okro (*Abelmoschus esculentus*) were grown together with native American crops like corn (*Zea mays*), cashew (*Anacardium occidentale*), cassava (*Manihot esculenta*), avocado (*Persea americana*), guava (*Psidium guajava*), sweet potatoes, tomatoes (*Lycopersicon esculentum*) and starches like *Xanthosoma* species. Also grown were European vegetables and Asian plants like yams (*Dioscorea bulbifera*), sugar cane (*Saccharum officinarum*) and fruits (*Mangifera indica*, *Citrus* species, *Musa* species and *Tamarindus indica*).

The second perception is that Creolization in folk medicine is similar but different to Creolization in languages. In languages the Creole form is a transitional phase in which a new generation assimilates a second, reduced language (Patois), as a first language. Patois has a complexity and a range of meanings (*double entendre*) only available to insiders who shared the lived experience of the country (Mohammed, 1998). Patois has its allotted space in neighbourhood life and is used when deemed appropriate to the social context (Burton, 1993; Friedman, 1999). The social place of Patois in relation to French was thus similar to the relationship of folk medicine with allopathic medicine in Trinidad and Tobago, 'less than'. Another parallel between medicine and Patois is the ability of the Caribbean population to shift back and forth between the official and the unofficial forms. In this idea of Creolization the question is whether a coherent body of Creolized Caribbean folk knowledge was created that was structured and ordered and passed on to subsequent generations as such. There are indications that this has been the case (with limitations). For example the names of plants are sometimes related to their use. An unidentified plant named dégonfier has an ethnomedicinal use for stomach problems. In patois a bloated stomach is called gonflé. The plant used to alleviate the problem is therefore dégonfier. *Xiphidium caeruleum* leaves are rubbed on the feet and knees of children learning to walk. The local name of this plant is walkfast or corrimiento (Spanish correr, to run). Ewen (1896) refers to *Ageratum conyzoides* as 'herbe chatte' and *Eupatorium ayapana* as 'z'herbe à femme'. A name change in the last century may have occurred because of the use of *Ageratum conyzoides* then and currently (given to women after childbirth and to promote menstruation).

Several plants have been used in Latin America and the Caribbean for at least one hundred and fifty years, suggesting successful generational transmission. *Cordia curassavica* has been used to control ticks in the Caribbean since the 1800s or before (Ewen, 1896). *Justicia pectoralis* is used for muscle fatigue in South America and for bathing and as a beneficial mouth wash in Venezuela (Morton, 1975; Wilbert, 1996). These uses and the use for internal bruises were found in pre-1834 Barbados (Handler and Jacoby, 1993). Wong (1976) has recorded the use of *Desmodium adscendens* and *Desmodium canum* in Trinidad as a depurative, for oliguria, and kidney and venereal diseases. These uses are also current in Colombia, Mexico, Nicaragua and in Barbados where the ethnomedicinal use existed pre-1834 (Zamora-Martínez and Nieto de Pascual Pola, 1992; Handler and Jacoby, 1993; Barrett, 1994; Laferriere, 1994). *Scoparia dulcis* was used in Barbados as a diuretic prior to 1834 (Handler and Jacoby, 1993). *Chamaesyce prostrata* was used in Barbados prior to 1834 for venereal complaints (Handler and Jacoby, 1993).

The unexpected results of experiments are explained in terms of the Creole folk medicine system. A farmer in Tobago had given his cows lime skins as a supplemental feed. An unexpected benefit from these lime skins was explained in terms of the folk medicinal system: "There was a change in their appearance, they put on weight, it was more than a

coincidence. The skins were still fresh, they still had lime oil, the oil was a repulsive thing to worms. My father reminded me that long time grannies used to give lime peel tea for stomach problems. So the internal parasites in the gut no longer enjoyed living in the stomach. The cows got the peels for six months out of the year. Also the parasite eggs life cycle in the pasture had an effect, I was rotating the pastures so it was a combination of two things". There were other indications that experiments are taking place which refines the folk knowledge rather than the knowledge being simply handed down or passed on:

One respondent claimed that: "I used to try things as a small boy. When my fowls were sick I gave them lime juice, Canadian oil, and a pinch of salt. If it was good for them it was good for me and vice versa".

Respondent 2: "I learn by experiments, the young they are lazy to do it, they don't know how, it takes time. I use the quantity five [as a dosage] because there are five fingers on each hand, and five senses, each man has his own science, you have to offer and pray over it, and let the sickness go along with the sun when it is setting.

There were also rules of thumb on dosages"

Respondent 3: "Take a reasonable handful, with 'bush' you sometimes overdose sometimes underdose."

Respondent 4: "First you have to get the animal accustomed to it. There are alkaloids in 'bush'. You could poison yourself if you take the full dose right away, so take one leaf the first day, two leaves the 2nd day, until the full dose at 9 days. Goats get diarrhoea from juicy things, this is not a medicinal cure, but bamboo is a dry thing, dry breadfruit, give these to the goat. The bacteria will be destroyed by not having enough water. I experiment on many things. People taught me from long time. I am 77, when I am sick I ask people, I do research. I figured out the principle myself. Others did not know why it worked."

However the clearest example of this idea of Creolization as a coherent body of knowledge that was structured and ordered and passed on to subsequent generations as such is seen in case study 7 on hunting dogs. A 'reduced' body of knowledge (practising the rituals without knowing the underlying belief-system) was passed from the Amerindian hunters in the 1800s or before to their Creole co-hunters who then passed on this knowledge to family and friends. Unlike some of the other respondents the hunters never assigned their knowledge to Africa or India.

Cultural codes

There are certain instances in which cultural codes transfer from one continent to another with migrants but the original meaning, plant use, or plant used, or belief system is lost or modified in the transfer process. The following section lists and discusses a few of these cultural codes that have undergone a process of Creolization. One unexplained code or practice is given first: "After eating the roast corn, cut the cob into rings and make holes in them, put these on a string and tie it around the dog's neck. This cures kennel cough."

In Paramin, Ruda (*Ruta graveolens*) was said to be a spiritual bush, and harvesters had to have clean hands to touch it, and could not be perspiring. The plant could not be told that it smelt funny or it would die. It could not be planted too close to people. "No evil meddles with it." It had to be paid or 'mounted' which means burying a few silver coins near

to the plant in exchange for special favours. A similar belief was expressed about hog tannia (*Xanthosoma brasiliense*, *Xanthosoma undipes*) in Mayaro at the other end of Trinidad. It had to be planted away from people since unclean people caused it to wither. Moodie (1982) describes special plants that are a source of strength, good luck, and success in hunting and cock fighting and protect people and their homes. These 'mounted' plants are planted in holes sprinkled with the blood of a dove or chicken, on Good Friday or the first Friday in Lent, and the roots are sprinkled with milk (Moodie, 1982). The mounted plants whistle to their owners to warn them of danger. This belief is similar to that of the Miskito of Eastern Nicaragua where plants are given symbolic payments if they are considered to have supernatural owners who require such payment (Dennis, 1988).

Guinea pepper (*Aframomum melegueta*) seeds had the reputation of causing quarrels if the seeds were scattered on the ground or if they were thrown into someone's yard. "How you getting on so, like they throw guinea pepper or what"? The reputation for causing quarrels may have come from the ethnomedicinal practice in Liberia. *Aframomum melegueta* grains are mixed with rum or brandy to which it bestows a fiery pungency and it is then used as a sexual stimulant (van Harten, 1970). The use of obie seed (*Cola nitida*) is also recognised as an African tradition. Imported seeds are sold in the market, but one respondent had a tree. The seeds are used for a wide range of medicinal purposes while in Nigeria the seeds are often used as a stimulant. These traditions have passed down through the generations in a Creolized form.

Before electric lights were widespread some people put jumbie bead seeds (*Abrus precatorius*, Fabaceae) in the lamp oil with garlic. It was said that no witch / soucouyant⁶⁹ could come into the house at night when the lamp was lit. Evidence of a soucouyant was a blue / black mark on the skin. "If you didn't get a lash it had to be a witch." Similar beliefs about witches leaving blue bruises are found in Nepal (Eigner and Scholz, 1999). The Yucatec Maya in Mexico use *Abrus precatorius* baths against evil eye (Ankli *et al.*, 1999).

Days of the week/ phases of the moon

Rules of thumb about Good Friday may have Spanish origins (Martínez-Lirola *et al.*, 1996). A Talparo respondent claimed that *Bixa orellana* root was to be cut on a Wednesday or Friday for dropsy, 'this was a secret not obeah, but for jaundice it could be cut at any time'. Seasoning makers in Paramin spoke of a religious-based belief that on Good Friday if someone dug up a clump of fowl foot grass (*Eleusine indica*) they would get a piece of coal below the roots. White/red physic nut (*Jatropha curcas* / *gossypifolia*, Euphorbiaceae), if cut on Good Friday would produce the blood of Jesus.

According to Bayley (1949) plants which have associations with obeah can only be cut at certain times of the moon and it is thought that brews which are left overnight in the dew acquire maximum efficacy (Bayley, 1949). These practices were seen in a few instances. Children suffering from marasmi (malnutrition) were bathed for eight or nine days with congo lala (*Eclipta prostrata*). This was to be put in the dew for four days before use. A tisane for colds consisted of koko root (*Petiveria alliacea*), urine of a young boy, camphor and rosemary (*Rosmarinus officinalis*). This was put in the dew for nine days before external

⁶⁹ Even the soucouyant is said to be 'Creole' a syncretism of the European vampire and the African complement (Besson, 2000)

application. A decoction of *Capraria biflora* used as an eyewash is also put in the dew over night before use.

Folk beliefs

G.P. Murdock has developed a global typology of causal theories of illness (Green, 1998). Murdock has a binary classification of natural and supernatural and subdivides the latter into mystical causation (impersonal, contagion), animistic causation (spirit aggression) and magical causation (sorcery and witchcraft). Mystical causation occurs when someone comes into contact with a polluting object, substance or person.. e.g women's reproductive fluids. Mystical causation beliefs still exist in Trinidad. One respondent was bitten by a spider, and fell three times before he reached to the back of his house. When his wife called him he could not answer because before treating himself he had to: "Keep to yourself don't go by too much woman, if you see a pregnant woman you can't survive." He chewed three tref (*Aristolochia trilobata*) leaves found at the back of the house and recovered. Then he spoke to his wife.

A few of the female respondents claimed that pregnant or menstruating women should not climb over a rope tethering an animal or sit cross-legged or on a doorstep where people would cross over them. Landman and Hall (1983) report similar beliefs in Jamaica. Women also should not untie or tie hunting dogs, step over them or could not climb trees during their menstrual cycle. However if a hunting dog was 'tied' by another jealous hunter, a woman was supposed to 'loose' it by bathing it a river. Taylor (1950) claims that Dominica Caribs did not allow 'heaty' women (pregnant or menstruating) to eat hunted meat, handle dogs or guns since this would make the hunter's dogs 'spoiled' or slow and heavy.

If someone crushed another person's foot by accident the hurt person was supposed to return the action otherwise some unknown pain of the 'hurter' might transfer itself to the 'hurt'. Likewise if a woman had painful menstruation she should kick a banana tree and then turn away without looking back. She should also not tell anyone about her actions or condition. There is a widespread local belief in Barbados, also found in Trinidad that *Carica papaya* trees planted to the windward of a house have harmful effects, particularly to women (Gooding, 1940). Gooding (1940) claims that it is unlikely that this belief is of African origin.

Mayoc chapelle (*Entada polystachya*, Fabaceae) used for cooling was said to be only for women as it would cut men's 'nature'. It was also said that Lani bois (*Lepianthes peltata*) should be put in all cooling for men otherwise 'they would get like a watchman'. Some people pass a comb over the udder for mastitis. "It is a secret business, nobody must see or hear you do it." "When the breast has too much milk, get a basin and comb the breast. The pain and the hardness go; it softens the milk. It is a horse comb, light grey with one-sided teeth, and long like your hand. I don't know why it is called a horse comb".

Transmission through time and space

This body of Creolized Caribbean folk knowledge was organised, made systematic and schematic and taught and learned in an organised form across time and space in the absence of writing (Mathias and McCorkle, 1997; Goodenough, 1996). This was

accomplished by recall involving ceremonial and ritual events such as the folk media reported below.

In the following section two examples of the oral tradition are given. The first is a calypso that gives an accurate description of the folk knowledge, its uses and the oral tradition from grandparents to the young. Calypsonians can be regarded as the folk socio-cultural historians of Trinidad and Tobago and Calypso has been described as the redemptive potential of Caribbean folk wisdom (Price and Price, 1997). The second is a description of the Tobago Play 'Man better Man'. This play has parallels to the struggle between 'science' and 'non-science' where both are claiming to be the 'better man', rather than 'an equivalent man'. The play gives a description of knowledge as a source of power for its holders. Only those who are accepted by the community as 'knowledgeable' can market this knowledge.

A Calypso: Long Time Remedy by Willard Harris, (Lord Relator) 1971, Verse 1

Nowadays if you sick you in plenty pain, Because it ain't have good medicine again
Nowadays people does be sick for a week, Long time, one day you sick, next day you on your
feet, I living at my granny, so I bound to know, You can't beat a remedy of long ago
Long ago, if the cold giving you trouble, 'bois canoe, black sage tea, or some soft candle, vervine,
christmas bush or shado beni, bound to pass the cold immediately, It is my belief, you could settle
yourself with soursop leaf, I say we have a right to take example, and try to live like the old people,
because, as a youngster, I realise, de old people way of living is really wise. It's only recently, look
I find it strange, old people used to live to a hundred and change, 'cause anything gone wrong
with their body, they could find a suitable remedy (Rollocks, 1991).

Man Better Man: A play for the Tobago Heritage Festival 1990.

The show was entitled 'Man-better-Man' after one of the more efficacious herbs used by the islands' folk practitioners. The play was woven around two 'medicine men', each of who was trying to prove himself more efficient, skilful and powerful, than the other. In other words, they were engaged in battle of 'Man-better-Man'. At the end of this battle which was fiercely fought with ants, nimbles, puncheon rum, 'compelling oil', red lavender, man-better-man, wonder of the world, ruckshun, and verses of Psalm 37 and 59, the 'better-man' surfaced, as master over his opponent. In proving his efficacy as a 'medicine-man' the 'better-man' won the admiration and recognition of the crowd. As the 'better-man', he was able to foil all the tricks of his opponent. The practitioner needs to prove himself efficient as a healer to claim the title (Rollocks, 1991).

Legitimation

Indigenous knowledge exists in parallel to Western science. The process of legitimisation in Indigenous Knowledge takes place in a similar manner to what takes place in the scientific world, through culturally esteemed opinion leaders in a community. In folk medicine there are three domains that legitimise the healer: the subjective reality of the healer; the objective reality as measured by his clientele based on his successful cures; and the belief systems of the community [locally and globally influenced] which impacts on the first two (Laguerre, 1987). Laguerre (1987) claims that rejected knowledge [like some types of indigenous knowledge] has three types of adherents. Those born and socialised in it who would be permanent advocates, temporary advocates who turn to it in crisis times, and those who only believe in specific aspects, not in the totality. There are also three types of transmission of indigenous knowledge: the society and community, the family, and the individual (dreams) (Laguerre, 1987).

Cultural legitimisation

In parallel to the scientific world, actors in traditional medicine use a process of legitimisation in that healers need to be or become culturally esteemed opinion leaders in a community as described in the play above. Cultural esteem is linked to the social standing of the healer. Herbalists and religious healers claim to have the power to effect cures. The gift is regarded as given to be of service to others and if it is not used in this way, it will be lost. These specialists, both Indian and Creole, do not share their knowledge with this researcher or with others because they claim it is 'a gift from God'. Some herbalists ('bush' doctors) view knowledge as a private good and thus a source of revenue and power. Some have learnt about plants through dreams or revelations. Some respondents die with their gifts while others feel compelled to pass on their knowledge at their deathbeds so that they can rest in peace. One respondent had gained her knowledge from a dying healer and claimed that the cock that flew into her kitchen the day after the healer died was a sign from beyond the grave. Trinidad has Indo-cultural specialists such as 'vein pullers' and masseurs who may be consulted for sick animals. One vein puller interviewed in the first research phase is quoted below:

"I know more than them [the Vets]. I treat people as well as animals. I am the eldest son, a vein puller. When doctors 'band' a sprain, I will pull it. If neighbours animals have trouble giving birth I will go. But if the 'young' dies and the animal's belly is swollen I call Dr.G. I can push back a prolapse so that it never comes out again. My father taught me. I can't read, so I watch pictures in books. I asked a doctor for his book of human medicine with lots of pictures. When my animals are sick I buy medicine, and if Dr G. comes to treat them he doesn't charge".

One anecdote related to the objective reality/validation tells of an American tourist who had serious medical problems on a popular beach related to his high blood pressure. A food vendor (shark and baked bread) boiled a tea of *Ocimum* species for him. The story goes that he felt better and rewarded the vendor with a trip to New York.

The social [de]-construction of knowledge

A few scientists were honest enough to admit that they rejected folk medicine based on negative childhood experiences. These negative childhood experiences and the female aspect of folk medicine are described in the excerpt from a short story⁷⁰ given below:

My grandmother was regarded by the community around us in Tunapuna as a nurse and a midwife. I rather suspect that she had acquired that reputation by her practical experience and knowledge, and from skills which were handed down. I may be wrong but I do not believe that she had any formal training as a nurse, but her vitality her fund of knowledge on the merits of the different grasses, bushes and shrubs which were always to hand, and her success with confinement cases, had over the years, built up the respect and the faith in her prowess and they are the two essentials in the healing process. She had delivered all of us, my cousins included, and our health and our vitality bore living witness to her ability.

⁷⁰ Quote taken from "Nostalgia" an unpublished short story by Kenneth Lans.

She was the one to whom we were sent whenever we felt out of sorts, and at the beginning of the school holidays. Castor oil, senna, fever grass, shining bush and all the other mixtures fashionable in those days were inflicted on us with the admonition that they were good for us. Castor oil was usually given during the first week of the holidays. What we got was a foul-smelling, un-refined oil which she had extracted by means unknown to us, from a tree which she nurtured in her yard. She was not one to indulge in the purchase of medicines when all the necessary ingredients were easily to hand either in her yard or in that of the many solicitous neighbours'.

I had a particular loathing for that castor tree, and that dislike extended to a physic nut tree which grew in our own yard. They epitomized the violence done on our persons, both internally and externally. Swallowing that awful tasting thick foul-smelling spoonful of oil was only the prelude to the glass of Epsom's Salts which had to be taken the following day. The salts were given to us by our mother. We were never quite sure which we hated the more, the oil or the salts. The oil was only a spoonful, but we felt the taste in our mouths whenever we burped, while the long glass of the bitter-tasting salts took an eternity to go down, and to our minds only aggravated an already bad situation.

We were all given our doses on the same day, and this created a logistical problem, for there was only one out-house. There were five young busy bodies vying for the offensive relief that it only temporarily gave, and chamber pots were pressed into service....Those first days were traumatically busy, and we soon learnt to develop a pale listless look which was interpreted by the adults as the medicine 'taking hold'. Once that was out of the way, we were considered to be immune to almost everything. The exception was growing fever. 'Growing fever' was any type of ailment which induced a temperature and which did not readily lend itself to any other diagnosis after careful scrutiny by the medicine maker of the family. Remedies for that malady were limited only by the imagination, for readily available within easy reach was a formidable array of herbs, leaves, and other bushes which had proved effective in the past. Confronted by such diversity, volume, and absolute faith, no self-respecting virus - a modern word - would stay around long enough to hamper any child's holiday. Armed with the immunity of the purges, the bush teas, and fortified by the equally effective coolings and tonics, together with the love and patience of all those good people, we were free to conquer the world in any way we chose. So long as we did not get into 'trouble'.

The search for original continents

The origin of the ethnoveterinary knowledge indicates why things are done in certain ways, and if there are any theories behind the practice. Table 19 traces the possible origin of some of the medicinal plants. Difficulties arise because of the remigration of some Indian indentured labourers, the repatriation of some freed African slaves and the migration of Caribbean peoples throughout South America. References used are Joseph (1837), Williams and Williams (1969), Morton (1981) INRA-CARDI (1991) and Pacific Island Ecosystems at Risk (www.hear.org/pier/scinames.htm). Native in the geographical origin column means Latin America and the Caribbean.

Table 19. Possible origin of the ethno [veterinary] medicinal plants

	Scientific name	Common name	Geographical Origin
1.	<i>Abelmoschus esculentus</i>	Okro	Africa
2.	<i>Abelmoschus moschatus</i>	Gumbo musque	S.E. Asia
3.	<i>Abrus precatorius</i>	Jumbie bead	Native
4.	<i>Achyranthes indica</i>	Man better man	Asia
5.	<i>Acnistus arborescens</i>	Wild tobacco	
6.	<i>Acrocomia aculeata</i>	Gru gru boeuf	Native
7.	<i>Aframomum melegueta</i>	Guinea pepper	Africa
8.	<i>Ageratum conyzoides</i>	Z'herbe á femme	Native ?
9.	<i>Aloe vera</i>	Aloe	Africa
10.	<i>Allium sativum</i>	Garlic	Europe
11.	<i>Ambrosia cumanensis</i>	Altamis	
12.	<i>Anacardium occidentale</i>	Cashew	Native
13.	<i>Annona muricata</i>	Soursop	Native
14.	<i>Antigonon leptopus</i>	Coralita	Native
15.	<i>Apium graveolens</i>	Celery	Europe
16.	<i>Areca catechu</i>	Betel nut	Malaysia
17.	<i>Aristolochia rugosa</i>	Mat root, racin mat	Native
18.	<i>Aristolochia tribolata</i>	Tref	Native
19.	<i>Artemisia absinthium</i>	Wormwood	Europe
20.	<i>Artocarpus altilis</i>	Breadfruit	Pacific
21.	<i>Asclepias curassavica</i>	Red top	Native
22.	<i>Azadirachta indica</i>	Neem	Asia
23.	<i>Bambusa vulgaris</i>	Bamboo	Asia
24.	<i>Barleria lupulina</i>	Snake bush	Mauritius ?
25.	<i>Bauhinia cumanensis</i>	Monkey step	Native ?
26.	<i>Begonia humilis</i>	Lozeille	Native
27.	<i>Bidens pilosa</i>	Needle grass	Native
28.	<i>Bixa orellana</i>	Roukou	Native
29.	<i>Bontia daphnoides</i>	Olive bush	Native
30.	<i>Brownea latifolia</i>	Cooper hoop	Native
31.	<i>Cajanus cajan</i>	Pigeon pea	Africa, India
32.	<i>Cannabis sativa</i>	Ganja	Asia
33.	<i>Capraria biflora</i>	Du thè pays	Native
34.	<i>Capsicum frutescens/annum</i>	Pepper	Native
35.	<i>Calotropis gigantea</i>	Madar	Asia
36.	<i>Carica papaya</i>	Papaya	Native
37.	<i>Catharanthus roseus</i>	Periwinkle	Native ?
38.	<i>Cecropia peltata</i>	Bois canôt	Native
39.	<i>Cedrela odorata</i>	Cedar	Native
40.	<i>Centropogon cornutus</i>	Crepe coq	Native ?
41.	<i>Chamaesyce hirta</i>	Mal nommée	Native ?
42.	<i>Chenopodium ambrosioides</i>	Worm grass	Europe ?
43.	<i>Chromolaena odorata</i>	Christmas bush	Native

Table 19. Possible origin of the ethno [veterinary] medicinal plants (cont.)

	Scientific name	Common name	Geographical Origin
44.	<i>Chrysobalanus icaco</i>	Ipecak	Native
45.	<i>Cissus verticillata</i>	Blister bush	
46.	<i>Citharexylum spinosum</i>	Bois côtelette	Native
47.	<i>Citrus aurantifolia</i>	Lime	Asia
48.	<i>Citrus aurantium</i>	Sour orange	Asia
49.	<i>Citrus limonia</i>	Lemon	Asia
50.	<i>Citrus paradisi</i>	Grapefruit	Asia
51.	<i>Citrus nobilis</i>	Portugal	Asia
52.	<i>Citrus sinensis</i>	Orange	Asia
53.	<i>Cocos nucifera</i>	Coconut	Pacific
54.	<i>Coffea arabica</i>	Coffee	Africa
55.	<i>Cola nitida</i>	Obie seed	Native?
56.	<i>Coleus aromaticus</i>	Spanish thyme	
57.	<i>Commelina species</i>	Water grass	Native
58.	<i>Cordia curassavica</i>	Black sage	Native
59.	<i>Costus scaber</i>	Wild cane	
60.	<i>Crescentia cujete</i>	Calabash	Native
61.	<i>Crotalaria retusa</i>	Shack shack	Pantropical
62.	<i>Croton gossypifolius</i>	Blood bush	
63.	<i>Curcuma domestica</i>	Turmeric	Asia
64.	<i>Cuscuta americana</i>	Love vine	Native
65.	<i>Cymbopogon citratus</i>	Fever grass	India
66.	<i>Cynodon dactylon</i>	Dube	Pantropical
67.	<i>Cyperus rotundus</i>	Nut grass	Eurasia
68.	<i>Datura stramonium</i>	Datur	India
69.	<i>Dendropanax arboreus</i>	Fei jein	Native
70.	<i>Desmodium canum</i>	Sweet heart bush	
71.	<i>Dorstenia contrayerva</i>	Refriyau	Native
72.	<i>Eclipta prostrata</i>	Congo lala	
73.	<i>Eleusine indica</i> *	Dead man's grass	India
74.	<i>Eleutherine bulbosa</i>	Dragon blood	
75.	<i>Entada polystachya</i>	Mayoc chapelle	
76.	<i>Eryngium foetidum</i>	Chadron bënëe	Native
77.	<i>Erythrina pallida</i>	Immortelle	Native ?
78.	<i>Eupatorium triplinerve</i>	Japanne	Native
79.	<i>Eupatorium macrophyllum</i>	Z'herbe chatte	Native
80.	<i>Flearya aestuans</i>	Stinging nettle	Pantropical
81.	<i>Flemingia strobilifera</i>	Kidney bush	Asia, Malaysia
82.	<i>Gomphrena globosa</i>	Bachelor button	India
83.	<i>Gossypium species</i>	Cotton bush	Native ?
84.	<i>Hibiscus rosa-sinensis</i>	Hibiscus	Asia
85.	<i>Hibiscus sabdariffa</i>	Sorrel	Asia

Table 19. Possible origin of the ethno [veterinary] medicinal plants (cont.)

	Scientific name	Common name	Geographical Origin
86.	<i>Hippobroma longiflora</i>	Ipecac	Native
87.	<i>Hyptis suaveolens</i>	Matrank	Native ?
88.	<i>Jatropha curcas</i>	Physic nut	Native
89.	<i>Jatropha gossypifolia</i>	Physic nut	Native
90.	<i>Justica secunda</i>	St. John's bush	Native
91.	<i>Justica pectoralis</i>	Carpenter grass	Native
92.	<i>Kalanchoe pinnata</i>	Wonder / world	Asia
93.	<i>Lantana camara</i>	Kayakeet	Native ?
94.	<i>Laportea aestuans</i>	Red stinging nettle	
95.	<i>Lawsonia inermis</i>	Mehndi	N. Africa, Asia
96.	<i>Leonotis nepetaefolia</i>	Shandileer	Africa
97.	<i>Lepianthes peltata</i>	Lani bois, sun bush	Native
98.	<i>Lippia alba</i>	Santa Maria	
99.	<i>Mangifera indica</i>	Mango	Asia
100.	<i>Manilkara zapota</i>	Sapodilla	Native
101.	<i>Mammea americana</i>	Mammy apple	Native
102.	<i>Microtea debilis</i>	Alantukai	
103.	<i>Mimosa pudica</i>	Ti marie	Native
104.	<i>Momordica charantia</i>	Caraalli	Asia
105.	<i>Monstera dubia</i>	Sei jein	
106.	<i>Morinda citrifolia</i>	Noni	Asia, Australia
107.	<i>Morus alba</i>	Pawi bush	China
108.	<i>Mucana pruriens</i>	Cowitch	Pantropical
109.	<i>Musa species</i>	Plantain	Asia
110.	<i>Myristica fragrans</i>	Nutmeg	Moluccas
111.	<i>Nasturtium officinale</i>	Water cress	Europe
112.	<i>Neurolaena lobata</i>	Z'herbe á pique	Native
113.	<i>Nicotiana tabacum</i>	Tobacco	Native
114.	<i>Nopalea cochenillifera</i>	Rachette	Native
115.	<i>Ocimum gratissimum</i>	Fon bazin	Pantropical
116.	<i>Ocimum campechianum</i>	Ti bom	
117.	<i>Ocimum sanctum</i>	Tulsi	
118.	<i>Oryza sativa</i>	Rice	Asia
119.	<i>Ottonia ovata</i>	Pot bush	
120.	Unknown	Eyebright	—
121.	<i>Panicum maximum*</i>	Wiz/ Guinea grass	Africa
122.	<i>Parinari campestris</i>	Bois bandé	
123.	<i>Parthenium hysterophorus</i>	White head broom	Native
124.	<i>Paspalum virgatum</i>	Razor grass	Native
125.	<i>Passiflora quadrangularis</i>	Barbadine	Native
126.	<i>Passiflora foetida ?</i>	Marie gourgéis	Native
127.	<i>Passiflora suberosa</i>	No name known	Native

Table 19. Possible origin of the ethno [veterinary] medicinal plants (cont.)

	Scientific name	Common name	Geographical Origin
128.	<i>Pelargonium zonale</i>	Geranium	South Africa ?
129.	<i>Peperomia pellucida</i>	Shining bush	Native ?, W. Africa?
130.	<i>Peperomia rotundifolia</i>	Giron fleur	Africa? Native ?
131.	<i>Persea americana</i>	Avocado	Mexico
132.	<i>Petiveria alliacea</i>	Kojo root	Native
133.	<i>Phyllanthus niruri</i>	Seed under leaf	Native
134.	<i>Phyllanthus urinaria</i>	Red Seed under leaf	Native ?
135.	<i>Pilea microphylla</i>	Du thé bethelmay	Native
136.	<i>Pimenta racemosa</i>	Bayleaf	Native
137.	<i>Piper hispidum</i>	Candle bush	Native
138.	<i>Piper marginatum</i>	Agouti bush	Native
139.	<i>Pithoccellobium unguis-cati</i>	Cat's claw	Native
140.	<i>Pityrogramma calomelanos</i>	Egyptian secret	
141.	<i>Plantago major</i>	Planten	
142.	<i>Pluchea symphytifolia</i>	Guèrèr toute	Native
143.	<i>Pogostemon heyneanus</i>	Pachouli	
144.	<i>Portulaca oleracea</i>	Pussley	Eurasia ?
145.	<i>Pouteria sapota</i>	Mammy sapote	Native
146.	<i>Psidium guajava</i>	Guava	Native
147.	<i>Pueraria phaseoloides</i>	Kudzu	Asia, Pacific
148.	<i>Punica granatum</i>	Pomegranate	Eurasia
149.	Not yet identified	Turpentine bush	-----
150.	Not identified	Matapal	-----
151.	<i>Renealmia alpinia</i>	Wild balisier	
152.	<i>Richeria grandis</i>	Bois bandé	
153.	<i>Ricinus communis</i>	Castor oil leaf	Africa
154.	<i>Rosmarinus officinalis</i>	Rosemary	Europe
155.	<i>Roupala montana</i>	Bois bandé	
156.	<i>Ruellia tuberosa</i>	Minny root	Native
157.	<i>Ruta graveolens</i>	Ruda	Native ?
158.	<i>Saccharum officinarum</i>	Sugar cane	Asia
159.	<i>Sambucus simpsonii</i> *	Syrío [Sabugueiro]	Native ?
160.	<i>Sansevieria guineensis</i>	Langue bouef, lash	
161.	<i>Scoparia dulcis</i>	Sweet broom	Native
162.	<i>Senna alata</i>	Senna	Native
163.	<i>Senna occidentalis</i>	Wild coffee	Native
164.	<i>Sida acuta</i>	Garaba broom	Pantropical
165.	<i>Siparuma guianensis</i>	Dead man's bush	
166.	<i>Solanum americanum</i>	Agouma, gouma	Native
167.	<i>Solanum melongena</i>	Melongene	India
168.	<i>Solanum species</i>	Devil pepper	-----
169.	<i>Spiranthes acaulis</i>	Lappe bush	Native

Table 19. Possible origin of the ethno [veterinary] medicinal plants (cont.)

	Scientific name	Common name	Geographical Origin
170.	<i>Spondias mombin</i>	Hogplum	Native
171.	<i>Stachytarpheta cayennensis</i>	Rat tail vervine	Native
172.	<i>Stachytarpheta jamaicensis</i>	Vervine	Native
173.	<i>Syngonium podophyllum</i>	Matapal-kit	Native
174.	<i>Tagetes patula</i>	Marigold	Mexico
175.	<i>Tamarindus indica</i>	Tamarind	E. Africa
176.	<i>Theobroma cacao</i>	Cocoa	Native
177.	<i>Tournefortia hirsutissima</i>	Chigger bush	
178.	<i>Triumfetta lapula</i>	No name known	Native
179.	<i>Urena lobata</i>	Cousin Mahoe	Asia ?
180.	<i>Urena sinuata</i>	Patte chien	Asia ?
181.	<i>Vernonia scorpioides</i>	Ruckshun	Pantropical
182.	<i>Vetiveria zizanioides</i>	Vetivert	India
183.	<i>Vitex trifolia</i>	No name known	S.E. Asia
184.	<i>Wedelia trilobata</i>	Verven Caribe	Old World tropics
185.	<i>Xanthosoma brasiliense</i>	Hog tannia	Native ?
186.	<i>Xanthosoma undipes</i>	Hog tannia	Native ?
187.	<i>Xiphidium caeruleum</i>	Walk fast	
188.	<i>Zingiber officinale</i>	Ginger	Asia
189.	<i>Zea mays</i>	Corn	Native

Conclusion

Caribbean folk medicine is based on a marriage-à-cinq of European folk medicine; scientific medicine; African-based practices; Amerindian medicine and Indian-based medicine. It is a product of inter-group borrowing based on cultural traditions.

This chapter has examined some of the cultural traditions and the socio-historical 'baggage' of the Caribbean. There are people in the Caribbean who prefer to live in the present and try to skip parts of their history, especially the five centuries of colonisation (Douglas, 1995; Price and Price, 1997). The irony of Creolization is that it is the same destructive double consciousness of the colonized subject that paradoxically generates the creation of rich creolized cultural forms (Barnes, 1998). African and Indian identities built on half-forgotten collective memories are being strategically used by political and cultural interest-seekers for their own political, social or economic agendas (Ryan, 1999). Part of this phenomenon can be explained in terms of self-perceived subalterns now claiming an equal space in the 'rainbow society'. Brathwaite (1971) claims that the original white élite's political weakness⁷¹ and their dependence on Europe for normative value-references created a pattern of behaviour which has since continued with the equally weak Afro-Saxons. Currently non-residential traditions are being sought not only in Britain, the colonial mother country, but also in North America, Africa and India.

⁷¹ Local whites in Trinidad had their own internal tensions based on their different European origins (Wood, 1968).

During indenture East Indian families and immigrants from the same villages or regions were sent to the same estates (Weller, 1968). This has always been said to have allowed for a greater retention of Asian cultures and traditions than the practice of slavery did for African traditions. The issue to be debated is whether all African survivals are indeed so or whether Amerindian culture provides the base of creolization. If the African survivals were indeed limited then the tendency for Afro Creoles to imitate their white masters imitation of Europe as claimed by Brathwaite (1971) is only partly a rejection of their own culture. In the early years of slavery in Trinidad many of the slaves were born in Martinique and Guadeloupe and arrived in Trinidad already possessing a creolized African-French-Caribbean culture that included Patois as the main language. The descendents of these slaves and those born in Africa may have decided to reject or rename the Amerindian culture they had learnt as a reduced but insufficiently understood native 'cultural language'. Those who accuse others of erasure of their heritage have to correct the historical record with care (Haslip-Viera *et al.*, 1997).

Conclusions

"to enumerate all the fantastic recommended therapy based on witchcraft, hearsay and superstition and to describe all the authentic efforts to refute it is impossible in one article" (McCollough and Gennaro, 1970 cited by Martz, 1992)

15. Conclusions

Livestock producers are generally low resource farmers who if given an opportunity can continue to make a contribution to the development of the islands. The current economic environment of globalisation and trade liberalisation is removing traditional markets and reducing the competitiveness of the domestic production sector. Sustainable production systems and economic viability for small farmers means low cost, technically appropriate management, minimising of most types of risks, and increased independence from imported inputs (Evans, 1992). Ethnoveterinary practices are already one component of sustainable production. The objective of this thesis was to document ethno[veterinary] medicinal knowledge in Trinidad and Tobago and to explore whether ethno[veterinary] medicinal knowledge could usefully complement formal veterinary and medicinal knowledge; and if so, how? The non-experimental validation used for each plant gave indications that several of the plants had chemical compounds that justified their ethnomedicinal use. Ethnoveterinary remedies based on these uses may be cheaper than Western drugs.

Ethnomedicine and ethnoveterinary medicines are complementary rather than separate fields. The majority of the ethnoveterinary practices had parallel uses in ethnomedicine in the Caribbean, other tropical countries and sometimes in Europe. One case study focussed solely on this parallel by examining nine plants used for reproductive health in both ethnomedicine and ethnoveterinary medicine. Culture and religion also play a role in the choice of ethno[veterinary] plants. Creolized technology development by Caribbean immigrants involved matching available knowledge from their different origins to available plants that were or were not botanically related to previously known plants for emergent health needs. Creolization in folk medicine is similar but different to Creolization in languages. A coherent body of Creolized Caribbean folk knowledge was created that was structured and ordered (but reduced in terms of content and explanations) and passed on to subsequent generations as such.

Those plants that were not being used similarly in other places are tentatively judged to be 'indigenous' to Trinidad and Tobago. These ethnomedicinal plants are *Antigonon leptopus*, *Justicia secunda*, *Microtea debilis*, *Eupatorium macrophyllum*, *Centropogon cornutus*, *Bontia daphnoides*, *Brownea latifolia*, *Xiphidium caeruleum*, *Isco chrysobalanus*, *Sansevieria guineensis*, *Richeria grandis*, *Roupala montana*, *Eupatorium triplinerve*, *Persea americana* and *Hippobroma longifolia*. Indigenous to Trinidad implies that the Amerindian knowledge found throughout South and Central America is excluded. It is difficult to judge whether Trinidad and Tobago folk medicine has influenced that in other countries as well as being influenced. For example Morton (1981) considers that periwinkle (*Catharanthus roseus*) is native to the West Indies, but it was first described from Madagascar.

A wider view might be required which recognises folk medicine in the Caribbean basin as one entity. During and after colonialism East Indians and Creoles went to South America especially to Venezuela (Weller, 1968). The Caribbean basin countries included in TRAMIL studies are Colombia, Costa Rica, Guatemala (Livingston, Antilleans on the Atlantic coast), Panama (Antilleans in Colon), Honduras (Garífunas on the Atlantic coast), and Nicaragua (Creole and Garífuna on the Atlantic coast) (Girón *et al.*, 1991; Barrett, 1994; Coe and Anderson, 1996a) (see Map 1). 'Bush doctors' are found in Miskito communities in Eastern Nicaragua (Dennis, 1988). Medicinal plants of the Caribbean basin would include *Mimosa pudica*, *Tagetes patula*, *Eryngium foetidum*, *Piper hispidum*, *Cissus sicyoides*, *Pityrogramma calomelanos*, *Persea americana*, *Neurolaena lobata*, *Wedelia trilobata*, *Peperomia pellucida*, *Scoparia dulcis* and *Chamaesyce hypericifolia*.

A wider view of 'indigenous knowledge' is also necessary based on the experience of other researchers. Of 216 introduced plant species used by populations in northern South America (Brazil, Colombia, Ecuador and Peru) 80% were of European, Mediterranean or Asian origin, 9% were of African origin and 8% were from the New World (Bennett and Prance, 2000). Voeks (1996) found that 36% of the taxa used in the Atlantic forests of Bahia, Brazil for which origins could be established came from Africa, Asia and Europe. Voeks concurs with Davis and Yost (1983) on the plant pharmacopoeia in South America: it is cultivated, exotic and opportunistic and based on home gardens, roadsides and secondary forest rather than on indigenous species from the primary forests that were alien to the new settlers. Davis and Yost (1983) found that some isolated Amerindian tribes had smaller pharmacopoeias than the acculturated tribes and speculated that these latter benefited from the chaos of contact and the accelerated experimentation that was necessary to combat the diseases encountered in post-contact times. However other explanations for this finding exist: male ethnobotanists may not have recorded women's knowledge for various reasons or their research focus may have been on shamanic medicine and hallucinogens (Milliken and Albert, 1996).

The non-experimental validation of the ethnoveterinary medicines was undertaken in recognition of the fact that western science has become the main means of determining the validity of knowledge. Biomedicine like other dominant world-views maintains its stability and resilience by dismissing alternatives as illogical or unscientific (Banuri, 1990). Marglin (1990a) talks about the failure of those who cannot imagine the creation of a space for the dynamic transformation of indigenous culture without validation in western terms. Rather than an imaginative failure, this research attempts to reduce the cultural confrontation between science and tradition by showing scientists in western scientific terms that ethnoveterinary medicine can provide an economic alternative to some western technology. This is a pragmatic approach given the recognition that most sciences, including medicine do not critically reflect on their own underlying philosophical assumptions (Nandy and Visvanathan, 1990). Biomedical paradigm-defenders will have the choice of ignoring the research, dismissing it because of various flaws (i.e. no lodging of voucher specimens) or assimilating the new information (Dolby, 1979).

An action/collaborative approach was taken to document the ethnoveterinary medicinal plants used by hunters, pet and livestock owners. The result was a non-random, culturally-informed account of pharmacologically active plants, some of which may warrant further phytochemical and/or pharmacological analysis (Etkin, 1993). Information was captured on medicinal plants used for pigs, poultry including game cocks, ruminants, horses, pet dogs,

hunting dogs, ruminant reproductive health and ethnomedicine currently not related to ethnoveterinary medicine. Future clinical trials or research projects will establish in scientific terms whether the Creole legacy of folk medicine is of positive value for human and animal health.

The school essay method was chosen as a method that would be quick, clean, cheap and alter the researcher's role as an interviewer. This last is important since ethnoveterinary knowledge is cultural knowledge that is shared in networks of relationships. The time limits of the first phase did not allow for the identification and development of relationships with key informants. The essays thus provided much needed 'entrance'. The method also provided more respondents in Trinidad than the veterinarians and AHA/Extension officers. As part of the collaborative approach used in the first research phase, the school principals' request for questionnaires was agreed to. However student essays proved better than the questionnaires. Questionnaires may have seemed too inflexible and too political for students and for informal oral knowledge like folk medicine. Some schools can be considered to have given their students more choice to collaborate with the research or not. This may account for the high non-response in some schools, and may also explain why one student felt obliged to invent information because he could not identify a respondent. The School essay method brought folk medicine into the education system for one brief moment.

This research has disproved the view of Sutton and Orr (1991) who say that the essay method should not be extended beyond its capabilities, and that it is unlikely to yield useful quantitative data. The student responses give a list of plants, their uses and sometimes exactly how they are to be prepared. Thirty diseases, twenty-five plants and eight non-plants were described in the responses. Some responses also indicated whether the moon phase was applicable to picking the plant or treating the animal. The school essay method was an effective means of identifying respondents. The difference in the responses from the schools was very apparent. Carapichaima Junior Secondary and its very supportive principal produced the best results. The principals who actively supported this research with their students rather than merely giving permission impacted on the information quality of the essays. Other criteria like geographic location in choosing schools played a lesser role.

The workshops provided the basis for preparing practical booklets on poultry and ruminants for farmers to use, and for discussing the information gathered with the informants. The booklets of ethnoveterinary practices provided to participants in the workshops, if used, could provide a form of corrective action at a local inclusive level (Rappaport, 1993). This corrective action would be based on local knowledge guided by local people and should thus be more culturally sensitive, nuanced and less disruptive than a program imposed by remote, central regulators. Action based on local knowledge also strengthens rather than undermines local institutions, strengthens the correcting capacities that local systems have and could restore adaptiveness to an agricultural system deformed by maladaptions (Rappaport, 1993).

Validation of ethno [veterinary] knowledge is important because it cannot be assumed that all of the practices are effective. Workshops like that of IIRR (1994) are forms of group validation. The experiments of Dr. Brown of the Poultry Surveillance Unit (PSU) and Carlton Snipe are also validation processes. Validity for ethnoveterinary knowledge based on most farmers' criteria would mean practices that fit their farm performances. Empiricism (informal clinical trials, observations and experiments) was seen in the informal clinical trials that were documented in the case study on commercial poultry. Expert 1 conducted his own

experiments; with wonder of the world (*Kalanchoe pinnata*), on combating debeaking stress and on vaccination stress. He also tested to see if caraaili (*Momordica charantia*) reduced mortality from Aspergillosis and found that garlic reduced a flock's respiratory reaction to the Newcastle Disease Virus vaccine. He also encouraged his 18 contract farmers to use those plants which proved effective.

Lubchenco (1998) suggests a new social contract for science in which science is seen as both part of the problem and a source of solutions. In this research an attempt was made to use a type of science that produces 'socially robust knowledge'. Socially robust knowledge has three aspects: it is valid inside and outside the laboratory; its validity is achieved through involving an extended group of experts, including 'lay' experts; and thirdly this participatory-generated knowledge is likely to be less contested in the future (Funtowicz and Ravetz, 1993; Gibbons, 1999). Research would become a co-learning activity that develops mutual accountability (Jiggins and Gibbon, 1997). Co-learning develops ways of understanding the world that re-enter society and affect action in society (Jiggins and Gibbon, 1997). Co-learning was seen in the case study of the PSU.

The PSU operated on the basis that farmers need help in searching out and selecting information that is relevant to them (Nitsch, 1991). This implies continuous learning about the farming situation by advisors like the PSU who then assess and suggest alternatives (like medicinal plants) to farmers to coordinate their complex farming systems (Nitsch, 1991). The Caribbean does not have a strong livestock extension service so the PSU is perhaps an example of one of the new types of support structure that the Caribbean states can provide for livestock-based extension.

Shiva (1993) assessed that 'local knowledge systems throughout the world have been conquered through the politics of disappearance'. Feminist researchers have shown the power that can be defined over women, and their subjugated [traditional] knowledges through researchers defining objective knowledge as superior to personal experience (Holland and Ramazanoglu, 1994). Non-scientific knowledge often disappears with its holders because it is considered in the short term to have no economic importance, and it seems that no one is in charge of the long term, for according to Allport (1990), [some] 'social science never solves any problems, it just gets tired of them'.

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Summary

This book consists of Parts 1, 2 and 3. An introductory chapter gives the overview and background. Chapter 2 gives details on agriculture in Trinidad and Tobago with a focus on livestock and poultry production. Part 1 consists of Chapters 3, 4 and 5. Chapter 3 outlines the methodological approach taken. The approach compares 'hard' and 'soft' science, and gives a brief overview of social constructivism and knowledge-based action. Chapter 4 examines the concepts and theories embedded in folk medicine and the origins of the folk medicine in the Caribbean. Chapter 5 provides details on the methods used to collect the data. Part 2 consists of nine case studies. Chapter 6 outlines the folk medicinal terms used and includes case study 1 on pigs. Chapter 7 includes case study 2 on commercial poultry and case study 3 on gamecocks. Chapter 8 contains case study 4 on ruminants and case study 5 on reproductive health. Chapter 9 includes case study 6 on pet dogs and case study 7 on hunting dogs. Chapter 10 comprises case study 8 on horses. Chapter 11 contains case study 9 on [human] ethnomedicine.

Part 3 contains the synthesis and conclusions. Chapter 12 looks at the actor networks involved in science and folk medicine, pointing out some of the processes by which knowledge is accepted into or excluded from science. Chapter 13 outlines the published Caribbean medicinal plant research and the attempts by various actors to incorporate herbal medicine into primary health care in the Caribbean. Chapter 14 examines the cultural factors that shape ethnomedicinal creolization. Chapter 15 contains the conclusions.

Research in ethnoveterinary knowledge was conducted as one possible solution to the existing constraints in animal health care in Trinidad and Tobago. The origins of the folk knowledge in Trinidad and Tobago were traced since socio-cultural rather than scientific logic provides the basis for some of the folk remedies. The dominant form of transmission seemed to be from the 'older heads' to the young. The most commonly mentioned 'older heads' were mothers, grannies and old aunts. Knowledge of these cultural practices is necessary in the verification process, so that research effort is not wasted in chemical analysis of plants that are used for culturally specific reasons.

The methods used were inter-disciplinary and paid equal attention and respect to local and western-scientific perspectives (McCorkle *et al.*, 1996). The first phase of the research involved data collection carried out for five months in 1995. This data collection can be divided into four parts: the school essay method; the group and individual interviews; the focus group workshops and the secondary literature review. The school essay method used in the first step of the data collection is a Rapid Rural Appraisal (RRA) tool. The group interviews and the workshops used in the second and third steps of the data collection fall under the category of Participatory Rural Appraisal (PRA) (Catley and Mohammed, 1996).

In the second phase of the research, the researcher worked through previously known individuals and from previously existing social networks in building a snowball sample (Nalven, 1987). Known people helped in the creation of some networks by suggesting people who could be interviewed. Snowball sampling led to community members who were well recognised as knowing more than the average person knows. A purposive sample of ethnoveterinary key respondents was obtained, which minimised negative outcomes. This networking approach was necessary because there was no sampling frame of persons involved in traditional healing. From 1997 - 1999, the researcher also conducted research

with one group of seven hunters based in south Trinidad. This research included participant observation which involved taking part in five hunts over the three years (going into the forest, observing the chase and capture, sharing a meal and sharing of take home game). Participant observation and in-depth interviewing of key respondents are traditional anthropological approaches (Etkin, 1993). The results were divided into nine case studies, pigs, commercial poultry and gamecocks, ruminants and reproductive health, pet dogs and hunting dogs, horses and [human] ethnomedicine.

Eight plants are used for health problems and husbandry in pig farming. *Erythrina pallida*, *E. micropteryx*, *Cecropia peltata*, *Bambusa vulgaris*, *Carica papaya*, *Citrus aurantium*, *Centropogon comutus* and *Coffee arabica / robusta*. Seventeen medicinal plants are used to treat four categories of health problems common to poultry production. Two previously existing health problems (pox and yaws) were also treated with medicinal plants. The most common plants used for poultry were *Kalanchoe pinnata*, *Allium sativum*, *Aloe vera*, *Citrus* species, *Neurolaena lobata* and *Momordica charantia*. Nine plants are used for game cocks. These were *Citrus aurantium*, *Acrocomia ierensis* (tentative identification), *Chenopodium ambrosioides*, *Gossypium* sp. *Aloe vera*, *Plantago major*, Eyebright and *Citrus limonia*.

Twenty-one medicinal plants are used to treat ruminants. Plants used for ruminants are used largely for reproductive reasons and for endoparasite removal. The most common plants used for ruminants were *Momordica charantia*, *Aloe vera*, *Citrus* species, *Azadirachta indica*, *Kalanchoe pinnata*, *Cordia curassavica*, *Curcuma domestica*, *Neurolaena lobata*, *Psidium guajava*, *Chenopodium ambrosioides*, and *Gossypium* species. Medicinal plant dosages for ruminants tended to be case and context specific. Phases of the moon were taken into consideration in farmers' decision making. A methodology for the non-experimental validation of herbal medicines was used to evaluate nine (9) plants used for reproductive health in both ethnomedicine and ethnoveterinary medicine. These nine plants were *Spondias mombin*, *Senna occidentalis*, *Petiveria alliacea*, *Ruellia tuberosa*, *Curcuma longa*, *Abelmoschus esculentus*, *Bambusa vulgaris*, *Oryza sativa* and *Stachytarpheta jamaicensis*. The purpose of the non-experimental validation was to provide a guide to laboratory researchers as to which of these plants merit further investigation (Browner *et al.*, 1988; Heinrich *et al.*, 1992). The non-experimental validation of these nine plants suggested that these plants are used for rational reasons (in Western scientific terms) and are used similarly elsewhere.

Twenty plants are used to treat pet dogs in Trinidad and Tobago. The plant uses parallel those practised in human folk medicine in other Caribbean countries and in other tropical countries. The plants used were *Areca catechu*, *Carica papaya*, *Cassia alata*, *Azadirachta indica*, *Gossypium* species, *Cajanus cajan*, *Chenopodium ambrosioides*, *Crescentia cujete*, *Musa* species, *Bixa orellana*, *Eclipta prostrata*, *Manilkara zapota*, *Pouteria sapota*, *Mammea americana*, *Cordia curassavica*, *Nicotiana tabacum*, *Scoparia dulcis*, *Psidium guajava*, *Anacardium occidentale* and *Stachytarpheta jamaicensis*. Hunters use ethnoveterinary medicines for themselves and their hunting dogs. Plant use for hunting dogs was based on smell and plant morphological characteristics. These plant uses are embedded in a complex cultural context based on indigenous Amerindian beliefs (Heinrich *et al.*, 1992; Jovel *et al.*, 1996). Plants are used for snakebites, scorpion stings, for injuries and mange of dogs and to facilitate hunting success. The plants used are: *Piper hispidum*, *Pithecellobium unguis-cati*, *Bauhinia excisa*, *Bauhinia cumanensis*, *Cecropia peltata*, *Aframomum melegueta*, *Aristolochia rugosa*, *Aristolochia trilobata*, *Jatropha curcas*,

Jatropha gossypifolia, *Nicotiana tabacum*, *Vernonia scorpioides*, *Petiveria alliacea*, *Renealmia alpinia*, *Justicia secunda*, *Phyllanthus urinaria*, *Phyllanthus niruri*, *Momordica charantia*, *Xiphidium caeruleum*, *Ottonia ovata*, *Lepianthes peltata*, *Capsicum frutescens*, *Dendropanax arboreus*, *Siparuma guianensis*, *Syngonium podophyllum*, *Monstera dubia*, *Solanum* species, *Costus scaber*, *Eclipta prostrata* and *Spiranthes acaulis*, *Barleria lupulina*, *Cola nitida* and *Acrocomia ierensis*.

Seventeen plants are used in equine ethnoveterinary medicine, several of which are used similarly in ethnomedicine. Exclusive to the horse case study were the use of *Nasturtium officinale* to increase blood counts, the use of *Pueraria phaseoloides* and *Stachytarpheta jamaicensis* as high protein feeds and the use of *Mucuna pruriens* as an irritant to enhance performance.

There is evidence that some of the ethnomedicinal plant uses have been transferred from the original countries of Trinidad's first migrants. This finding is matched by those of Voeks (1996) and Davis and Yost (1983) who found that the plant pharmacopoeia in South America is Creolized. The plants used are cultivated, exotic and opportunistic and are found in home gardens, roadsides and secondary forest rather than being indigenous species from the primary forests. Those plants with very few ethnomedicinal references are perhaps the true 'indigenous [to Trinidad] knowledge'. This is a tentative conclusion since it is possible that the relevant ethnomedicinal references for these plants were not found or are still unpublished (in the scientific literature). These 'indigenous' ethnomedicinal plant uses are those that involve *Antigonon leptopus*, *Justicia secunda*, *Microtea debilis*, *Eupatorium macrophyllum*, *Centropogon cornutus*, *Bontia daphnoides*, *Parinari campestris*, *Brownea latifolia*, *Eupatorium triplinerve*, *Richeria grandis*, *Eupatorium triplinerve*, *Begonia humilis* and *Sansevieria guineensis*. Some of the local claims of medicinal properties of the ethnomedicinal plants have been supported by scientific studies.

Chapter 12 looked at the actual practices and discourses of local scientists and veterinarians and the tension between them and ethnoveterinary practitioners. This chapter pointed out a few of the processes by which some knowledge is accepted as science and some is excluded from science. It hopes to provide a 'tool for understanding' that interested scientists can use as the first step towards putting useful technologies in sustainable agriculture 'on the shelf' in research institutions (Christoplos and Nitsch, 1996; Flora, 1992). Chapter 13 briefly outlined the existing research approach taken to document medicinal plants, an alternative approach promoted by TRAMIL (Traditional Medicine in the Islands), the current bioprospecting environment, the major players and stakes involved and a vision for future research into ethno [veterinary] medicine. This chapter like Chapter 12 documents an attempt to create a shared vision of an approach to medicinal plants research and use that is sustainable and equitable to all the stakeholders (Costanza, 2000).

The content of Caribbean and other folk pharmacopoeia shows that plant use is based on empiricism: informal clinical trials, observations and experiments (Barsh, 1997; Slikkerveer, 1995). Wagner (1993) has claimed based on a decade of chemical investigations of medicinal plants, that "all plants that are claimed to be antiinfectious, antiviral, antitumoural, or antiparasitidal are good candidates for potential immunostimulating activities and deserve further investigation." Clinical trials will establish in scientific terms whether the Creole legacy of folk medicine is of positive value for human and animal health.

Samenvatting

Dit boek bestaat uit deel 1, 2 en 3. In de inleiding wordt een overzicht en achtergrond-informatie gegeven. In hoofdstuk 2 wordt in details ingegaan op de landbouw in Trinidad en Tobago, specifiek gericht op de productie van groot- en pluimvee. Deel 1 beslaat de hoofdstukken 3, 4 en 5. In hoofdstuk 3 wordt de methodologie beschreven. In de gekozen benadering wordt een vergelijking gemaakt van de 'harde' en 'zachte' tak van wetenschap en wordt een kort overzicht gegeven van het sociale constructivisme en op kennis gebaseerde actie. In hoofdstuk 4 worden concepten en theorieën onderzocht die aan de basis liggen van de traditionele geneeskunde in het algemeen en specifiek aan haar oorsprong in het Caribische gebied. In hoofdstuk 5 wordt uitgebreid ingegaan op de methoden die gebruikt zijn voor de verzameling van de gegevens.

Deel 2 bestaat uit negen case studies. Hoofdstuk 6 geeft een overzicht van de terminologie in de ethno-veterinaire geneeskunde en bevat de eerste case studie over varkens. In hoofdstuk 7 worden case studie 2 over commerciële pluimveeproductie en case studie 3 betreffende kemphanen beschreven. Hoofdstuk 8 beschrijft case studie 4 over herkauwers en bevat case studie 5 waarin aandacht wordt besteed aan de vergelijkbaarheid van methoden gebruikt in de volksgeneeskunde, met name waar het de baker praktijk betreft. Hoofdstuk 9 bevat case studie 6 over honden en case studie 7 over jachthonden. Hoofdstuk 10 beschrijft case studie 8 over paarden. In hoofdstuk 11 wordt case studie 9 behandeld over de volksgeneeskunde voor mensen.

Deel 3 bevat de discussie en conclusies. In hoofdstuk 12 wordt gekeken naar de netwerken van actoren betreffende wetenschap en volksgeneeskunde waarbij met name gewezen wordt op de processen die bepalen of ethno-veterinaire kennis geaccepteerd of afgewezen wordt in de wetenschap. Hoofdstuk 13 geeft een overzicht van de publicaties betreffende het medicinale plantenonderzoek in het Caribische gebied en de pogingen die verschillende actoren gedaan hebben om de kruidengeneeskunde te integreren in de primaire gezondheidszorg in het Caribische gebied. In hoofdstuk 14 worden de culturele factoren onderzocht die in Trinidad en Tobago vormgegeven hebben aan de voor de eilanden zo typische mengvormen van de volks(dier)geneeskunde. Hoofdstuk 15 behandelt de conclusies.

Onderzoek naar ethno-veterinaire kennis is uitgevoerd als een mogelijke oplossing voor de bestaande problemen in de diergezondheidszorg in Trinidad en Tobago. De oorsprong van de volkskennis in Trinidad en Tobago is nagegaan omdat eerder sociaal culturele dan wetenschappelijke logica ten grondslag ligt aan sommige volksgeneesmiddelen. De meest voorkomende vorm van overdracht schijnt plaats te vinden van de 'oudere hoofden' naar de jongere. De meest genoemde 'oudere hoofden' waren moeders, oma's en oudtantes. Kennis van deze culturele praktijken is nodig in het proces van verificatie, om te verzekeren dat onderzoeksinspanningen gericht worden op chemische analyses van planten die voor specifieke culturele doeleinden gebruikt worden.

De gebruikte methoden hadden een interdisciplinair karakter en gaven evenredige aandacht en respect aan lokale en westers wetenschappelijke perspectieven (McCorkle et al., 1996). In de eerste fase van het onderzoek in 1995 zijn gegevens verzameld gedurende een periode van vijf maanden. Voor deze verzameling van gegevens zijn vier methoden gebruikt: de 'school essay' methode; groep- en individuele interviews; groep georiënteerde workshops

en literatuuronderzoek. De 'school essay' methode die in de eerste fase van de gegevens verzameling is gebruikt, kan als een Rapid Rural Appraisal (RRA) beschouwd worden. De groepsinterviews en de workshops die in de tweede en derde fase toegepast zijn, worden gerekend tot de categorie Participatory Rural Appraisal (PRA) (Catley en Mohammed, 1996).

In de tweede fase van het onderzoek heeft de onderzoeker voor de selectie van de steekproef de sneeuwbal methode gehanteerd door te werken met bekende individuen en door bestaande sociale netwerken te gebruiken (Nalven, 1987). Bekenden hebben geholpen bij de identificatie van netwerken door personen voor te dragen die geïnterviewd konden worden. Het gebruik van de sneeuwbal methode voor de steekproefselectie leverde respondenten op die meer wisten dan de gemiddelde persoon. Deze selectie steekproef van ethno-veterinaire informanten heeft onbruikbare resultaten tot een minimum beperkt. Deze netwerkbenadering was nodig omdat er geen bestaande lijst was van mensen die zich bezig houden met traditionele geneeswijzen. Van 1997-1999 heeft de onderzoeker ook onderzoek verricht met een groep van zeven jagers met het zuiden van Trinidad als basis. Dit onderzoek omvatte participatieve observatie hetgeen betekende dat er deelgenomen werd aan vijf jachten gedurende drie jaren (het bos intrekken, observatie van de jacht en de vangst, deelname aan de maaltijd en deelname aan het 'take home' spel). Participatieve observatie en diepte interviews met sleutelfiguren zijn traditionele antropologische benaderingen (Etkin, 1993).

De resultaten zijn verdeeld in negen case studies: varkens, commercieel pluimvee en kemphanen, herkauwers en reproductieve gezondheid, de hond als huisdier en jachthonden, paarden en volksgeneeskunde. Acht planten worden gebruikt voor gezondheidsproblemen bij de productie van varkens: *Erythrina pallida*, *E. micropteryx*, *Cecropia peltata*, *Bambusa vulgaris*, *Carica papaya*, *Citrus aurantium*, *Centropogon cornutus* and *Coffee arabica* / *robusta*. Zeventien medicinale planten worden gebruikt om vier categorieën van gezondheidsproblemen te behandelen die voorkomen bij de pluimveeproductie. De meest bekende planten die voor pluimvee gebruikt worden zijn *Kalanchoe pinnata*, *Allium sativum*, *Aloe vera*, *Citrus species*, *Neurolaena lobata* en *Momordica charantia*. Zes planten worden gebruikt voor kemphanen. Dit zijn *Citrus aurantium*, *Acrocomia ferensis*, *Chenopodium ambrosioides*, *Aloe vera* en *Citrus limonia*.

Eenentwintig medicinale planten worden gebruikt om herkauwers te behandelen. Planten die gebruikt worden voor herkauwers worden merendeels gebruikt om reproductieve redenen en voor het verwijderen van endoparasieten. De meest bekende planten die gebruikt worden voor herkauwers zijn *Momordica charantia*, *Aloe vera*, *Citrus species*, *Azadirachta indica*, *Kalanchoe pinnata*, *Cordia curassavica*, *Curcuma domestica*, *Neurolaena lobata*, *Psidium guajava*, *Chenopodium ambrosioides* en *Gossypium species*. De dosering van medicinale planten voor herkauwers scheen af te hangen van het ziektegeval en de context. De maanstanden worden door boeren in overweging genomen bij de besluitvorming. Een methode om medicinale kruiden niet experimenteel te valideren, is gebruikt om negen planten te evalueren die gebruikt worden voor de reproductieve gezondheid in zowel de traditionele geneeskunde als de traditionele diergeneeskunde. Deze negen planten zijn *Spondias mombin*, *Senna occidentalis*, *Petiveria alliacea*, *Ruellia tuberosa*, *Curcuma longa*, *Abelmoschus esculentus*, *Bambusa vulgaris*, *Oryza sativa* en *Stachytarpheta jamaicensis*. Het doel van de niet experimentele validatie was om laboratoriumonderzoekers een handleiding te verschaffen welke planten verder onderzoek verdienen (Browner et al., 1988; Heinrich et al., 1992). Uit de niet experimentele validatie kwam naar voren dat deze negen

planten om rationele redenen gebruikt worden (in Westers wetenschappelijke termen) en op vergelijkbare wijze elders gebruikt worden.

Twintig planten worden gebruikt om honden te behandelen in Trinidad en Tobago. De toepassing van planten in de volksgeneeskunde loopt parallel met die in andere Caribische en tropische landen. Deze planten zijn *Areca catechu*, *Carica papaya*, *Cassia alata*, *Azadirachta indica*, *Gossypium* species, *Cajanus cajan*, *Chenopodium ambrosioides*, *Crescentia cujete*, *Musa* species, *Bixa orellana*, *Eclipta prostrata*, *Manilkara zapota*, *Pouteria sapota*, *Mammea americana*, *Cordia curassavica*, *Nicotiana tabacum*, *Scoparia dulcis*, *Psidium guajava*, *Anacardium occidentale* en *Stachytarpheta jamaicensis*. Jagers gebruiken ethno-veterinaire medicijnen voor zichzelf en hun jachthonden. Het gebruik van planten voor jachthonden is gebaseerd op reuk en morfologische kenmerken. Het gebruik van planten ligt verankerd in een complexe culturele context en is gebaseerd op inheems indiaanse overtuigingen (Heinrich et al., 1992; Jovel et al., 1996). Planten worden gebruikt voor slangenbeten, schorpioenensteken, voor verwondingen en schurft bij honden en om een succesvolle jacht te bewerkstelligen. De planten die gebruikt worden zijn: *Piper hispidum*, *Pithecelobium unguis-cati*, *Bauhinia excisa*, *Bauhinia cumanensis*, *Cecropia peltata*, *Aframomum melegueta*, *Aristolochia rugosa*, *Aristolochia trilobata*, *Jatropha curcas*, *Jatropha gossypifolia*, *Nicotiana tabacum*, *Vernonia scorpioides*, *Petiveria alliacea*, *Renealmia alpinia*, *Justicia secunda*, *Phyllanthus urinaria*, *Phyllanthus niruri*, *Momordica charantia*, *Xiphidium caeruleum*, *Ottonia ovata*, *Lepianthes peltata*, *Capsicum frutescens*, *Dendropanax arboreus*, *Siparuma guianensis*, *Syngonium podophyllum*, *Monstera dubia*, *Solanum* species, *Costus scaber*, *Eclipta prostrata* en *Spiranthes acaulis*, *Barleria lupulina*, *Cola nitida* en *Acrocomia ierensis*.

Zeventien planten worden gebruikt voor paarden in de ethno-veterinaire geneeskunde, waarvan sommigen eveneens in de volksgeneeskunde gebruikt worden. Exclusief voor de paarden case studie was het gebruik van *Nasturtium officinale* om bloedtellingen te verhogen, het gebruik van *Pueraria phaseoloides* en *Stachytarpheta jamaicensis* als proteïnerijke voeders en het gebruik van *Mucuna pruriens* als een prikkelend middel om harder te lopen.

Er is bewijs dat sommige van de ethno-veterinaire toepassingen van planten overgebracht zijn van de moederlanden van Trinidad's eerste migranten. Deze conclusie komt overeen met die van Voeks (1996) en die van Davis en Yost (1983) die vonden dat de planten farmacopee in Zuid Amerika vermengd is. De planten die gebruikt worden zijn geteeld en exotisch en worden eerder gevonden in erfthuinen, langs de kant van de weg en in secundair bos, dan als inheemse soorten in primair bos. Die planten met maar weinig ethno-medische referenties vertolken waarschijnlijk de echte 'inheemse kennis' (voor Trinidad). Dit is een voorzichtige conclusie omdat het mogelijk is dat de relevante ethno-medicinale referenties voor deze planten niet gevonden zijn of nog niet gepubliceerd zijn (in de wetenschappelijke literatuur). Deze inheemse ethno-medicinale toepassingen betreffen *Antigonon leptopus*, *Justicia secunda*, *Microtea debilis*, *Eupatorium macrophyllum*, *Centropogon cornutus*, *Bontia daphnoides*, *Parinari campestris*, *Brownea latifolia*, *Eupatorium triplinerve*, *Richeria grandis*, *Eupatorium triplinerve*, *Begonia humilis* en *Sansevieria guineensis*. Sommige van de lokale beweringen over medische eigenschappen worden ondersteund door wetenschappelijke studies.

Hoofdstuk 12 beschrijft de feitelijke praktijken en uiteenzettingen van wetenschappers en veeartsen in Trinidad en Tobago en het spanningsveld tussen hen en de ethno-veterinaire

beoefenaars. Dit hoofdstuk toont enkele van de processen die bepalen welke kennis geaccepteerd wordt door de wetenschap en welke niet. Het hoopt te voorzien in een 'hulpmiddel voor begrip' dat geïnteresseerde wetenschappers kunnen gebruiken als een eerste stap richting de acceptatie van nuttige technologieën voor duurzame landbouw door onderzoeksinstituten (Christoplos and Nitsch, 1996; Flora, 1992). Hoofdstuk 13 behandelt achtereenvolgens de bestaande onderzoeksbenadering die gekozen is om medicinale planten te documenteren, een alternatieve benadering gepromoot door TRAMIL (Traditional Medicine in the Islands), de kansen die de huidige situatie biedt, de belangrijkste spelers en belanghebbenden die betrokken zijn en een visie voor toekomstig onderzoek naar de volksgeneeskunde. Een discussie van Intellectual Property Rights is aan het eind van het hoofdstuk geplaatst als een appendix. Zowel dit hoofdstuk als hoofdstuk 12 beschrijft een poging om een gedeelde visie te creëren voor een benadering van medicinale plantenonderzoek dat duurzaam en het gebruik dat duurzaam en gelijk is voor alle belanghebbenden (Costanza, 2000).

De inhoud van de farmacopee van Caribische en andere volken toont aan dat de toepassing van planten gebaseerd is op empirie: informele klinische proeven, observaties en experimenten (Barsh, 1997; Slikkerveer, 1995). Wagner (1993) heeft op basis van tien jaar chemisch onderzoek van ethno-medicinale planten beweerd dat "alle planten die anti-infectie, anti-virus, anti-tumoren of anti-pest zouden zijn, goede kandidaten zijn voor potentiële immuniteitsstimulerende activiteiten en verder onderzoek verdienen." Klinische proeven zullen in wetenschappelijke termen bepalen of de creoolse erfenis van de volksgeneeskunde van positieve waarde is voor de gezondheid van mens en dier.

Curriculum vitae

Cheryl Lans was born in Trinidad and Tobago. Her first degree done at the University of Guelph, Ontario, Canada was in Agriculture with a major in Animal and Poultry Science. Next was work in agriculture including a three-and-a-half year stint with the Caribbean Agricultural Research and Development Institute (CARDI) in Tobago. The project involved was called the Caribbean Sheep Production and Marketing Project and its target group was low resource sheep farmers in Barbados, Guyana and Tobago. An M.Sc in Ecological Agriculture at the (then named) Landbouwniversiteit, the Netherlands followed. Subsequent to this the fieldwork for the Ph.D. was conducted in conjunction with other research contracts and consultancies mainly for the NGO Caribbean Network for Integrated Rural Development (CNIRD) and for the Centre for Gender and Development Studies at the University of the West Indies, Trinidad and Tobago.