

Notes on Huckleberry, *Solanum scabrum*, and Related Black Nightshade Species

by
Rudy Schippers
Natural Resources Institute
University of Greenwich

March 1998



1. Huckleberry farmer in Founbot, Cameroon. Note the presence of Amaranth in between the huckleberries

INTRODUCTION

Huckleberries are cultivated in several locations in Africa's humid highlands and somewhat less in its lowlands in e.g. Zaire and Gabon. It is an important subsistence crop in southern Nigeria. In Cameroon it is one of the most popular cash crops and especially in western and northwestern province it was found to be the most commonly grown traditional vegetable. They are less frequently seen in East Africa where small populations were noticed near Kabale in Southern Uganda and near Eldoret in Kenya. The smaller black nightshades, which are closely related to the huckleberry, are often grown in the same areas as the huckleberry but populations

appear to be less domesticated and closer to the wild weedy species. They are produced over a wider area than huckleberries and some types with orange berries can even be grown in areas with a low rainfall e.g. Embu in Kenya. The group is also cultivated as a minor crop in tropical Asia and in South America.

There are many local names for these vegetables and in many places a different name is given for the tall huckleberry and the smaller black nightshade which are both called la morelle noire in French.. The Yoruba's in Nigeria call black nightshades Odu and give the name Ogunmo to the huckleberry. In other places no difference is made such as in Kiswahili where it is called Mnavu. In Southeast Nigeria where huckleberries are also popular, they are called Ewa. In Uganda they are referred to as Nsugga. In Cameroon people use the name Jamajama when they refer to the semi-wild material and use the name Zom when referring to huckleberry.

The species complex

Solanum scabrum belongs to the *Solanum nigrum* complex. Most species in this group are difficult to identify but *S. scabrum* can be recognized with relative ease by its large sized leaves and strong stem with distinct dented wings. The flowers are either white or light purple in colour and have brown anthers. Its berries are broadly ovoid, dark purple and 12-15 (-17) mm broad. In contrast to most other members of the *S. nigrum* complex, these berries remain on the plant at maturity. In Cameroon this is by far the most different varieties can be importance only. The tall more purple in colour. stems is sometimes variety and are grown on monocrop in that area.

From Nigeria, two are mentioned: the *scabrum* with nodding fruit and with smaller from the lowlands with of about 10 x 8 cm. In Nigeria this annual growing up to 1m in when left undisturbed. studies will need to be

There is confusion about names since reports from Nigeria often refer to *S. nodiflorum* which is now called *S. americanum*, when likely referring to *S. scabrum*.



2 Black nightshade

common type and many seen, often of local stems can be green or The tall type with green referred to as the Foubot a large scale as a

subspecies of *S. scabrum* montane group ssp. pedicels in flower and in leaves than ssp. *nigericum* erect pedicels and leaves

herb is reported as height and 120cm in width Further comparative made to verify the above.

West Africa is suspected to be the origin of the huckleberry because of the many distinct varieties being found there, and a probably wild population is reported from Nigeria.

The *Solanum nigrum* complex including *S. americanum* consists of a large number of 'micro species' with different levels of ploidy and often with characteristics which are not easy to distinguish. There are some varieties which are greyish in colour and

distinctly hairy, others medium or dark green whereas varieties with dark purple stems and even with some anthocyanin on the leaves were seen both in Nigeria and in Cameroon. When we realise the plasticity of other *Solanum* species such as *Solanum aethiopicum* and the possibility of hybrids between species, it will become clear that there is much confusion about the delimitation of the species. Fortunately, huckleberries, *Solanum scabrum*, are quite distinct even though there is a lot of variation amongst them. Taxonomic details for the major African species within this group are mentioned in Annex 1 below.

Aspects of breeding

Huckleberries and black nightshades are predominantly self-pollinating although there are likely to be differences between the different 'species', considering the differences in the lengths of their styles. Both peristyles and longistyles have been observed but further studies on these aspects will need to be made. The commonly cultivated *Solanum americanum* is often noticed with styles well beyond the anthers, indicating a higher level of cross pollination.



3 Purple flowers of
S. scabrum

The autogamous character which is likely to be present in most huckleberry varieties, is a very useful tool since it will help to stabilise any crossings made whereby after say 4 or 5 generations, the new populations are likely to be sufficiently uniform. It will also assist the genetic enhancement programme through purification of landraces whereby a selected accession could be multiplied quite rapidly and the offspring will have a high degree of uniformity. Varieties could thus be created within a short period.

After identifying a plant which has the right plant architecture and growth characteristics, the desirable late flowering, a good leaf size and shape, desirable culinary qualities (as identified during earlier evaluations) and possible tolerance to local stress factors including pests and diseases, berries to be collected from this one selected plant only.

Pollination can be effected by small bees and black syrphid flies which could result in cross pollination. Therefore, when a crop is grown for seed production, care must be taken to avoid such a cross pollination. It is recommended to plant a seed crop in blocks (and not in lines) whereby the outer rows will be discarded and berries should only be collected from the inside of the block. The block should be exclusively made up by plants grown from seeds extracted from one selected plant as above. The planting distance for a seed crop should be about 60 x 60 cm

AGRONOMIC ASPECTS

Seeds and Sowing

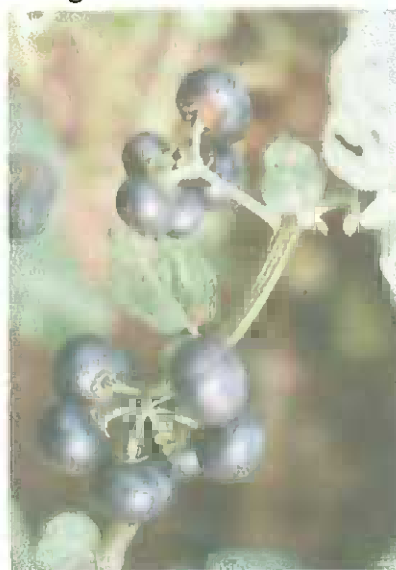
Huckleberries (HB) and black nightshades (BN) produced for subsistence are mainly sown directly at the beginning of the rainy season whereas nurseries are used for a

commercial crop, mainly in the dry season and for monocropping. When sowing directly, a few (3-10) seeds are used per location, e.g. next to the companion crop in a mixed cropping system. The strongest plants will be kept and others removed as a first harvest or for planting in a different place.

Seeds sown for a commercial crop will be in the nursery for about one month from sowing to transplanting. Lines on the nursery bed are about 20 cm apart or alternatively, seeds are broadcasted in the nursery bed. Seeds are either mixed with dried poultry manure and/or sand or sown on a bed which has been given poultry manure. Some farmers mix seeds with ash to spread the seeds more evenly and to use the ash as a source of potash. It has been noticed both in Kenya and in Nigeria that seeds require manure to germinate well. In Uganda, BN was found to germinate very well on land where there had been recent fires. Germination was found to be significantly lower when seeds are sown on non-fertilised land. The germination time is usually 5 - 7 days.

Direct sowing during the rainy season results in taller plants and, when there is adequate room, in more and larger leaves and branches and a better dry-matter content when compared with transplanting. Flowering occurs earlier when sown directly than when transplanted.

In Cameroon seeds are either produced on the farm or purchased at the market for CFA 200 (about \$ 0.40) per glass. Some farmers make an effort to produce HB seeds for sale. This activity is not very profitable due to limited demand since most farmers reserve a number of plants for their own seed production. Some of the seed producers also specialise in the production of HB seedlings for sale to others. Strong plants with desirable characteristics are normally selected after the third or fourth harvest when no further shoots will be plucked and the plant allowed to produce flowers and berries. Other farmers are less selective and designate one corner of their farm where all plants will be used for seed production



4 Berries ready for seed extraction

The berries from HB are easy to collect since they remain on the plant whereas the berries from most BN types drop on the ground, sometimes before being fully ripe. Collecting BN berries, mainly done by children, takes a lot of time. For this reason seeds from BN are far more difficult to obtain than seeds from HB and is frequently mentioned as a major constraint to BN production.

The most frequently used seed extraction process in Cameroon is whereby farmers collect berries which they put in a jute bag or a fertilizer bag with a few small holes in the bottom. They hang this bag so that there is plenty of air around. Fruits will start rotting and the juices will disappear through the holes. After some time the produce will have dried completely. By storing dried fruits with seeds in this way, there is

little chance of damage by rodents or insects. The fruit remnants and seeds are separated by a winnowing process just before sowing.

Another system is either through fermentation or by sun-drying of fruits. For the fermentation process fruits are squashed inside a container with water and left for about one day to separate the fleshy parts from the heavy seeds which will settle at the bottom of the container. These seeds could be collected by pouring the water with floating material out of the container and once this has been repeated for say 3 times, what is left are mainly seeds which will then be dried in the shade on a piece of cloth. Some farmers don't take this trouble and simply squeeze the seeds out of the berries, wash the seeds and dry them.

Alternatively, as noticed in Yaounde's seed market, the ripe berries are spread on a sheet of plastic or cloth, placed onto the concrete where they will be dried by the sun. The dried berries will then be collected after about one week and the seeds are either sold inside the berries for the farmer to remove when required or alternatively the seeds are cleaned through a winnowing process. It is said that seeds will keep longer inside the dry berry than as pure and clean seeds.

One farmer in Yaounde was seen sowing HB berries rather than sowing seed. First, he turns the plant over with the roots in the air, thereby allowing the berries to ripen faster and to get soft. Berries do not fall off but need to be picked from the plant. This ripening process is said to hasten the germination. Those soft berries will be sown and the resultant bunches of young plants are used as seedlings.

From one kg of HB berries farmers will get about 40 grams of seeds. The number of seeds per HB or BN berry varies from about 20-60. There are about 1000 seeds in a gram of the larger varieties of HB whereas there are up to an estimated 3500 seeds per gram for some BN types. For the large Foubot variety, one can easily get 150 - 300 berries per plant and sometimes more if needed.



5 Directly sown huckleberries flower early

HB and BN seeds will remain viable for several years. Trials showed that after eight months, the germination capacity was still around 80 %. A condition is that seeds should be kept dry. This can be done by keeping them in a closed container, ideally with charcoal placed at the bottom, separated from the seeds by a piece of cloth.

Transplanting

When transplanting, seedlings are selected for their strength and freedom from diseases and planted late in the afternoon either as a monocrop or intercropped with a staple crop. Seedlings should be at least 6-8 cm tall and have about 5-6 true leaves. Some seedlings may be up to 20 cm tall when they become too spindly. From sowing to transplanting usually takes 4 - 5 weeks.

The spacing may differ, depending on the variety (small and short or tall and large leaved) and on the intended crop duration. It is usually wider during the rainy season than during the dry season. Spacing is normally somewhere in between 15 x 15 and 25 x 25 cm (16-40 plants per m²) with staggered planting or occasionally 25 x 10 cm when planted in rows on beds about 10 m long and 110 cm wide. Spacing can be even wider (25x40 cm) when the crop will be kept for a long period, allowing stronger branches and an extended harvest period for which additional fertilizers will be needed.



6 Heavy HB stems can be used for cuttings

An alternative propagation method is occasionally used in Nigeria where the large HB variety Ogunmo is propagated through stem cuttings. When using this method, the spacing is normally 40 x 40 cm or even 40 x 60 cm, considering that this variety is ratooned with side shoots on the side shoots, thus creating a wide plant that can reach 100 cm in height (when left undisturbed).

It is essential to provide adequate water just before and immediately after transplanting since roots are sensitive to drought. Replacement of plants should be done within a week to avoid an irregular crop.

The higher yields obtained during the dry season are attributed to the generally wider spacing used and thus less disease pressure. Branching is stronger at a wider spacing, making up for the lower number of plants.

Cultivation practises

Regular irrigation is needed on a daily basis for the first week after transplanting especially during the dry season. Afterwards, irrigation is recommended three times per week, depending on temperatures, cloud cover or possible rains.

Especially during the early stages of development, weeding is essential. Once the lower branches have spread out, weeds are generally suppressed.

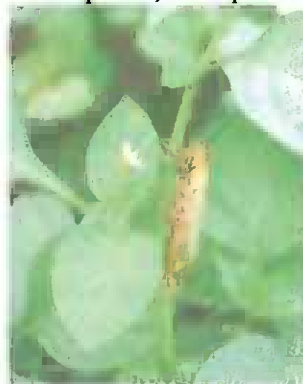
HB requires large amounts of Nitrogen and other nutrients. For that reason they do well in soils that are rich in organic matter. They also grow well on land covered with ashes from recently burned vegetation. Fertilizers were found to be effective and farmers mainly use 20-10-10 or urea when there is no poultry or farmyard manure available. Side dressing with 20-10-10 is practised on occasion.

During heavy rains diseases can be problematic especially when the plant spacing is close. The plant can tolerate a reasonable level of shade, but thrive well when exposed to full sun during the cool season. It does not do well during the hot season unless when it has adequate access to water.

PESTS AND DISEASES

Huckleberries and black nightshades are frequently eaten by insects but apparently people do not mind buying leaves with holes in them (it is a sign that chemicals have not been used). In Cameroon ants are said to be responsible for those holes. Black aphids may cause leaves to curl and affect further growth of the plant. In some areas aphids appear to have taken over altogether and even when they are controlled by chemicals, the characteristic curly leaves remain. Caterpillars and occasionally grasshoppers including *Zonocerus variegatus*, can also be most problematic. Small black beetles (flea beetles ?) found at the underside of HB leaves cause those leaves to twist and fold, making them unattractive for sale. Black aphids, millipedes and snails have been reported as problematic in Kenya.

A traditional cure for pests is woodash, spread onto the leaves. People do not like the resulting grey colour of the leaves and would rather go for dark green leaves of a product treated with chemicals (Sevin 85 or Decis, costing CFA 650 per bottle, enough for about 60 liter, covering up to 25 plant beds). Spraying is done once or twice a month, depending on the seriousness. Some farmers use Actellic in the nursery. Chemicals are not always effective against insects that are hiding underneath the leaves. Many farmers believe that the effects of chemicals last only 24 hours and will thus harvest one day after spraying, thus causing problems for consumers.



7 Variegated grasshopper can be a major pest

A major disease in HB was found to be *Phytophthora infestans*, the late blight which is also common in tomatoes and Irish potatoes. This causes a greyish rot of leaves and stems and drop of leaves. It is said to be particularly problematic during the rainy season when temperatures are low. Proper crop rotations should be practised but this is not the case since the three most profitable crops all happen to be affected by late blight. According to Edmonds and Chweya ([997] *S. nigrum* and *S. villosum* are resistant to late blight, offering opportunities for the plant breeder.

A second important diseases is *Cladosporium oxysporum* which can be recognised by a greyish green mould on the lower side of the leaves and the light green-yellow colour above. Other diseases recorded include a species of downy mildew, the eye spot, *Cercospora nigrescens*. and the powdery mildew *Leveillula taurica* with yellow spots on the upper surface and a white mould below. In Kenya a 5% plant loss was recorded due to *Pseudomonas solanacearum*, the bacterial wilt.

During the dry season there may be a slight problem with leaf curl virus in Cameroon. In Nigeria a yellow vein virus was reported for the rainy season which is probably transmitted by the whitefly *Bemisia tabaci*.

Disease spraying programmes to be recommended to farmers will be similar to those for tomatoes and Irish potatoes. This will however only be feasible during the dry season when the resulting products could be sold at a profit.

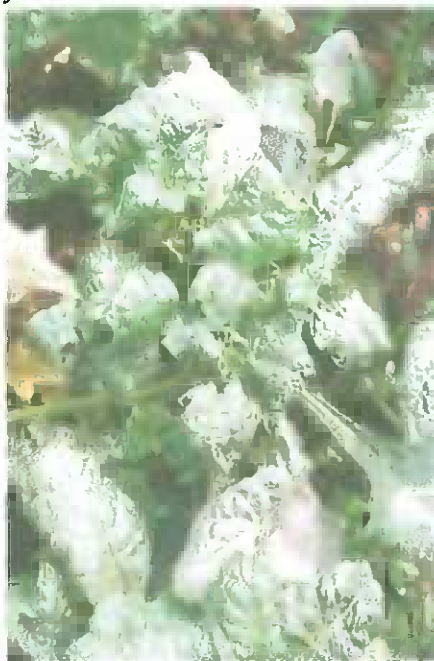
HARVESTING/MARKETING

It takes about 5 weeks from transplanting for the first harvest to take place whereby the first cutting is taken from well below the middle of the stem or roughly from the fourth leaf, starting from the base, allowing new side shoots to develop. Further harvests take place with 7-14 days intervals for on average 3-4 times per plant when there is not enough manure or fertilizers. The large-scale commercial farmers will harvest 10 times and occasionally more. Most farmers keep the plants until February/March when the land is needed again for other rainy season crops or staple crops.

Once-over harvesting is also practised whereby the spacing is as close as 10 x 10 cm and plants are uprooted. This method is sometimes used when there is suitable land available but less than 2 month time before the main crop will need to be planted. Roots of the harvested crop can be kept in water to keep it fresh.

In Kenya the early crop of BN is mainly brought to the market with roots attached. Subsequent harvests are usually short shoots which are sold in a heap.

It was found in Cameroon yields are obtained during 5th) harvest which is about planting. Yields are tons per ha for the first till third harvest where densely planted crop has its decline significantly after unless adequate fertilisers commercial farmer can thus ha and with good considerably more from his the green Foubot variety. leaved type which is very Cameroon, the average yield about 50 large bundles (of per harvest. Also here 7 - 10 possible, especially when applied immediately after smaller plant types have a season than the large leaved when the small plants get older, their shoots get thinner.



8 Aphids cause leaves to curl and strongly reduce their market value

that optimum the third (2nd - two months after between 7 and 13 12-20 tons for the especially the more peak. Yields the 6th harvest are applied. A obtain 50 tons per management dry season crop of For the dark, small popular in West per 1000 m² is about 20 kg each) harvests are quite fertilisers are harvesting. The shorter harvest tall types because

The average rainy season farmer harvests between one and four bags of HB per week from a monocrop plot of 100 m² to 500 m². Yields from mixed farms depend on their crop mixture. Such yields are very hard to establish and no accurate data are available.

Yield data from other sources varied from about 20-25 tons for BN to 35-80 tons per hectare for HB but many of these data were based on small plots or experiments of a few m² and not commercial sized fields.

Actual harvesting may be twice a week, depending on the market day of the village or nearby town but this plucking of shoots will not be from the same plant. Harvesting takes place very early in the morning and the produce is sold the same day. Alternatively, it is collected late in the afternoon and produce is placed on plastic sheets or banana leaves after which they will be tied in small bunches and brought together in large bundles. When left overnight, the bundles are placed in such a way that the stems touch the ground. If the stems are placed in a horizontal position, the heads may turn upwards, making it more difficult to present. Wholesale consignments will go to assembly markets where trading takes place from 5-6 o'clock in the morning.



9 The small leaved variety. Note holes in the leaves caused by ants

Bags or large bundles are carried as head loads or alternatively, carts or anything on wheels is being used for transport. Most farmers (women) sell the produce themselves. This is usually at retail markets or occasionally sales take place through middlemen whereas larger producers may sell to a trucker on assembly markets, who brings the produce to longer-distance markets. The traders who sell these vegetables, including wholesalers, are mainly women in both East, Central and West Africa.

HB is expensive during the dry season with prices ranging from CFA 12000-15000 per 50 kg bag sold to truckers (prices per bundle remain stable at about CFA 25 per bundle for a farmer) but during the rains when a 50 kg bag will only fetch between CFA 4000 and 7000, a bundle can be large (about 35 stems per bundle), whereas in the dry season it is only very small (say about 10 stems which could also be smaller in size). The price per bundle remains constant at CFA 25 but the quality and quantity may vary considerably. This practice whereby the price remains constant but the volume differs can be seen in most African countries where it concerns traditional vegetables.

Yaounde retail price statistics show that HB prices are lowest from May to October and rise to a peak price towards the beginning of the rainy season in March when farmers can fetch a price which is two to two and a half times higher than the main season price.

In Kenya where black nightshades are rarely seen outside the rural areas, there was a good demand in Nairobi which can hardly be met by farmers from the surrounding areas (e.g Embu). Now farmers from as far away as Kisii and South Nyanza districts have made arrangements to transport their produce to the capital.

POST-HARVEST

Especially in Nigeria, leaves are frequently dried for use in soups or sauces during the dry season. Drying in the shade where temperatures are relatively low was found to be better for the retention of ascorbic acids. The levels of crude protein and mineral nutrients were not much affected by drying.

A different product found in western Kenya is used as a meat substitute. BN is cooked whereby the wastewater is replaced with milk. The resulting product is compressed and left to dry for a few days when it becomes solidified and turns almost black in colour. This 'cake' is now ready and the slices cut out of it are said to be high in proteins. It is served together with cassava or other starchy product and can be accompanied by freshly prepared leafy vegetables.

NUTRITIONAL VALUES

The nutrient value will depend on many factors including the age of the crop, the crop species, whether it was grown during the rainy or the dry season, the soil fertility etc. Mrs Zonfac [1984] observed that leaves collected during the vegetative stage had a higher protein and mineral yield than those harvested from flowering onwards. However, the cellulose content is low at the vegetative stage.

Nutritive value of 'black nightshade' per 100 g fresh shoots/leaves*

Nutrient	measure	Range of Values
Water	%	83 - 91
Crude Protein	g	2.8-5.8
Crude Fibre	g	0.6 -1.4
Fat	g	0.8
Carbohydrate	g	3.3-5.0
Calories	Kcal	38
Etheral Extract	g	38-44
Total Ash	g	3.3-8.8
Iron	mg	1.0-4.2
Calcium	mg	90-442
Phosphorus	mg	75
Beta-Carotene	mg	1.7-11.6
Ascorbic Acid	mg	20-158
Oxalate	mg	58.8-98.5
Nitrate-N	mg	29-400
Total Phenolocs	mg	68.3-73.4

*Source: Edmonds and Chweya [1997].

A major consideration is also the fact that about 60% of the vitamins and many other micro-nutrients can be lost in the cooking process, especially when the cooking water is replaced several times. This is one of the reasons why the less bitter huckleberry is possibly a better vegetable than the bitter *Solanum americanum* and similar species since the cooking water can be used in soups and sauces. The shorter the cooking process, the less nutrients will be lost whereby the Ugandan method of steaming may

be the best. However, many people in Uganda do not like their 'Nsugga' because it is too bitter.

Toxicity

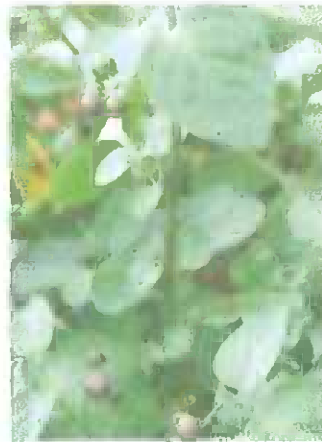
People never eat the green, immature berries whereas most people also remove the flowers and inflorescences. This is likely a result of their experience whereby when eating immature berries people may develop problems which could be serious. Green berries contain the poisonous alkaloid solanine and the less poisonous solanidine. The effect of solanine poisoning includes vomiting and dizziness, mental confusion and loss of speech and could even result in blindness.

Leaves contain only low levels of these alkaloids which are however associated with the bitter taste. Cooking will reduce this bitterness and may destroy the toxic effects of solanine and solanidine.

Consumers likes and dislikes

The cooking water of especially the dark stemmed varieties can be black in colour (most black nightshade types have green cooking water). People may or may not change the water once or several times, to reduce the dark colour and to reduce the bitterness. Unfortunately vitamins and other micro-nutrients could be thrown away with this water, thereby much reducing the nutritious value of HB and BN. Only young shoots are harvested, the shoots themselves can be eaten as well. Older shoots or shoots left overnight produce a foam when cooked. This is not appreciated. People prefer fresh shoots with dark green leaves.

Berries are being removed before cooking. To my knowledge no mature berries with a green or blackish colour are eaten in west or central Africa whereas in America and Asia huckleberry varieties have been specifically selected for their fruits. The ripe orange berries of *Solanum villosum* (?) are occasionally eaten by children in Kenya and Tanzania. Birds do appreciate the ripe berries and are thereby distributing their seeds over a large area where these seeds develop into 'weeds'.



10 Consumers will need to remove the berries first

In southwest Nigeria people remove the inflorescence with buds, flowers and small fruits before cooking. According to van Epenhuysen [1974] these flowers can subsequently be used in soups for flavouring. These flowers taste very bitter.

In Cameroon's western province HB is much liked in combination with corn fufu. HB is a spinach-like vegetable which is not mucilaginous unlike *Corchorus*, okra and others. People prefer it over cabbage, a crop which is more suitable for long-distance markets (less perishable) and as such cabbage attracts higher prices.

A favourite dish in the forest zone is called "Sanga" which is prepared from fresh maize and huckleberries. People who grow huckleberries eat it 2 or 3 times per week on average but they mention that when it is eaten more frequently, people may

develop stomach ache and change to other vegetables such as *Colocasia* leaves, amaranth, bitterleaf or cabbages during the rest of the week. The toxicity may be caused by the glycoalkaloids solanine and solanidine that are usually associated with plants of the Solanaceae family. Leaves contain an appreciable amount of methionine.

Huckleberries are relatively mild in taste when compared with other members in the *Solanum nigrum* group which generally have a more bitter taste. There are large differences between varieties and this aspect requires further studies.

Farming systems and seasons

Many farmers have both a home garden for their own use and a garden for commercial production which is usually located some distance from the home. This division is by no means strict and produce could be sold from the home garden and visa versa. Most home gardens have a greater variety than production gardens for the market. The IV seen in most Cameroonian home gardens is bitterleaf, followed by huckleberry. Other very important leafy vegetables are amaranth and jute mallow (*Corchorus olitorius*) and roselle (*Hibiscus sabdariffa*) in the drier parts of the country.

Intercropping can be with virtually any crop which includes maize, potatoes, lettuce, amaranth, cabbage, cassava, garden egg, cocoyam etc. The cocoyam itself can be intercropped with maize etc. Where monocropping was encountered, usually on the distant farms, most of the produce was for the market whereas for home use or mixed subsistence/income generation, people grow it as an intercrop.

In Western province people can grow HBs on a year-round basis when there is irrigation water available. If not, people plant the first time in March and the second time in July/August. Many farmers also plant over an extended period to ensure a continuous supply. In the rainy season direct sowing is the most common, mainly as a mixed crop. HBs do not grow well under hot weather conditions whereas during heavy rains diseases can be problematic especially when the plant spacing is close. Production during the dry season (sowing from mid September) is done close to rivers or near a swampy area. In this case HB are often grown as a monocrop on an area of between 100 and 500m² per farmer. Most products will be marketed during this period when compared with a rainy season product that is mainly produced for subsistence. During the dry season yields are higher than during the rainy season.

Other socio-economic notes

Children are often used to assist on the farm with either transplanting or harvesting. These include young children from the age of about 6 years. Children could be from within the family or others from the village. The income from these vegetables is often used to pay for their school fees.

People prefer to grow HB rather than cabbages because there is less work and they require less financial inputs. Cabbages are heavy to carry and can mainly be grown near a road whereas HB could be grown on more distant farms. Seeds for cabbages have to be purchased. HB is therefore a favourite crop for people with limited or no access to funds needed to purchase external inputs.

On mixed farms the man usually takes care of the tuber crops such as cassava or cocoyams whereas the women and children work with vegetables. Once vegetables become an important cash crop such as tomatoes or potatoes, the men usually take over control. This also applies to the larger monocropped fields of huckleberry or amaranths.

In the forest zone, West of Yaounde, huckleberry is traditionally produced in the groundnut/casava-based mixed food crop field. All crops in this field, including root crops, are handled by women (source: J Gockowski).

LITERATURE USED

- AGONG SG. 1993. Seed extraction procedures for long term conservation of *Solanum nigrum*. *Seed Science and Technology* 21(2):447-51.
- BEDIGA, J. M. 1992: *Time of picking and the yield of two leafy vegetables (black nightshade *Solanum nigrum* and Jew's mallow *Corchorus olitorius*)*. INADER, University Centre of Dschang.
- BUKENYA Z.R. and HALL J.B. 1988: *Solanum* in Ghana in: *Bothalia* 18,1:79-88
- BUKENYA Z.R. and CARASCO J.F. 1995. *Solanum* in Uganda in: *Bothalia* 25,1
- CHWEYA JA. 1985. Identification and nutritional importance of indigenous green leaf vegetables in Kenya. Tidbury GE, Tindall HD. Ninth African symposium on horticultural crops. *Acta Horticulturae* (Netherlands); 1983 Jul 27-1983 Jul 29; Mahe (Seychelles). Wageningen (Netherlands): ISHS. p 99-108.
- DALZIEL, J. M. 1937. *The Useful Plants of West Tropical Africa*
- DENTON L and AYODELE F A. (1996) Notes On Selected Indigenous Vegetable Crops In Nigeria. Unpublished paper prepared for NRI project A 0515.
- EDMONDS J M and CHWEYA J A (1997). Black nightshades, *Solanum nigrum* L. and related species. An IPGRI-IPK publication
- EPENHUIJSEN, C.W. Van. (1974): Growing native vegetables in Nigeria. FAO, Rome.
- FOMBIN, V. A. 1995: *The cultivation of huckleberry (*Solanum scabrum*) in Fombot area, Western Province of Cameroon*. Field study report, FASA, University of Dschang.
- FAWUSI MOA. 1983. Nitrogen fertilization and storage temperature effects on the nutritive value of *Solanum nigrum*. *Journal of Plant Foods* 5(3):161-7.
- GBILE Z O., 1979: *Solanum* in Nigeria in: *The Biology and Taxonomy of the Solanaceae*
- GBILE ZO. 1986. Epidermal studies in the *Solanum nigrum* complex in Nigeria. D'Arcy WG, ed. *Solanaceae: biology and systematics*. New York, USA : Columbia University Press. p 159-68.
- IMUNGI J G , 1989: *The role of indigenous vegetation in human nutrition in Kenya*.
- NGEPI Giselle, 1991: *La Morelle Noire (*Solanum nigrum*): Techniques de Production Paysannes et Tentative d'Amélioration*. (Huckleberry: Farmers' Production Practices and Tentative Improvements). Student report, INADER, University Centre of Dschang.
- ONAYEMI O, and BADIFU GIO. 1987. Effect of blanching and drying methods on the nutritional and sensory quality of leafy vegetables. *Plant Foods Hum Nutr* 37(4):291-8.
- ONYANGO M A: (1993) Effect of plant density and harvesting frequency on the yield and vegetable quality of four variants of black nightshade (*solanum nigrum* l). a MSc thesis University of Nairobi
- SCHIPPERS, R.R., 1996. Domestication of Indigenous vegetables for sub-Saharan Africa, an NRI report.
- SCHIPPERS, R.R. 1996. Cash cropping study in Enugu, Nigeria - preliminary overview of field studies conducted in March, April and May 1996.
- STEVENS, J M C. "*Légumes traditionnels du Cameroun, une étude agro-botanique*" Wageningen Agricultural University Papers 90-1 (1990)
- TETIO-KAGHO T and ZANFACK E. "*Etude de quelques legumes (*Amaranthus hybridus*, *Corchorus olitorius*, et *Solanum nigrum*) traditionnellement cultivés au*

Cameroon. II. Valuers nutritives a different stades de recolte.” In *Proceedings of the Biosciences Conference*, Ngaoundere, 1990.

WESTPHAL E, 1981. *L'Agriculture autochtone au Cameroun*. [Traditional agriculture in Cameroon] Miscellaneous papers 20, Landbouwhogeschool, Wageningen, The Netherlands.

ZONFAC J.C, 1984: *Techniques culturales et valeur nutritive de quelques légumes locaux (Amaranthus hybridus, Corchorus olitorius and Solanum nigrum)*. Cultural techniques and nutritive value of some indigenous vegetables (*Amaranthus hybridus, Corchorus olitorius* and *Solanum nigrum*)

Annex 1: Cultivated species within the African black nightshade complex

***Solanum americanum* Miller**

Plants glabrescent to slightly pilose

Stems with inconspicuously dentate ridges or edentate

Leaves 3-6.2 (11)cm long x 1.1-4 (6.6) cm broad; lower surface moderately pilose; margins entire to sinuate

Inflorescence simple, umbellate cymes, 3-6 flowered

Calyces 1.1-2.4 mm long **Sepals** reflexed away from mature berries

Corollas stellate, white (or with purplish tinge). Basal star, translucent or yellow-green in colour, 2-4 (6) mm

Anthers yellow. 0.7-1.5 mm

Styles 1.2-3.5 mm, usually exerted beyond anthers.

Berries globose, dark green or black, 4-8 mm. *Falling from calyx when ripe*

Cytology: 2n = 24

Note: morphologically rather variable; common throughout Africa and found throughout the world. It is the most commonly cultivated species next to the huckleberries.

***Solanum nigrum* L.**

Plants: decumbent to erect, up to 70 cm high

Leaves 2.5-7cm long x 2-4.5 (6) cm broad; subglabrous, margins entire to sinuate-dentate

Inflorescence simple, often extended cymes, 5-10 flowered.

Calyces 1.2-2.5 mm long, **Sepals** usually ovate, adherent to base of mature berries

Corollas stellate, white with translucent basal star, 5-7 mm, usually 1.5-3 times as long as calyx

Anthers yellow. 1.5-2.5 mm.

Styles 2.8-3.5 mm, not exerted beyond anthers.

Berries broadly ovoid, dull purple to blackish (or yellow-green), 6-10 mm.

Remaining on plants or falling from calyces when ripe.

Cytology: 2n = 72

Note: There are two subspecies: *ssp nigrum* with only slight pubescence. The non-glandular hairs are appressed.

ssp schultesii has long, soft hairs with a glandular head.

***Solanum scabrum* Miller Garden Huckleberry**

Synonyms: *S. guineense* Miller
S. tinctorium Welw.

Plants erect, glabrescent to subglabrous, lateral branches sparse, usually spreading horizontally. Plants can reach 1.00 m in height and become 1.20 m wide when undisturbed

Stems prominently ribbed, ridge with distinct teeth.

Leaves large 10-12 (16)cm long and 6-8 (14)cm wide, with entire to sinuate margins. Apices acute to obtuse.

Inflorescence simple or forked, often extended cymes, 6-14 (27) flowered.

Calyces 1.9-3.5 (4.5) mm; **Sepals** usually reflexed away from berry.

Flowers stellate, white (or with purplish tinge). Basal star, yellow-green, 7-9 mm

Anthers brown or purplish brown, 2.5-3.3 mm

Styles 2.9-4.5 mm long, not exerted beyond anthers

Berries broadly ovoid, dark purple, 15-17 mm broad, *remaining on plant and adhering to erect pedicels at maturity.*

Cytology: hexaploid $2n = 72$ (an autoallopolyploid)

Note: commonly cultivated in Cameroon, Zaire and Nigeria

***Solanum villosum* Miller**

Plants subglabrous to hairy, up to 50 cm high. With glandular hairs

Leaves 2-7 cm x 1.5-4 cm, rhombic to ovate-lanceolate, margins entire to sinuate-dentate.

Inflorescence simple, umbellate or small cymes with 3-5 (7) flowers.

Peduncles short, erect but long pedicels deflexed in fruit

Calyces 1.2-2.2 mm, deflexed or adhering to mature berry

Corollas white 4-8 mm, 3-5 times as long as the calyx

Anthers yellow, 1.5-2.5 mm

Styles 2.9-5 mm long, rarely beyond anthers

Berries elliptic or oval shaped, less commonly round. 6-10 mm broad, falling when ripe. Berries orange to red

Cytology: tetraploid $2n = 48$

Note 1: The berries range in colour from orange to red with orange the most common. Its berries are frequently consumed by children.

Note 2: The hairy subspecies '*villosum*' tolerates drier conditions than the subglabrous subspecies '*miniatum*'. It is especially cultivated in Tanzania, Kenya and Ethiopia.