Opportunities for Indigenous African Vegetables

L.J.G. van der Maesen
Biosystematics Group and National Herbarium of the Netherlands
Wageningen University, Gen. Foulkesweg 37, 6703 BL, Wageningen
The Netherlands

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Abstract

Attention is drawn to vegetables of limited geographical distribution in Africa. A wealth of information is available in the 2004 PROTA Handbook 2: Vegetables, published simultaneously in English and French. Research gaps are pointed out in the 2005 companion issue Special Products. Distinction is made in several categories, such as species with well-defined vegetable use well covered by extension and research, those deserving more attention, or vegetable species with established or potential other uses such as medicinal or ornamental use.

INTRODUCTION

Vegetables that are popular and well-used in the western world are also liked in tropical countries. Many research efforts have gone into the adaptation of temperate vegetable species for the tropics (Grubben et al., 1993). Affluent sections of the population, following erstwhile colonial inhabitants of tropical countries, appreciate temperate vegetables, so cultivars adapted to warm climates have been bred and trade in vegetables produced at higher altitudes of the tropics has flourished. For instance, cauliflowers were only widely available in India in the 1930s. This was made possible by the availability of adapted cultivars, a process taking c. 200 years (van der Vossen, 1993), and few people realize that cauliflower has not always been a vegetable popular in Indian cuisine. The related modern broccoli cultivars reached Northern Europe, Japan and other countries in the last 50 years, after introduction into the USA by Italian immigrants in the early 20th century.

Tropical vegetables often have properties that differ from the temperate ones. Two characteristics that differentiate the two kinds are a bitter taste, appreciated by many in combination with meat, and sliminess (Bedigian and van der Maesen, 2003) that combines well with starchy preparations such as yams and cassava. Chemical analyses of indigenous tropical vegetable species are often lacking, and offer interesting research possibilities to verify the veracity of the health claimed for so many leafy and fruit vegetables indigenous in the tropics. Some African species, that have not yet reached a very wide distribution, are presented here. Statistics of production and trade are usually lacking, seasonality and rapid deterioration of vegetables, in particular leafy ones, are often a deterrent for obtaining production and sale figures. A succinct discussion of "underutilized" crops, from the Western perspectives, is given by Blench (1997), where arguably the importance given to these crops by African farmers (and those elsewhere) is far greater than usually perceived. Their contribution to food security can be characterized with greater clarity.

See for an extensive overview in various priorities Bosch et al. (2005) who distinguish seven classes or priorities:

WELL-KNOWN, WIDELY DISTRIBUTED VEGETABLES THAT ARE WELL-COVERED BY EXTENSION AND RESEARCH

These 27 species cover most "temperate" vegetables. Original African species included are the fluted pumpkin, *Telfairia occidentalis* Hook. f. and the cowpea, *Vigna unguiculata* (L.) Walp. The origin of waterleaf, *Talinum triangulare* (Jacq.) Willd. is uncertain, usually a South American descent is indicated (Fontem and Schippers, 2004).

SPECIES WITH A WELL-DEFINED VEGETABLE USE THAT DESERVE MORE ATTENTION FROM EXTENSION AND RESEARCH

In total 90 species qualify in this class, such as the African *Abelmoschus caillei* (A. Chev.) Stevels (West-African okra), *Adansonia digitata* L. (Baobab), *Brassica carinata* A. Braun (Ethiopian kale), *Launaea taraxacifolia* (Willd.) Amin ex C. Jeffrey (African lettuce), *Psophocarpus scandens* (Endl.) Verdc. (African winged bean), *Sesamum radiatum* Thonn. ex Hornem. (Black beniseed), *Solanum aethiopicum* L. (African eggplant), *S. anguivi* Lam. (bitter eggplant), *S. macrocarpon* L. (Gboma eggplant), *S. scabrum* Mill. (African nightshade), examples out of 59 plants with mainly an African origin.

SPECIES WITH POTENTIAL AS GENITORS FOR BREEDING OF RELATED USEFUL SPECIES

Seventeen species are classified in this group. All but two have their origin in (parts of) Africa.

RELATIVELY UNIMPORTANT IN TROPICAL AFRICA AS VEGETABLES BUT POTENTIALLY IMPORTANT MEDICINAL PLANTS

No less than 67 species rank in this class; all but three have their home in Africa.

RELATIVELY UNIMPORTANT IN TROPICAL AFRICA AS VEGETABLES BUT POTENTIALLY IMPORTANT ORNAMENTALS

Except for the hurricane palm *Dictyosperma album* (Bory) Scheff. from Réunion and Mauritius, all 21 species in this group are native to continental Africa. The parrot plant, *Impatiens niamniamensis* Gilg, is classified here.

SPECIES WITH LIMITED POTENTIAL IN TROPICAL AFRICA

This group counts 32 species, 7 of which originate outside tropical Africa (or Madagascar). Cauliflower and broccoli are minor crops in tropical Africa (Tjeertes, 2004) and statistics are very incomplete.

SPECIES NOT (YET) RELEVANT FOR TROPICAL AFRICA

This category numbers 21 species, six of which are encountered in Africa but stem from elsewhere spinach, (*Spinacia oleracea* L.) and cornsalad (*Valerianella locusta* (L.) Laterr.) are examples of those. Of *Begonia macrocarpa* Warb. (in French called oseille de la brousse: jungle sorrel), a relatively well-distributed begonia (from Guinea to DR Congo and Angola) usage is only known from Gabon (Lemmens, 2004).

The subjects lacking entirely or in parts for the lesser known indigenous vegetable species are: agronomic practices, treatment of diseases and pests, production statistics, post-harvest techniques and processing technology, nutritive value and chemical analyses, pharmacological research and use as ornamentals. From each category I selected one example or more, admittedly partly at random, and some by personal preference.

SOME AFRICAN SPECIES USED AS VEGETABLE

1. *Talinum triangulare* (Jacq.) Willd. (Portulacaceae), Waterleaf, Ceylon spinach: This succulent pantropical weed is eaten as vegetable throughout the tropics; cultivation is reported from Nigeria and Cameroon. It produces the slimy soup or sauce complementing the main starch dish also containing fish or meat, tomatoes, onions and the main vegetable jute species, *Corchorus olitorius* L. The raw leaves are also eaten as a salad. In Cameroon, measles are treated with waterleaf, in Assam diabetes is treated with this species, and the fleshy root produces a tonic in Indonesia (Fontem and Schippers, 2004). The plants improve palatability in stock pasture.

2a. *Abelmoschus caillei* (A. Chev.) Stevels (Malvaceae), West-African okra: Few people distinguish this from the common okra (*A. esculentus* (L.) Moench), and there is no difference in usage. About half the okra produced in West Africa is estimated to belong to

A. callei. The epicalyx segments are 4-13mm wide in *A. caillei*, and 0.5-3mm in *A. esculentus*. The species may be of amphidiploid origin from the parental species *A. esculentus* and *A. manihot* (L.) Medik. It is an attractive horticultural plant for home gardens, as the productive period (4 to more than 12 months) is longer than for cultivars of common okra, and it is more tolerant of diseases (except vascular *Fusarium* wilt) and pests. Fruits should be picked when 7-8 days old, otherwise they grow fibrous. West-African okra is a useful genitor to improve common okra, as has been proven in India (Siemonsma and Hamon, 2004). Despite differences in chromosome numbers, vigorous but infertile hybrids are produced, and backcrossing is required to yield fertile cultivars.

2b. *Ceratotheca sesamoides* Endl. (Pedaliaceae), False sesame: The finely chopped leaves and flowers of false sesame constitute an ingredient of sauces, and mixed with groundnut flour add taste to porridge. Adding wood ash (from the kitchen) reduces bitterness and softens the leaves (Bedigian and Adetula, 2004), it helps drying and prevents sticking together (Nikiema, pers. comm.), and so leaves are sometimes sold dried mixed with ash. Medicinal uses are several, and the leaf sap promotes the separation of fat in shea-butter preparation (Bedigian and Adetula, 2004). The plant is readily grazed. It is usually harvested as a weed, but for instance in Uganda the plant is sown and intercropped with other crops such as sorghum, sweet potato and various vegetables. The seeds are also useful as a salad oil (Bedigian and van der Maesen, 2003).

2c. *Sesamum radiatum* Thonn. ex Hornem. (Pedaliaceae), Black beniseed: One of the wild sesame species, black beniseed is a popular leafy vegetable, also available in the dry season. It is harvested both from the wild and from cultivation in West and Central Africa. Shoots and leaves are cut for cooking in soups and sauces to eat with starch foods, resulting in the mucilaginous (slimy) texture appreciated in parts of tropical Africa. Medicinal uses include treatments to ease childbirth, as shampoo and to kill head lice, to treat rectal prolapse, metrorrhagia, as an antidote for scorpion stings and sprains. The seeds are similar to the true sesame in chemical composition (Bedigian 2004).

3. *Vigna luteola* (Jacq.) Benth. (Fabaceae), Hairypod cowpea: There are many wild species of *Vigna* ranging from small to reasonably vigorous climbing herbs, sometimes rather difficult to determine to species. The flower color is important to note, as it is useful for identification. The hairypod cowpea is found throughout the tropics. Only from Ethiopia and Malawi the use as cooked vegetable is reported, and the tender boiled seeds are edible. The roots are dug up in Malawi, children peel and chew the roots to extract a sweet juice. The plant is an excellent protein-rich livestock fodder, does well in wet and slightly saline soils, but has a short life cycle and seed production is difficult. Some medicinal uses are reported from Ethiopia and Argentina. The species functions as a bridging species in *Vigna* breeding programs including e.g. mungbean (Bosch, 2004).

4. *Trianthema portulacastrum* L. (Aizoaceae), Horse purslane: This pantropical weed is widespread in Africa. A succulent herb, the young tops and leaves are eaten in Ghana, Cameroon and Tanzania, but also in India and SE Asia. Older leaves, however, may cause diarrhea or paralysis, and seeds are considered a contamination in food grains. Domestic animals may refuse to eat it. Medicinal uses are many: against liver obstructions, oedema, jaundice, urine loss and dropsy, asthma, as emmenagogue, abortifacient, as vermifuge, wound-dressing, for rheumatism and combating alcohol poisoning. Medicinal properties further include reductions of cancers of the liver, affection of blood pressure in guinea pigs, while the steroid ecdysterone is a potential chemosterilant to molt housefly larvae (Jansen 2004). These aspects and nutritional properties merit further research of this herb mainly known as a widespread weed in man's living areas.

5. *Impatiens niamniamensis* Gilg (Balsaminaceae), Parrot plant, Congo's cockatoo: Named after the ethnic group Niam-niam (now usually named Azande) from type material found in SW Sudan, this species is distributed naturally from Cameroon eastward to SW Kenya and South to Angola. In temperate zones as well as in tropical Africa the plant is very ornamental as pot plant. Raw leaves taste acid, and the pretty orange-red plus green and white and yellow flowers have a sweet-and-sour taste. Eaten as a vegetable in the Congo, the leaves are [presumably] cooked and said to be curing heart troubles and

treat illnesses caused by evil spirits. Sepals and petals contain a tannin, procyanidin, reportedly a potential hair growth chemical (Takahashi et al., 2001) and prodelphidin, another tannin. *I. niamniamensis* prefers shaded humid conditions at altitudes from 600-1350m, is propagated by cuttings, as seed does not easily set in cultivation (Bosch, 2004). In the USA several ornamental cultivars are recognized, such as 'African King' and 'African Queen' and those are even available with leaf variegations.

6. *Corchorus trilocularis* L. (Tiliaceae), Bush okra: Recorded from many tropical countries in the Old World, bush okra has probably originated from Africa. In the Indo-Burmese region there is a secondary center of diversity, and the species is found in Asia and Australia as well. Tender leaves are popular, as cooking takes little time so little fuel is required. Sauces or relishes are mucilaginous, and eaten with maize or other cereals. Dried leaves can keep up to a year. In Uganda the flowers are used fresh and dried for the same purpose, to be mixed with more coarse vegetables. Most produce is collected from the wild. Cattle graze the plants, and the stem fibers are used in Somalia (Schippers, 2004). The properties are likely the same as jute mallow, *Corchorus olitorius* L., which is the jute plant that produces a leading leaf vegetable for mucilaginous sauces. In Egypt and the Middle-East that is already available as deep-frozen vegetable. In cultivation *C. olitorius* is much larger, hence more productive, hence preferred.

7. *Solenostemon rotundifolius* (Poir.) Morton (Lamiaceae), Hausa potato: The Hausa or coleus potato is of East African origin, where it is still found in the wild. Quite often this tuberous species is found to be classified in the genus *Plectranthus,* of which *Solenostemon* is a segregate. In West Africa there are only relics of cultivation, and in Benin it has not been collected (van der Maesen, 2006). Fully insolated, well-drained sandy terrains are preferred. The tubers are very tasty, peculiarly in tropical Asia the crop is now more important than in Africa (Nkansah, 2004). The tubers are used as a relish, or sometimes as a staple. Nutrient contents are in line with those of many other tuberous species in the region.

TECHNOLOGIES

In the realms of cultivation, harvest techniques and processing several aspects can be improved. Several of the examples given above are perfect for home gardens, where leaves and fruits can be picked just before cooking, whereas transport to markets results in wilting and loss of quality in leaf vegetables. How is Parrot plant *Impatiens niamniamensis* picked? Leaf by leaf or entire shoots? Many vegetables are simply cut near ground level: Horse purslane, wild sesame's. Young plants give the best quality; older leaves have to be stripped from the plant. Plants harvested for condiment or medicine often are brought to the market either as stiffly bound bundles or rather indiscriminately, as wilting and drying do not harm the produce too much. Appropriate processing technology obviously increases shelf life and hence value. Drying is useful, expanding the shelf life of the vegetable into the dry seasons, but probably reducing vitamin content. Deep-freezing and canning are becoming more popular.

GENETIC RESOURCES

Of few of the examples given, seeds are available in official germplasm collections. Particularly where species are weedy and widely available, few or no scientific institutions hold stocks of seeds. This holds true for most African species with vegetable use. A Bioversity International (earlier IPGRI) database search yielded only two results pertaining to the species selected in this paper:

Abelmoschus caillei LMGV, Campos dos Goytacazes, Brazil 11 acc.
Corchorus trilocularis National Genebank of Kenya, KARI, Muguga 14 acc.

The (Millenium) Seed Bank at Wakehurst, Royal Botanic Gardens Kew, holds no stocks of the examples given here. Commercial nurseries keep one or more genotypes of ornamental species.

Access to seed sources is also problematic, as many countries nowadays hesitate to share germplasm; frequently Intellectual Property Rights (IPR) are involved, and

benefit-sharing should be agreed upon. For important food species resources may be obtained from the Multilateral System for utilization and conservation in research, breeding and training. When a commercial product is developed using these resources, the Treaty provides for payment of an equitable share of the resulting monetary benefits, if this product may not be used without restriction by others for further research and breeding. If others may use it, payment is voluntary. The important crops include e.g. beans, pea, cowpea, carrots, the *Brassica* spp., but others (tomato, *Allium* spp.) are not covered by the Multilateral System of Access and Benefit-sharing (part of the International Treaty on Plant Genetic Resources for Food and Agriculture signed in 2004) that circumvents monopolizing access,. Both wild genetic resources and those in the realm of agrobiodiversity are valuable for potential improvements of man's crops. In this regard no hurdles should be put in the way of scientists searching for diversity in protected areas (van der Maesen et al., 2005; Madhusudan et al., 2006; Prathapan et al., 2006; and Bawa, 2006).

DISCUSSION AND CONCLUSIONS

It cannot be denied that many indigenous vegetables, of which only a very few are presented here; never make it to larger market. Success stories of hitherto lesser-known vegetables are few and far between, despite the human appetite for novelties and the constant search of supermarkets both in the West as well in the upcoming economies, to increase their range. Now and then attention is brought back to so-called underutilized species, such as in this conference, but the wheel is invented over and over again and only occasionally new data are generated. Extension workers ought to increase knowledge of indigenous vegetables and broadcast that knowledge to increase the quality of nutrition. Availability of seeds in the public domain is very limited, and ought to be improved to allow or facilitate research. Appreciation also varies; some species have the odium of famine food.

In any case during this conference data are pulled together to enthuse agronomic and economic scientists to enlarge the tiny part of the Plant Kingdom that is used directly by man. Indeed the less-known species merit more attention from the public sector to improve health and increase income.

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