GENETIC RESOURCES OF TROPICAL LEGUMES

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The Leguminosae constitutes one of the important plant families widely studied both taxonomically and agronomically. Both in well-known and locally important legumes various levels of knowledge are extant, but many details need to be filled in. In tropical areas, floras do not extend to all regions and many genera require further taxonomic scrutiny. The taxonomic framework enables further detailed collection in order to safeguard genetic resources of legumes, firstly those needed to improve important legumes such as *Phaseolus* beans, *Pisum* peas, *Cicer* chickpeas, *Vicia faba* beans and vetches, as well as so-called minor legumes and those for other than food purposes. Of the major important legume crops, taxonomy has reached a fairly stable, yet not always unequivocal status. For *Arachis*, taxonomy is seriously wanting. The genetic resources at hand in living shape are only abudant for the major crops, but not in other cases nor for the wild relatives of major grain legumes. Continued attention and funding are required.

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The important of Leguminosae for food, animal fodder, fuel and wood, as restorers of soil fertility and for toxic or medicinal properties is well understood. In tropical areas the key role of legumes is probably larger than in the temperate zone, since for reasons of religion, seasonal lack of availability or poverty animals proteins are not or less frequently eaten. The role of legumes is important even if sometimes quantitatively overemphasized, as it is not always realized that the bulk of food proteins are supplied by the cereals, but few people manage to eat cereals in the absence of additions such as pulses, vegetables, fat or spices.

The key to all knowledge of plants is the name of the species involved. The names are provided by systematic botany, which includes the classification of cultigens.

The systematics of the Legume family are in relatively good shape. After two international gatherings in 1978 and 1986 of the many scientists who continue to work in legume taxonomy and many other aspects, attention to classification is adequate (Polhill & Raven 1981, Polhill & Zarrucchi, in press). Cultivated legumes and their wild relatives receive considerable attention, if not always including taxonomy, but in many cases taxonomic data can be considered sufficient (Polhill & van der Maesen 1985). The ILDIS (International Legume Database and Information Service), intended to become available within a few years, will provide scientists with accepted or provisionally accepted names from one edited source. This initiative is probably the first establishment of a taxonomic database of a single important plant family with worldwide coverage. Part of the database is operational, such as for *Glycine max*, the soybean (contributed by Newell, St. Louis). Only the input of many specialists and availability of existing databases can make this project succeed. A pilot project in Vicieae, the Vicieae database, is operational at the University of Southampton and with BIOSIS, York.

Taxonomy is the basis for most aspects of tropical research in plants and animals. Scientists involved with organisms should know exactly the names of those they investigate. Folk taxonomy and the study of vernaculars are important ethnobotanical links to formal scientific taxonomy, which in itself is a starting point for basic and applied research. Even if names of certain well-known plants are taken for granted, scrutiny of names and classification, particularly at infraspecific level, is needed. The study of taxonomy to register man's natural heritage is an on-going affair. Even if in 200 years or so nearly all species of flowering plants would have been described (Raven *et al.* 1971), the knowledge needs to be updated so study of taxonomy cannot be left to computers and libraries. Identification, even with the aid of computers, has to be done by people. The rate of evolution is faster in species with rapid generation turn-over, e.g. *Arabidopsis thaliana*, but in 200 years this increase would not be so enormous as to equate the probable rate of extinction of species, for which very pessimistic forecasts are probably true (Koopowitz & Kaye 1983). A large increase in taxonomic units can be predicted in new crop cultivars. On-going efforts to improve and diversify edible (and ornamental) crops by breeding counteracts the disappearance of old cultivars and narrows the genetic base by producing uniformity. The possibility of gene transfer by genetic engineering, it may be speculated, will increase the search for somewhat more distant relatives of crop plants, and that emphasizes the need for up-to-date systematics. Here RNA and DNA variation in, e.g. cell ribosomes and chloroplasts, offer new objective tools for classification and phylogeny, to assist gene transfer programs to locate suitably compatible germplasm.

In cultivated plants classification in cultivar groups very much tailored by current practical needs is needed from time to time. The naming, classification and documentation also of disappearing cultivars is needed to assist genetic conservation of old landraces and obsolete cultivars. In comparison to a number of 250 000 species of flowering plants, a similar number has been estimated for cultivars formerly and presently in cultivation. Cultivars and groups thereof maybe envisaged either on a regional scale, or involving all material within a species on a world scale. Cultivar names can also carry names in languages other than English, French, Spanish and German. Most of the crop-oriented International Research Institutes have been assigned or took up a mandate for one or more pulse crops (Table 1). Several national genetic resources centres carry large numbers of cultivated legume accessions, and small numbers of wild relatives of pulses. Numerous Botanical Gardens list wild or cultivated, often ornamental, legumes and exchange these, but the accompanying data vary greatly, and the status of the samples is not always clear. Attempts are made to focus on well-documented samples of authenticated wild origin.

This paper attempts to highlight some of the achievements of legume classification and the use made thereof in genetic re-

Table 1. International Agricultural Research Institutes and their crop mandates in Leguminosae.

Institute	*Crops*
CIAT, Cali, Colombia	Phaseolus beans, fodder legumes
ICARDA, Aleppo, Syria	Chickpea, Lentil, Fababean, fodder legumes
ICRISAT, Patancheru A.P. India	Groundnut, Chickpea, Pigeonpea
IITA, Ibadan, Nigeria	Cowpea, Vigna spp.

Note: for the numerous national and regional gene banks see IBPGR directories. Strong national programs with international links exist e.g. on soybean, pea and groundnut.

sources and breeding. The multitude of uses of Legume species overlaps almost all topics of this Symposium. Just as Systematic botany is the key science for tropical research, the conservation of genetic resources is the key to further improvement of crops, medicinal or other technical plants, the study of ecology, nutrition and many other disciplines.

Available resources

Documentation

Documentation provides us with the background of data concerned with the accessions in collections, and the status of the various collections. The last ten to fifteen years were very important for the genetic resources of food legumes. The other legumes, for fodder, timber and pharmaceutical use have not received so much attention. Several legumes have more than one usage, and classification in use categories can be made in many ways. Genetic conservation is applied to very different degrees to overcome narrowing the genetic base for breeding and to save part of nature's vanishing diversity.

Documentation of the various accessions in botanical collections and gene banks is a matter of concern. Taxonomic verification is very important. After seed exchange samples may get re-identified correctly, but that information rarely gets back into the original database, an aspect several curators worry about.

Documentation involves screening, and gene bank personnel usually carry out characterization and preliminary evaluation. Specialists such as phytopathologists and entomologists apply special-purpose screenings to select resistant accessions for further use in breeding, breeders search for special plant types and high yield. Biochemical screenings, such as for protein, are obscured by season and location effects, but it is important that high yield is not accompanied by reduced protein content.

Geographical information. Delimitation to purely tropical plants and crops is not easy, where especially in the Papilionoideae subfamily several crops of the cool season extend into the summer season of the temperate zone or vice-versa. Wild relatives sometimes have a larger ecological and geographical amplitude than the crop itself; on the other hand, crop species have often a wider range of distribution than the wild species. Temperate legume species are grown at higher altitudes in the tropics and are of local commercial importance or even exported. The use of temperate vegetables is spreading in the tropics, if these cannot be grown importation is common for the high-income population groups. Vegetables such as fresh

Table 2. Publication status of the major recent Floras in tropical regions.

Country	Papilionoideae	Caesalpinioideae	Mimosoideae
N. AFRICA			
Algeria	Nouv. Fl. Alg. 1(1962)	do.	do.
Egypt	Stud. Fl. Egypt (1974)	do.	do.
Libya	Fl. Libya 86(1980)	Fl. Libya 61(1978)	Fl. Libya 60(1978)
Morocco	Fl. Maroc Occ. 1(1961)	do.	do.
E. AFRICA			
Ethiopia	Cufodontis 6/13, 22/26	do.	do.
	Fl. Ethiopia 3 (in press)	do.	do.
Kenya	FTEA (1971)	FTEA (1967)	FTEA (1959)
Tanzania	"	"	"
Uganda	"	"	"
C. AFRICA			
Zaire etc.	Fl Congo B. 4&5(1953–4)	Fl. Congo B. 3(1952)	do.
S. AFRICA			
Angola	Consp. Fl. Ang. 3(1962–6)	do. 2(1956)	do. 2(1956)
S. Africa	–	F.S. Afr. 16–2(1977)	F.S. Afr. 16–1(1975)
Mascarenes	Fl. Mascar. 80 (in press)	do.	do.
Namibia	Prodr. SWA 60(1970)	do. 59(1967)	do. 58(1967)
Zambia	–	–	Fl. Zambes. 3(1970)
W. AFRICA			
W. Africa	FWTA 1(1958)	do.	do.
Cameroun	–	Fl. Camer. 9(1970)	–
Gabon	–	Fl. Gabon 15(1968)	–
Sao Tomé	–	Fl. S. Tomé (1970)	Fl. S. Tomé (1973)
Guin. Bissau	–	Fl. Guin. Port. 81973)	–
ASIA			
Taiwan	Fl. Taiwan 3(1977)	do.	do.
Laos, Vietn.	Fl. Cambodge, etc. 17(1979)[a]	do. 18(1980)	do. 19(1981)
India	Fl. India Fasc. 8(1982)[b]	–	–
Pakistan	Fl. Pak. 100(1977)	–	–
Okinawa	Fl. Okin. (1976)	do.	do.
Indonesia	Fl. Java 1(1963)	do.	do.
Iran	Fl. Iranica (1979)[c]	–	–
Iraq	Fl. Iraq 3(1974)	do.	do.
Israel	Fl. Palaest. 2(1972)	do.	do.
Sri Lanka	Hdb. Ceylon 1(1980)[d]	–	Hdb. Ceylon 1(1980)
AMERICA			
general	Fl. Neotrop. 1(1968)[e]	–	–
Argentina	Legum. Argent. (1952)	do.	do.
Barbados	Fl. Barbados (1965)	do.	do.
Cuba	Fl. Cuba 2(1951)	do.	do.
Fr. Guyana	Fl. Guyana Fr. 2(1952)	do.	do.
Guadeloupe	Fl. Guadel. (1978)	do.	do.
Guatemala	Fieldiana 24/5(1946)	do.	do.
N. Antilles	Fl. Neth. Ant. 3(1979)	do. (1973)	do. (1973)
Panama	Ann. Missouri 52(1965)	do. 38(1951)	do. 37(1950)
Peru	Field. Mus. 13/3(1943)	do.	do.
OCEANIA			
N. Zealand	Fl. N. Zealand 1(1961)	–	–
Galapagos	Fl. Galapagos (1971)	do.	do.

peas are gaining popularity, e.g. in India, and Kenya is one of many tropical countries exporting fresh beans. Taxonomically, this paper is therefore not restricted to purely tropical taxa.

Modern revisions present detailed location data of wild legumes, and gene banks should document precise location data of cultivated accessions. If these are mapped (e.g. *Trifolium* or *Medicago* in the Mediterranean area, or *Cicer arietinum* in Ethiopia) it is clear that in historical times and even now opportunity plays an important role: main roads are always more frequently visited than places difficult of access. This does not mean that genotypes found in crops of vegetations off-the-road are necessarily different from those found along the road. Samples of crops can move long distances, either along the road or further into the interior. Eco-geographic studies of the collections in hand will reveal further gaps, as is being done for several crops to support future plans and priorities. Still, opportunity delimits areas of political inaccessibility, even more so than areas physically inaccessible.

Floras. The availability of Floras in the tropical areas is rather uneven as far as the Leguminosae family is concerned. A listing (Table 2) shows that Madagascar, Cameroun, Gabon, India and Indonesia are but a few of the countries that do not possess an up-to-date volume on Papilionoideae. The other smaller subfamilies have been completed in more cases. Some areas need an update, or just have a Prodromus available. The Flora of Tropical Africa (Oliver, 1871), is old and in part unusable. Baker's Leguminosae of Tropical Africa (1926–30) is still usable in parts. Bamps (1981) summed up the publication status of all plant families in African Floras. In India many regional floras are now available, but a treatment of all legumes for the subcontinent is wanting. The Papilionoideae are available for the Flora of Pakistan, but only in part for Vietnam. The Flora Malesiana (Leiden) and Flora of Thailand (Denmark) projects continue to work on Papilionoideae.

Frodin (1984) enumerated the present state of the world's floras, which is revealing reading, as there are many gaps. The situation with separate families cannot be extracted from this excellent guide.

Monographs. Monographs, usually genuswise and sometimes geographically restricted, compile at the time of issue the most recent taxonomic status, geographic distribution, and as many details as are available from various disciplines. Leguminosae are reasonably well served with monographs, but many genera are still in need of revision. With the 369 subscribers to the Bean Bag (Nov. 1986, these include 42 libraries), about 125 may be called legume taxonomists in a strict sense, hence the present round of taxonomic studies should not have to last a century. Detailed studies will of course take longer time.

Obviously, genera which contain economically important legumes have been tackled with priority recently. It is easy to compile the status from the accounts of the contributors to Advances in Legume Systematics

[a] only Phaseoleae; [b] only *Derris*, many modern regional and district Floras available and under publication; [c] only Vicieae; [d] only a few tribes; [e] only *Swartzia*.
Note: Floras are not separately listed in References.

(Polhill & Raven, 1981), who have considerably streamlined tribal taxonomy in the legume family. From an economical point of view, only the taxonomy of parts of the secondary and tertiary genepools of crops are of direct practical application (Williams, IBPGR, pers. comm.), but to support research whether certain species are of practical use, inventories of proper scientific status are required, viz. monographs.

In most tribes are found monotypic, small and large genera, some recently monographed, but most are not completely overhauled. Some examples follow. An updated revision of *Arachis* L. is in dire need to be published, as more and more *nomina nuda* swamp the literature (Resslar, 1980; Moss, ICRISAT, pers.comm.). Gregory and Krapovickas continue to work on the genus, and all groundnut scientists look forward anxiously to the results of their work. For instance, at ICRISAT (and several other institutions) frequent use is made of groundnut taxonomy to obtain species in order to incorporate various traits into the cultivated *Arachis hypogaea*, after cytogenetical investigation. *Stylosanthes*, which contains important fodder legumes, is in need of revision ('t Mannetje, Wageningen, pers. comm.). *Phaseolus* L. and *Vigna* L. seem to be in good shape now, through the work of Maréchal *et al.* and Verdcourt, and others, even if occasional changes are still required. There is even an International Phaseolus Germplasm Network (Lyman-Snow 1987). However, Williams (IBPGR, pers. comm.) mentioned that *Vigna* taxonomy, evolution and distribution within Africa do not fit and research goes on.

Verdcourt also monographed many other legume genera, particularly for The Flora of Tropical East Africa. In Cajaninae the only food species, *Cajanus cajan* (L.) Millsp. or pigeonpea, has been merged with *Atylosia*, where all wild relatives were hitherto classified (van der Maesen, 1986). Other Cajaninae remain to be treated, such as *Rhynchosia* for the Asiatic region. Grear (1978) treated the genus for America, Verdcourt (1970) gave an account for FTEA; *Dunbaria* and *Flemingia* are under revision, while *Eriosema* is under treatment by Stirton (1977, 1981 a & b, 1986).

Vicieae DC. is economically almost the most important legume tribe: all genera but the monotypic *Vavilovia* have one or more economic species. Cicerae Alef., now a separate monogeneric tribe, contains *Cicer arietinum*, the chickpea. *Cicer* has been monographed in 1972 (van der Maesen 1972), with an update in 1987 (van der Maesen, 1987). *Lens* has been monographed by Cubero (1981). Only three species remain, with *Lens montbretii* owning an uncertain place, since then considered as a *Vicia*, and two wild species placed as subspecies with the cultivated subspecies *culinaris*. *Pisum* has just two species left, with all former species classified as infraspecific taxa.

Legumes available in seed collections

Present situation. Tables 3 and 4 list some of the main tropical legumes. For details see the IBPGR directories (Bettencourt & Perret 1986), which are very useful sources of information even if the details change continuously. The number of collections is large, with obvious duplications in the holdings, but expulsion of duplicates is rather difficult (van der Maesen *et al.* 1986). Duplication is needed to some extent, to avoid disasters and promote free availability within regions, where the necessary phytosanitary regulations may slow down international transfer somewhat less.

Table 3. Number of collections of food legumes and their wild relatives in the world.

Legume species	small	medium	large	wild	total
No. of accessions	1–50	51–250	>250		
Arachis hypogaea		1	7	3	11
Cajanus cajan	1		2	1	4
Canavalia spp.		2			2
Cicer arietinum	5	1	7	4	17
Glycine max			13	7	20
Lablab purpureus	1	1			2
Lathyrus spp.	2	2	1		5
Lens culinaris	4	3	4	3	14
Lupinus spp.	1	5	4		10
Phaseolus acutifolius	1				1
Phaseolus coccineus		1	1		2
Phaseolus lunatus			1		1
Phaseolus vulgaris		1	14		15
Phaseolus spp.	2	4	13		19
Pisum sativum	3	5	11	?	19
Psophocarpus tetragonolobus	2	1	4		7
Trigonella spp.	2				2
Vicia faba	3	3	6		12
Vicia spp.	1		5		6
Vigna angularis		1	1		2
Vigna mungo		1	1		2
Vigna radiata			5		5
Vigna umbellata		1	1		2
Vigna unguiculata	1	2	5		8
Vigna spp.	1	2	1		4

Source: IBPGR, 1980. Some important collecions for which number of accessions was not specified were excluded. The 1980 issue is being updated.

Germplasm of the main cultivated pulse and oilseed legumes is now relatively safe, but depends on continuing funding. Tables 3 and 4 show 25 and 42 legume crops or groups of legumes respectively, involving 22 genera. Out of a total of 650 genera and 18 000 species this represents only a minute fraction of the existing genetic diversity, even if these are econimically the most important. Bisby (Southampton, pers. comm.) estimates that less than 10% of legume species (*i.e.* c. 1 800) is actually available. Probably even that figure is optimistic.

Botanical gardens maintain a large number of accessions of Leguminosae, for ornamental, technical or food purposes. Their task, however, is not always formalized to put continuing efforts in maintenance. Collaboration and specialization take shape, for instance in the Netherlands as shown by a common data base (Aleva *et al.* 1986). International collaboration is aimed at, but there

Table 4. Number of collections of food and fodder legumes and their wild relatives in Europe

Legume species	small	medium	large	total[a]
No. of accessions	1–50	51–250	>250	
Arachis hypogaea	1		1	3
Astragalus spp.		1		1
Cajanus cajan			1[b]	1
Centrosema spp.	1			1
Cicer arietinum	3	8	4	16
Cicer spp.			1[c]	1
Colutea arborescens	1		1	2
Coronilla varia	1			1
Glycine max	6	4	6	16
Glycyrrhiza glabra	1			1
Lablab spp.	2			2
Lathyrus spp.	4	2	1	7
Lens culinaris	4	4	3	11
Lens spp.		1[c]	1[c]	2
Lotus spp.	1	1		4
Lupinus spp.	6	3	9	20
Medicago arborea	1			1
Medicago sativa	7	9	2	20
Medicago spp.		4	5	9
Melilotus spp.	1			1
Onobrychis spp.	3	2		5
Ornithopus spp.	2	1		3
Phaseolus acutifolius	1			1
Phaseolus coccineus	2	1		3
Phaseolus lunatus	1			1
Phaseolus vulgaris	9	2	8	22
Phaseolus spp.	3	1	9[c]	14
Pisum abyssinicum	1			1
Pisum fulvum	1			1
Pisum sativum/arvense	9	4	12	24
Pisum spp. c)	4	2	3	9
Trifolium alexandrinum	1			1
Trifolium pratense	6	4	2	13
Trifolium repens				8
Trifolium subterraneum				4
Trifolium spp.	5	2	5	12
Vicia ervilia	1	1		2
Vicia faba	13	11	10	39
Vicia sativa	2	3	4	8
Vicia spp.	3	3	8	18
Vigna unguiculata	2			2
Vigna spp.		1	1	2

Source: Bettencourt & Perret 1986 (IBPGR); [a] totals non-matching the columns indicating collections with unspecified size [b] probably not for supply [c] sometimes including the cultivated species.

Table 5. Number of Leguminosae spp. offered in Indices Seminum by tropical gardens.

	Legum.	Total
Hortus Botanicus Maputensis 1985, Mozambique	45	247
Jardin Botanico Nacional de Cuba 1985, Cuba	132	1215
Botanic Gardens of Indonesia 1986–87	69	357

Many of these are rather or very common (ornamentally) used legume species, such as flamboyant tree (*Delonix regia*), rain tree (*Samanea saman*), and peacock flower (*Caesalpinia pulcherrima*) and tamarind (*Tamarindus indica*).

are many obstacles (Wijnands 1985; IUCN 1986, 1987). Only 30 gardens are present in Tropical Africa and only 70 in Central and South America, against 430 in Europe, 200 in the USA and 55 in Australia and New Zealand (Heywood 1985), and the few famous gardens in the tropics have all but lost their once-dominant role in plant introduction. Perhaps, through closer links to crop breeding their status could regain more importance (Smith, 1987). Some figures of the seed offered in exchange lists are given in Table 5.

Out of almost 25 000 vascular plants considered extinct, endangered, vulnerable or rare (in decreasing degree of threat), 250 were entered as examples to highlight various types of threats, locations, taxa and protective measures (Lucas & Synge 1978). Of these 250, 21 belong to Leguminosae (Table 6). As for other families, regional botanists and monographers probably each could contribute other cases (e.g. van der Maesen *et al.* 1985), and it is intended to compile them in future volumes by IUCN. All plants endangered to some degree are often narrow endemics, disappearing because of local habitat destruction, overexploitation or overgrazing, where natural regeneration (vegetative or generative reproduction) leaves much to be desired. The contrary is also well-known: several Leguminosae are known as invasive weeds.

Collecting strategies. Specialists have always collected with a bias, and Leguminosae researchers are no exception. Rarely all samples are available with seeds, even fewer are deposited with viable seeds in a place capable of handling all kinds of species. Priorities can be made when the conservation status is known, in that case more emphasis can be laid on collecting (Table 7). In cultivated crops and their wild relatives these will shift in the course of time. Present-day legume collections are quite rich, some almost contain the diversity that is possible to amass. However, the assumption is often made that certain groups are well collected, well preserved and being well used. This is not always the case, and mapping of identified accessions shows that systematic sampling of genepools was not done, but points to historical opportunism in collection (Williams, IBPGR, pers. comm.).

Collecting techniques. For cultivated legumes collecting is relatively simple. Population sample techniques apply for crossbreeders (Marshall & Brown 1975), but often practice dictates modifications. Legume seeds are larger than those of cereals and grasses, and rarely obtainable in large quantities as easily as many Gramineae, either

Table 6. Endangered species of Leguminosae

Species	Status	Geography	Conservation
Acacia aphylla	endangered	Australia	in one situ, not yet cultivated
Acacia peuce	vulnerable	Australia	in one garden, some plantations
Astragalus amacantha	vulnerable	Bulg.Crimea	law protection, 1 town park
Astragalus beatleyae	endangered	USA	Protection Act, ± in situ
Astragalus phoenix	endangered	USA	Protection Act, in situ
Astragalus physocalyx	endangered	Bulgaria	prot. by law, 2 parks
Carmichaelia exsul	vulnerable	Pacific	in situ, cult., pods rare
Ceratonia sp. nov.	endangered	Muscat, Arabia	in situ, should be cultivated
Cladrastis lutea	vulnerable	USA	in situ, ± cultivated
Clianthus puniceus	endangered	N. Zealand	in situ, cult. widely, should be increased
Cordeauxia edulis	endangered	Ethiopia, Somalia	wild population not protected, crop
Cytisus emeriflorus	rare	Switzerland, Italy	no protection, horticultural merit
Gigasiphon macrosiphon	rare	Kenya, Tanzan.	in situ, one location
Lotus berthelotii	extinct	Canary Isl.	cult. in gardens, self-incompatible
Mimosa lanuginosa	vulnerable	Brazil	none, should be in situ +cult.
Serianthes nelsonii	endangered	Guam, Rota	4 trees known, federal land, cult. in 2 gardens
Sophora fernandeziana	vulnerable	Pacific	± situ, local nurseries
Sophora masafuerana	endangered	Pacific	± situ, goat threat
Sophora toromiro	extinct?	Easter Isl.	formerly in Bot. Gdns somewhere cultivated?
Streblorhiza speciosa	extinct	Pacific	unlikely to have survived in cultivation
Taverniera sericophylla	extinct?	Socotra	last specimen seen in 1967
Cicer subaphyllum[a]	extinct	Iran	only collected in 1841
Cicer stapfianum[a]	extinct	Iran	only collected in 1885
Cicer yamashitae[b]	rare	Afghanistan	local, increase in three genebanks difficult
Cajanus villosus[b]	extinct?	India	last collected in 1895
Cajanus grandiflorus	rare	India, China	last collected in India 1948

Source: Lucas & Synge 1978; [a] van der Maesen 1972; [b] van der Maesen 1987.

wild or cultivated. Permission by the owner of the field is usually required, and sampling should not disturb the crop. Often sampling alongside the border of the field suffices, as the seed is sown at random. Random sampling is usually accompanied by biased sampling, as breeders often look for the off-types, which indeed possess different genes. Initial samples from cross-pollinated crops should be large (e.g. *Cajanus cajan*), to be able to store large base-samples as a start for seed increases, and seed supply should be

Table 7. Priorities for collecting food legumes

Priority	Species	Regional priority
1	Phaseolus beans	Central & S America
2	Arachis	1 in S Asia, SE Asia, C America
	Glycine	1 in China, Indonesia, parts of SE Asia
	Vigna unguiculata	1 in S Asia, W Africa
	do., subsp. sesquipedalis	1 in SE Asia
	Psophocarpus	Pacific; S, SE Asia
	Cicer	1 in SW Asia
	Vigna radiata	1 in S, SE Asia
	Vigna mungo	1 in S, SE Asia
	Vigna aconitifolia	
	Vigna umbellata	
3	Cajanus	
	Pisum	
	Vicia faba	1 in Mediterranean area
	Lens	1 in SW Asia
	Vigna subterranea	2 in W Africa
	Vigna angularis	
	Vigna trilobata	
4	Lupinus spp.	1 in the Andes region
	Mucuna spp.	
	Dolichos & Lablab spp.	
	Canavalia spp.	
	Kerstingiella geocarpa	
	Cyamopsis tetragonoloba	
	Sphenostylis stenocarpa	

Source: IBPGR (1981), expanded but no shifts since the 1976 edition.

done from the first increase. Again, practice often dictates otherwise. Many legumes in mixed cropping, or in subsistence farming do not produce much seed, making the farmer reluctant to part with amounts of a kilogram or so, even if paid. Farmers are normally quite prepared to share small samples.

Collecting from the wild should be done by a collector who is familiar with the genera concerned so as to avoid leaving behind samples which at first sight look similar to previously collected ones, and to be able to find the species at all. It is of advantage to collect ample flowers and pods, as the herbarium taxonomist rarely disposes of sufficient material for dissection.

Conclusions and recommendations

It is clear that only a minority of legume species is deposited in gene banks, and those cover cultivars of legume crops with some importance for human nutrition. Their wild relatives are also receiving attention. A certain number of well-known genera is maintained in Botanic Gardens. The present situation boils down to a kind of passive in-situ conservation as it is in other plant families, and preservation is therefore quite questionable in many cases. No plea is made to conserve each and every legume species or population in gene banks, but serious efforts are required to recuperate and safeguard rare and endangered species. Research in this direction may in some cases reassure the status of plants considered rare or extinct; with sufficient effort some may be found again. Strengthening of the network of genetic resources centres and of ex-situ conservation in (tropical) Botanic Gardens and particularly of in-situ conservation in Game Reserves or Forest and Savannah and Coastal National Parks has to be of continuing concern to scientists and authorities.

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