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Source: Journal of East African Natural History, 87(1) : 265-278

Published By: Nature Kenya/East African Natural History Society

URL: [https://doi.org/10.2982/0012-8317\(1998\)87\[265:SEONPI\]2.0.CO;2](https://doi.org/10.2982/0012-8317(1998)87[265:SEONPI]2.0.CO;2)

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## **SOME EXAMPLES OF NATURAL PRODUCTS IN THE EASTERN ARC MOUNTAINS**

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### **ABSTRACT**

There is a high diversity of natural ecosystems in the Eastern Arc Mountains, influenced by a long history of human colonisation. Natural products are an important part of the rural economy and people have a long tradition of utilising them, passed on orally from generation to generation. Urbanisation and migration in modern Tanzania have cut many of the traditional links with nature, and knowledge of nature and natural phenomena is no longer handed down from generation to generation as efficiently as in the past. Collecting the oral tradition in Tanzanian villages and saving it for the future is an urgent task. In this article the use of wild vegetables (Katariina Vainio-Mattila) and edible mushrooms (Marja Härkönen) are presented according to interviews and material collected during several visits to the Pare and the Usambara mountains.

### **INTRODUCTION**

Tanzania is a country of woodlands and forests, forming a mosaic of vegetation that fits into a landscape of mountains, plateaux and river valleys. It is also the birthplace of mankind from where the human race has wandered to new habitats with new natural conditions. So in East Africa the people have had the longest possible time to adapt to their environment, to use it, to change it, and to co-evolve with it.

The Eastern Arc Mountains of Tanzania reflect some of the national richness in vegetation types, ranging from perhumid tall forests on the wetter eastern slopes, through upland grasslands on the highest peaks, to woodland on the drier more seasonal plateaux and western slopes. Natural ecosystem diversity on the mountains is enhanced by a long history of cultivation. The Usambara Mountains have been more or less continuously occupied during the last 2,000 years by settled agricultural peoples (Schmidt, 1989). Modern cultivation in Tanzania is dominated by introduced plants, such as maize, cassava, potato and sweet potato from South America, sugar cane from the South Pacific and rice from Asia (Purseglove, 1987, 1988). Although some crop introductions are ancient, for example cultivated bananas are thought to have been introduced from Asia about 2,000 years ago (De Langhe *et al.*, 1995), it is likely that in the past communities in the Eastern Arc and elsewhere in Africa have relied primarily on the indigenous flora and fauna. Some local plants were domesticated: sorghum, pearl millet, and finger millet are all African plants grown in Tanzania (National Research Council, 1996).

In addition to the main cultivated varieties, there is a wealth of useful plants in the mosaic of vegetation in the Eastern Arc Mountains. In different sites, natural conditions and species

diversity vary, and the selection of useful natural products changes accordingly. Some useful plants are found in forests, some in the woodlands and others in ruderal habitats or in a semi-cultivated state. There is an enormous amount of knowledge on natural products accumulated in the Tanzanian villages and transferred orally through generations. Most housewives know which tree species are best for building poles or good as fuel wood, which wild fruits, mushrooms and plants are edible and which are good for home medicine. In most villages there is also a specialised traditional healer who has a long oral education (figure 1 & 2).

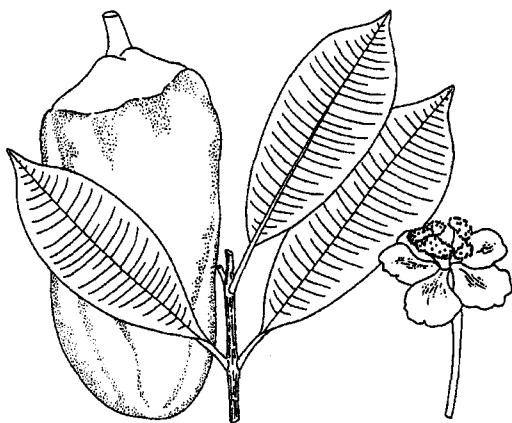


Figure 1. *Allanblackia stuhlmannii*, an endemic tree species in the Eastern Arc Mountains, has large fruits whose seeds provide fat for candles and soap making. *Allanblackia* also provides timber and has some medicinal uses (drawing by Jilly Lovett).

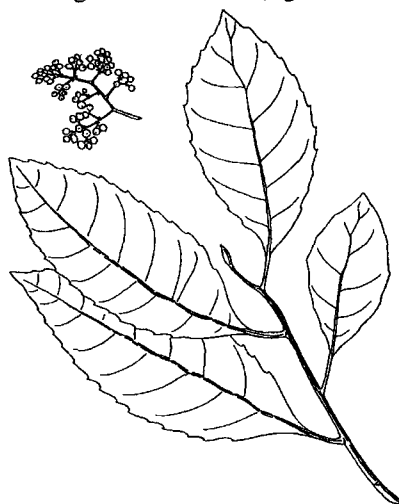


Figure 2. *Maesa lanceolata* provides firewood, building posts, colours for baskets, and has some medicinal uses (drawing by Jilly Lovett).

Emphasis is often placed on timber as the source of economic value in tropical forests, but increasingly the importance of non-timber forest products (NTFP) is being recognised in forest management (Grimes *et al.*, 1994; Melnyk & Bell, 1996; Panayotou & Ashton, 1992; Peters *et al.*, 1989). Economic values of NTFP from natural or semi-natural forests have been undervalued (Bruenig, 1996). Valuable wild products tend to be 'captured to culture' and it is believed that reliance on NTFP depends on poverty. However, this approach does not take into account the many goods and services natural ecosystems provide (Daily, 1997). Experience from developed countries makes it clear that vernacular knowledge of natural products has a high cultural value. For example in the United Kingdom, there are many books on plant uses and folklore (recently reviewed by Mabey, 1996), and in Finland there are dozens of mushroom guides available for various types of collectors.

Urbanisation and migration in modern Tanzania have cut many of the traditional links with nature and knowledge of natural phenomena is no longer handed down from generation to generation as efficiently as in the past. In 1967, the peasants in Tanzania were called upon by President Nyerere to move together and form 'socialist Ujamaa villages'. Between 1972 and 1975 there was a tendency to resettle people in bigger villages that were easier to administer (von Freyhold, 1979). When people moved, the knowledge they had received from their parents may no longer be useful in the new areas. Furthermore, when children go to school,

they concentrate on instruction valid for modern society and modern religions, and tend to undervalue vernacular knowledge. In contrast to undervaluing the rural tradition, Tanzanians should be proud of the good familiarity the village people have with their environment. If we let this chain of inherited knowledge break, a lot of wisdom is lost forever. Although a great deal of accumulated knowledge has been published (Chhabra *et al.*, 1987, 1989, 1990a, b; FAO, 1983; Haerdi, 1964; Hedberg & Hedberg, 1982; Hedberg *et al.*, 1983a, b; Kabuye, 1988; Kokwaro, 1976; Mbuya *et al.*, 1994; Ruffo *et al.*, 1989; Verdcourt & Trump, 1969; Watt & Breyer-Brandwijk, 1962), there is still much to learn and the collecting of the oral tradition from the Tanzanian villages and saving it in written form is an urgent task, not only for the potential economic values, but also for its cultural importance.

Early reports from the period of German administration in the Usambaras stated that the Usambara Mountains were sparsely populated. Throughout the German, British and independent administrations human pressure on the natural environment has been increasing (Iversen, 1991b). The total population of the Usambaras is estimated to be 400,000 inhabitants (Iversen, 1991b). According to census of 1988 the population density in the West Usambara ranges from 200 to 400 persons/km<sup>2</sup>. Most of the population is concentrated in the mountainous area, which is one of the most intensively cultivated rural areas in Tanzania (Iversen, 1991b). As the population continues to boom, there is an ever-increasing out-migration of the young men to towns and to sisal estates in the lowlands for off-farm employment (Mrecha, 1995). The majority of the inhabitants of the East Usambaras belong to Sambaa tribe, but there are villages of newcomers, mostly around the tea plantations (FINNIDA, 1988). The population of West Usambaras consists of three main ethnic groups, Sambaa (80 %), Pare (10 %) and Mbugu (5 %) (Mrecha, 1995). The local Sambaa language is very rich in botanical and ecological terms (Sangai, 1963), and hundreds of wild plants are important to the traditional tribal everyday life.

The Eastern Arc Forests of Tanzania are important both at a national level and at an international level (Lovett, 1985, 1988). At a national level they are important as areas of water catchment, a culture base, a source of non-timber forest products and until recently as a source of timber. At an international level, they are a genetic resource of medicinal plants, timber trees, and other plants of economic importance, notably wild coffee and cultivated flowers such as *Saintpaulia* and *Impatiens*. In addition, by virtue of the many unique species of plants and animals, the affinities of which may lead to a better understanding of earth history, the Eastern Arc Forests are of great scientific interest.

## WILD VEGETABLES

In comparison with cultivated plants, wild vegetables are often considered to be inferior in their taste and nutritional value. There have been fairly few studies on wild green leafy vegetables, particularly the extent to which they are consumed, and of their nutritional significance in agricultural communities in Tanzania.

As early as 1895, in the earliest years of the German colonial period in Tanzania, many species of wild leafy plants were noticed to be important in the diet of local populations (Engler, 1895). Fleuret (1979a, b) recorded more than 15 species of wild leafy vegetables in her nutritional study in Lushoto District. Johns *et al.* (1996a) recorded 53 cultivated food plants and 38 species of edible wild fruits and leafy vegetables during the course of ethnobotanical interviews with 51 informants in Mara Region. In addition, Johns *et al.* (1996b) recorded 35 cultivated food and beverage plants and 44 edible wild plants used by the

Batemi of Ngorongoro District. Woodcock's (1995) study on indigenous knowledge and forest use in the East Usambaras includes 25 wild leafy vegetables species.

The predominant diet in Tanzania, like in many areas of Africa, consists of a starchy staple food (maize, cassava) and 'side dish' or 'stew'. The starchy staple food is usually served as a form of porridge, which is called 'ugali' when made of maize or 'bada' when made of cassava and/or cooking bananas. The starchy staple food provides calories needed for the production of energy but it is low in other nutrients. The stew, 'mboga', is prepared separately and is eaten with the staple food. The composition of the stew varies according to the season of the year. In general, it consists of a mixture of onions, tomatoes and green leafy vegetables, with legumes such as peas or beans. Meat, fish or mushrooms are sometimes included.

### A case study among Sambaa

Wild vegetables used by the Sambaa in the Usambaras were studied during two expeditions. Fieldwork was carried out in Muheza District, the East Usambaras, in December 1995 (Vainio-Mattila *et al.*, 1997), and in Lushoto District, the West Usambaras, in October–November 1996. The villages visited in the East Usambaras were Amani, Bomole, Kimbo, Maramba, Mgambo, Misalai, Mkokola and Ubiri. Mayo, Mazumbai and Kishiku were the study villages in the West Usambaras. The main research methods were interviewing, preference rankings, free-listing, market surveys and collecting voucher specimens.

Interviews were mainly carried out among the Sambaa. Knowledgeable villagers were chosen as informants. In the East Usambaras seven women (three from Sambaa-tribe, two from Pare-tribe, one Bondei and one Ngoni), and three men (all Sambaa) were interviewed. Ages of the informants varied from 23 to 43 years. In the West Usambara Mountains the total number of interviewees was 13 (eight men and five women). All of them were Sambaa and most of them had always lived in the area. Most of the informants were subsistence farmers and had primary education. Ages of the informants varied from 18 to 62 years. A special questionnaire was used in the interviews, which were tape-recorded and partly video-filmed.

The majority of the informants preferred wild vegetables to the cultivated ones. In almost all cases wild vegetables are used more than cultivated. In many cases 3/4 of all used vegetables were estimated to be wild. Wild vegetables are regarded as easily obtainable and available all the year round. They are palatable and can be prepared without cooking oil, which is expensive. Those informants preferring cultivated vegetables regarded them as more easily obtainable. According to their opinion collecting of wild plants is troublesome due to their seasonal occurrence (mostly dependent on rainy season). However, the good taste of many wild species was appreciated by them as well.

### Species used

All together 73 species representing 26 families were used by the Sambaa as wild green leafy vegetables (see table 1). A total of 46 species, representing 18 families are used in the East Usambaras and 55 species from 22 families in the West Usambaras. Twenty-four species (33 %) are common. The most important families in the East Usambaras are Amaranthaceae, Asteraceae and Cruciferae, whereas in the West Usambaras they are Acanthaceae, Amaranthaceae and Asteraceae. The most favoured and important species in the East Usambaras are Ndelema (*Basella alba*) (figure 3), Msangani (*Dioscoreophyllum volkensii*) and Mshunga (*Launea cornuta*). These are considered to be easily obtainable, abundant and easy to prepare for food. In addition they taste good. Also Mnavu (*Solanum nigrum*) and *Amaranthus* species are popular. Sometimes Mnavu is preferred to Mshunga, because the latter is more seasonal in its occurrence. Bwache (*Amaranthus spinosus*), Buuza (*Amaranthus*

*lividus* ssp. *polygonoides*), Salade (*Rorippa nasturtium-aquaticum*) and Zinge (*Nicandra physalodes*) are the most favoured (tasty) species in the West Usambaras. However, the most used and important wild vegetables in the West Usambaras according to preference rankings are Mbwembwe (*Bidens pilosa*), Ngereza (*Galinsoga parviflora*) and Bwache (*Amaranthus spinosus*). These are easy to find and abundant. In addition they taste good. The taste of Mchicha (*Amaranthus hybridus*) (figure 4) is highly appreciated both in the East and West Usambaras. However, this species is mostly found cultivated.

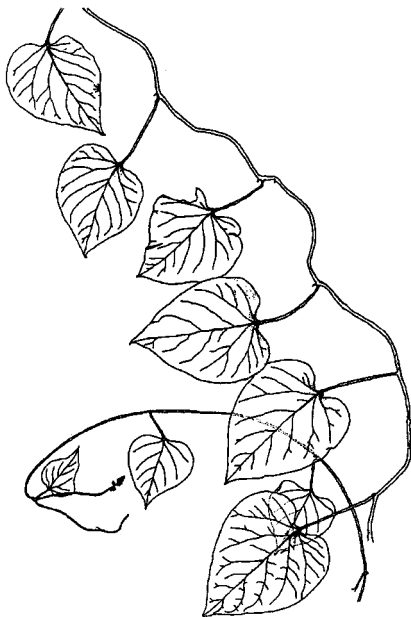


Figure 3. *Basella alba*, one of the most favoured wild vegetable species in the East Usambaras, is a pantropical species (drawing by Outi Vainio).



Figure 4. *Amaranthus hybridus*, one of the most favoured and tastiest green leafy vegetables, is common in ruderal habitats (drawing by Outi Vainio).

#### *Collecting and preparing of wild green leafy vegetables*

Wild vegetables are almost solely collected by women and children. They are mostly picked in home gardens and farmland or along the roads and footpaths. Collection is normally undertaken on the return from shamba or at the same time as collecting firewood. The most used species are easily available all the year round. However, collecting of some of the forest-derived species might be more time demanding. Plants are usually collected in vegetative stage, when the leaves are young and fresh. Usually leaves or shoots are tied to bundles with some vegetable fibres (e.g. banana), in order to keep them fresh during transport and to facilitate handling. Usually wild vegetables are collected only the amount needed each time, but occasionally the leaves are dried and stored. The most favoured species are collected and used four days a week on average. Many of the species are collected for sale. According to observations the market richest in wild vegetable was in Mombo (Lushoto District), where seven wild species were recorded.

Wild vegetables are used like spinach and eaten as a form of stew, served as a side dish of staple food, most commonly ugali. The process of preparing of wild vegetables for a meal is somewhat the same, although some details may differ from one species to another. First the

leaves and young shoots are sorted out; old leaves as well as the petioles are removed. After that the leaves are cut once or twice and rinsed. Then the leaves are boiled shortly, and squeezed dry. The water used for boiling is not used for other purposes. Finally the leaves are cooked in vegetable oil for 15 min to 1/2 an hour, usually together with tomatoes and onions. Salt might be added, but other spices are rarely used.

*Table 1. List of the wild vegetables used by the Sambia in the Usambara Mountains, NE Tanzania. Columns indicate family (in alphabetical order), genus and species, as well as the vernacular name (mostly in Sambia, occasionally in Swahili, and in Bondei-language when mentioned). Cultivated and naturalised species are indicated with an asterisk (\*).*

| Family             | Species  | Vernacular name                          | East Usam. | West Usam. |
|--------------------|--|--|------------|------------|
| <b>1. Monocots</b> |  |  |            |            |
| Araceae            | <i>Colocasia esculenta</i> (L.) Schott                           | Kieze/Eze/Gimbi*                         | x          | x          |
|                    | <i>Xanthosoma sagittifolia</i> (L.) Schott                       | Yugwa*                                   |            | x          |
| Commelinaceae      | <i>Commelina benghalensis</i> L.                                 | Nhkongo                                  |            | x          |
|                    | <i>Commelina</i> sp.   | Kikongo majura                           |            | x          |
| <b>2. Dicots</b>   |  |  |            |            |
| Acanthaceae        | <i>Asystasia gangetica</i> (L.) T. Anders.                       | Tikini                                   | x          | x          |
|                    | <i>Justicia anisophylla</i> (Mildbr.) Brummitt                   | N'tongoani/<br>Hongoani                  |            | x          |
|                    | <i>J. engleriana</i> Lindau                                      | N'tongoani/<br>Hongoani                  |            | x          |
|                    | <i>J. heterocarpa</i> T. Anders.                                 | Unkobo                                   | x          | x          |
|                    | <i>J. heterocarpa</i> T. Anders. ssp. <i>vallicola</i> Hedrén    | Unkobo                                   |            | x          |
|                    |  |  |            |            |
| Amaranthaceae      | <i>Aerva lanata</i> (L.) Schultes                                | Shaza/Tebwa<br>(Bondei)                  | x          | x          |
|                    | <i>Alternanthera sessilis</i> (L.) DC.                           | Mkoswe                                   | x          | x          |
|                    | <i>Amaranthus dubius</i> Thell.                                  | Bwache                                   | x          |            |
|                    | <i>A. graecizans</i> L. ssp. <i>thellungianus</i> (Nevski) Gusev | Buuzza                                   | x          |            |
|                    | <i>A. hybridus</i> L.  | Mchicha*                                 |            | x          |
|                    | <i>A. hybridus</i> L. ssp. <i>cruentus</i> (L.) Thell.           | Mchicha wa<br>kizungu*                   | x          |            |
|                    | <i>A. hybridus</i> L. ssp. <i>hybridus</i>                       | Mchicha wa<br>kizungu*                   | x          |            |
|                    | <i>A. lividus</i> L. ssp. <i>lividus</i>                         | Mchicha katongo                          | x          |            |
|                    | <i>A. lividus</i> L. ssp. <i>polygonoides</i>                    | Buuzza                                   |            | x          |
|                    | <i>A. spinosus</i> L.  | Bwache                                   | x          | x          |
|                    | <i>A. tricolor</i> L.  | Mchicha mavi ya<br>mbuzi*                | x          |            |
|                    | <i>Celosia schweinfurthiana</i> Schinz                           | Mchicha<br>pori/Shaza                    |            | x          |
|                    | <i>C. trigyna</i> L.   | Fungu msanga                             | x          | x          |
|                    | <i>Bidens pilosa</i> L.  | Mbwembwe                                 | x          | x          |
| Asteraceae         | <i>Emilia coccinea</i> (Sims) G. Don                             | Limijangombe                             |            | x          |
|                    | <i>Galinsoga parviflora</i> Cav.                                 | Ngereza                                  | x          | x          |
|                    | <i>Launea comuta</i> (Oliv. & Hiern.) C. Jeffrey                 | Mshunga/<br>Mshunga wa<br>bonde/Mshumpuu | x          | x          |
|                    | <i>Sonchus oleraceus</i> L.                                      | Kwake(Mshunga-<br>kwake)                 | x          | x          |
|                    | <i>S. schweinfurthii</i> Oliv. & Hiern.                          | Mshunga/<br>Mshunga-pwapwa               | x          | x          |
|                    |  |  |            |            |
| Basellaceae        | <i>Basella alba</i> L.   | Ndelema                                  | x          | x          |
| Boraginaceae       | <i>Trichodesma zeylanicum</i> (Burm.f.) R.Br.                    | Sesemranda                               | x          |            |
| Capparaceae        | <i>Gynandropsis gynandra</i> (L.) Briq.                          | Mgagani                                  | x          | x          |

| Family          | Species  | Vernacular name   | East Usamb. | West Usamb. |
|-----------------|--|---|-------------|-------------|
| Caryophyllaceae | <i>Stellaria media</i> (L.) Vill.                  | Kidendezezi   |             | x           |
| Connaraceae     | <i>Rourea orientalis</i> Baill.                    | Kisogo  | x           |             |
| Convolvulaceae  | <i>Ipomoea aquatica</i> Forsk.                     | Talata  | x           | x           |
|                 | <i>I. batatas</i> (L.) Lam.                        | Nkutu/Matembele*  | x           | x           |
|                 | <i>Ipomoea</i> sp.                                 | Rongwe  | x           |             |
| Cruciferae      | <i>Brassica juncea</i> (L.) Czern                  | Figiri*   | x           | x           |
|                 | <i>Brassica</i> sp.                                | Simwache  | x           |             |
|                 | <i>Brassica</i> sp.                                | Komba   |             | x           |
|                 | <i>Cardamine trichocarpa</i> A. Rich.              | Kisegeyuu   | x           | x           |
|                 | <i>Cardamine</i> sp.                               | Kisemusemu  | x           |             |
|                 | <i>Rorippa nasturtium-aquaticum</i> (L.) Hayek     | Salade  | x           | x           |
| Cucurbitaceae   | <i>Cucurbita maxima</i> Lam.                       | Ukoko/Ngoko*  | x           |             |
|                 | <i>C. moschata</i> (Lam.) Poir                     | Nhoko   |             | x           |
|                 | <i>Cucurbita</i> sp.                               | Machuchuki  | x           |             |
|                 | <i>Cucurbita</i> sp.                               | Imiwa*  |             | x           |
|                 | <i>Cucurbita</i> sp.                               | Bodwe*  |             | x           |
|                 | <i>Momordica foetida</i> Schumach.                 | Ushwe   | x           | x           |
|                 | <i>Sechium edule</i> (Jacq.) Sw.                   | Mchuchu*  | x           |             |
|                 | <i>Zehneria scabra</i> (L.f) Sond                  | Nkweyamzue  |             | x           |
|                 | <i>Zehneria</i> sp.                                | Kangedele   |             | x           |
| Euphorbiaceae   | <i>Erythrococca kirkii</i> (Muell. Arg.) Prain     | Mnyembeue   | x           |             |
|                 | <i>Manihot esculenta</i> Crantz                    | Kisamvu*  | x           | x           |
| Leguminosae     | <i>Ormocarpum kirkii</i> S. Moore                  | Kiumbu  | x           |             |
|                 | <i>O. trichocarpum</i> (Taub.) Harms               | Kiumbu  |             | x           |
| Lamiaceae       | <i>Platostoma africanum</i> Beauv.                 | Kisungu   | x           |             |
| Lobeliaceae     | <i>Lobelia fervens</i> Thunb.                      | Shambaai/<br>Shambaee                                       | x           | x           |
| Menispermaceae  | <i>Dioscoreophyllum volkensii</i> Engl.            | Msangani  | x           |             |
| Moraceae        | <i>Morus indica</i> L.                             | Mlobe   |             | x           |
| Oxalidaceae     | <i>Oxalis corniculata</i> L.                       | Kidadaishi  |             | x           |
| Passifloraceae  | <i>Passiflora edulis</i> Sims                      | Mkakaa  |             | x           |
| Polygonaceae    | <i>Polygonum</i> sp.                               | Nwanywa   |             | x           |
| Portulacaceae   | <i>Talinum portulacifolium</i> (Forssk.) Schweinf. | Tonge   |             | x           |
| Solanaceae      | <i>Cyphomandra betacea</i> (Cav.) Sendtn.          | Ngogwe*   | x           | x           |
|                 | <i>Nicandra physalodes</i> (L.) Gärtn.             | Mnavu zinge/<br>Mnavu kichaa/<br>Kibwabwa/<br>Mgagani/Zinge | x           | x           |
|                 | <i>Physalis peruviana</i> L.                       | Mchupwa/<br>Mtumbua   | x           | x           |
|                 | <i>Solanum nigrum</i> L.                           | Mnavu/<br>Mnavu buche                                       | x           | x           |
| Tiliaceae       | <i>Corchorus olitorius</i> L.                      | Kibwando  | x           |             |
|                 | <i>C. tridens</i> L.                               | Kibwando  | x           |             |
|                 | <i>C. trilobularis</i> L.                          | Sesemranda/<br>Mlenda                                       |             | x           |
|                 | <i>Grewia kakothamnus</i> K. Schum                 | Mnangu  |             | x           |
|                 | <i>Triumfetta annua</i> L.                         | Hombo ya<br>msitui/Hombo                                    |             | x           |
|                 | <i>T. trichocarpa</i> Hochst.                      | Hombo kibwando  |             | x           |
| Urticaceae      | <i>Droguetia debilis</i> Rendle                    | Mbawa   |             | x           |
|                 | <i>Pouzolzia parasitica</i> (Forssk.) Schweinf.    | Kanyandee   |             | x           |
|                 | <i>Urera hypselodendron</i> (A. Rich.) Wedd.       | Bwete   |             | x           |



Parboiling is not always needed before cooking in oil. However, some species are so bitter in taste that they need to be boiled longer or twice. The bitter ones are often mixed with other vegetables. Sometimes leaves are first dried and pound to powder, which is then boiled in water in order to make soup (e.g. *Triumfetta annua*).

According to several informants some of the recorded species are also used as herbal remedies. *Launea cornuta* is used for stomach pains and measles. *Bidens pilosa* can be used for the same purpose. *Gynandropsis gynandra* is considered to be effective against earache. On the other hand, some of the wild vegetables may cause stomach problems, if eaten in large quantities.

All of the recorded species can not be considered as indigenous, but some are cultivated in home gardens and naturalised (Iversen, 1991a). Many of the species listed are introduced, pantropical or cosmopolitan. The former group is represented by some Solanaceae and Amaranthaceae species, which originate in the Neotropics. The latter group is represented by e.g. *Basella alba* (Basellaceae), *Bidens pilosa* (Asteraceae) and *Gynandropsis gynandra* (Capparaceae). Most of the species are ruderal; they grow by the road and trail sides, grazed ground, wasteland and as weeds in cultivation. There are rather few clearly forest derived species (e.g. *Dioscoreophyllum volkensii*, Menispermaceae).

In summary, a great variety of green leafy vegetables are collected in the wild and used among the Sambia in the Usambara Mountains. They are utilised on a daily basis, at all seasons of the year, and most probably they make up an important source of minerals and vitamins in otherwise fairly poor staple food.

## EDIBLE MUSHROOMS

Until the present decade there had been very little research on the mushrooms of Tanzania. In the beginning of this century, Eichelbaum (1906) published a list of fungi on the East Usambara Mountains, and in the 1970s Pegler prepared a large book (which he called preliminary list) (Pegler, 1977) on the East African agaric flora, but these works did not include any ethnomycological data.

A joint research project on Tanzanian mushrooms and their use was carried out by the Universities of Helsinki and Dar es Salaam in the years 1990–1995 (Härkönen, 1992, Härkönen *et al.*, 1993a, 1994a). The method was to travel around the Tanzanian countryside during the rainy season interviewing people and picking mushrooms with them. Local market places were visited and mushrooms on sale at roadsides were purchased. The characteristics of fresh mushrooms were recorded in every evening and after that the specimens were dried with a mushroom drier for later identification in the laboratory in Helsinki.

After travelling about 20,000 km in the Tanzanian countryside, collecting about one thousand mushroom specimens and interviewing more than one hundred people, one can say with confidence that there is a strong indigenous mushroom tradition in Tanzania (Calonge *et al.*, 1997; Härkönen *et al.*, 1993b, c, 1994b, c, 1995; Karhula *et al.*, 1998; Saarimäki *et al.*, 1994). Mushrooms emerge in the beginning of each rainy season, when people are sowing their crops and the harvest of the previous growing season has almost been consumed. So fresh mushrooms provide a welcome change to the daily diet and may be picked every day. There are, however, tribes, such as the Chagga and the Maasai, who do not use mushrooms at all. Most of the interviewees were able to identify from three to seven mushroom species in their own language, but there were individuals who could identify as many as 28 kinds of fungi.

In the area of Eastern Arc Mountains information on mushroom use was collected in the East and West Usambaras and in Pare Mountains. In those areas the selection of edible mushrooms is smaller than in miombo woodland and consists of some species of *Termitomyces* and wood-inhabiting fungi e.g. *Armillaria*, *Auricularia*, *Pleurotus* and *Polyporus*. In miombo woodland one seldom finds wood-rotting fungi as all the woody material is burned, and people also consider wood-inhabiting fungi as inedible. Species of *Termitomyces* and mycorrhizal fungi make up the major part of the edible mushroom yield in miombo woodlands. Of mycorrhizal fungi, species of *Cantharellus*, *Lactarius* and *Russula* are the most popular. These genera are also found in the mountain forests, but *Lactarius* and *Russula* are considered as inedible there. Species of the genera *Boletus* and *Agaricus*, so highly appreciated in Europe, are only exceptionally used for food in Tanzania.

### Species of *Termitomyces*

The most appreciated mushrooms in the East and West Usambaras and in Pare Mountains are species of *Termitomyces*. *Termitomyces eurrhizus* (figure 5) and *T. letestui* (figure 6) are both big and fleshy fungi with a very pleasant taste. They are so eagerly hunted that unless you go to seek them very early in the morning somebody else has already found them. All the parts of these mushrooms are edible and dug carefully from the soil, so that no piece of the useful pseudorrhiza is left. These mushrooms are considered to be very healthy, and therefore in Pare Mountains they are given to women after childbirth to help them recover. Some of the Tanzanian specimens were analysed in Finland (Härkönen *et al.*, 1995), and the species of *Termitomyces* proved to be rich in proteins when compared, for instance, with the cultivated champignon, *Agaricus bisporus*. In South Pare *T. eurrhizus* is used together with some other ingredients as a skin ointment. Also the tiny *T. microcarpus* is used for food although it is very time-consuming to collect it.

### Wood rotting fungi

Several species of *Auricularia* are used for food in the Usambaras, and have a vernacular name Mangwede. These mushrooms have been used as food in China since antiquity (Chandra, 1989) and they are highly prized also in neighbouring countries e.g. Japan and Philippines, where they are also cultivated and sold dried in markets. Most tribes in Tanzania do not use this species and have no vernacular name for it, but some people call it with a Swahili name Uyoga Hindi, which refers to its common use in Asia.

In the Usambaras several species of *Pleurotus* are also used. *P. djamor* is called Mamama or Mameno in Sambaa and another, bigger species of *Pleurotus* is Fumba da shui. Several species of *Pleurotus* are also used in Asia, North Africa, and Europe. *P. ostreatus* is widely cultivated in all parts of the world on substrates like straw, sawdust and logs, and sold as fresh, dried or canned with the common name oyster mushroom (Chandra, 1989).

Many Sambaa people use *Armillaria mellea* s. lat. for food. Although it is a very common and wide-spread fungus, it is not used in most parts of Tanzania (figure 7). The reason might be that there are so many species of fungi growing in clusters on decaying trees, and some of them, for instance the very common *Hypholoma subviride*, have a very bitter taste.

Also some annual thin bracket fungi are used, even if their consistency is rather tough. For instance, *Polyporus moluccensis* is popular in West Usambaras and called Ngaha. It has to be boiled for a long time and ground into small pieces before use. Some polypores are also used for medicine. For instance in Pare Mountains some species of *Ganoderma* are cut into small pieces and cooked, and the cooking water is used as medicine for cows.

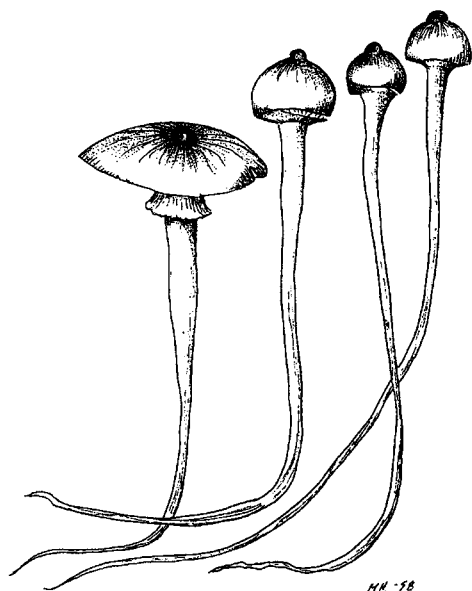


Figure 5. *Termitomyces letestui* is highly appreciated all over the country and always dug up from the soil with the long pseudorhiza (drawing by Marja Härkönen).

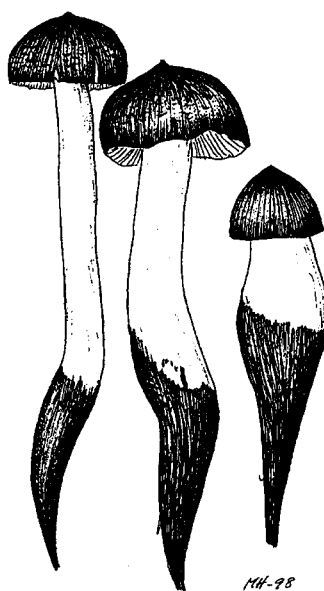


Figure 6. *Termitomyces eurhizus* is common and eagerly hunted in mountain areas (drawing by Marja Härkönen).

### Mushroom food

Although the mushroom species used for food vary in different parts of Tanzania, the mushroom stew is always prepared in the same way. Preparation begins by cooking onions and tomatoes in oil or water. Mushrooms are washed, cut into pieces and added to the pot. Depending on the locality peanuts, sunflower seeds, coconuts or wild or cultivated vegetables are also added. Spices other than salt are very seldom used. The stew is cooked until the vegetables become very soft, and eaten with ugali or cooking-bananas.

In miombo-woodland areas people have a custom to preserve mushrooms for later use by drying them on mats or iron sheets in the sunshine. In mountain areas people usually do not preserve mushrooms at all, or dry only small amounts in smoke above the fire.

### Mushroom poisonings

Mushroom poisonings, even fatal ones, happen at times. They seem to be rarer on mountains than in miombo woodlands, maybe because of the larger diversity of species used in the woodlands, which makes the identification much more difficult and poisonings caused by misidentification more common. African families just pick the traditional edible species taught by their parents and reject all others. They pay no attention to the identification of inedible species even after a case of mushroom poisoning.

There are three types of incidents that commonly lead to mushroom poisoning. One is the case when children are alone at home and prepare the mushrooms they have collected themselves. Usually their mother checks the mushrooms before cooking them. The other danger is during famine, when people often collect mushroom species that they are not able to

identify through tradition. They may pick mushrooms that are eaten by monkeys, or that are infected by maggots, assuming that they are safe. This is a wrong argument. Many maggots have enzymes to decompose the poisonous compounds and so mushrooms that are safe for some animals might be poisonous to humans. A new kind of danger is the introduction of exotic trees in which, apparently by accident, some exotic mycorrhizal fungi have been introduced. We ourselves have seen the well-known poisonous *Amanita muscaria* growing in masses in some pine plantations. It is sometimes confused with edible red *Amanita* species with tragic consequences (Härkönen *et al.*, 1993d).

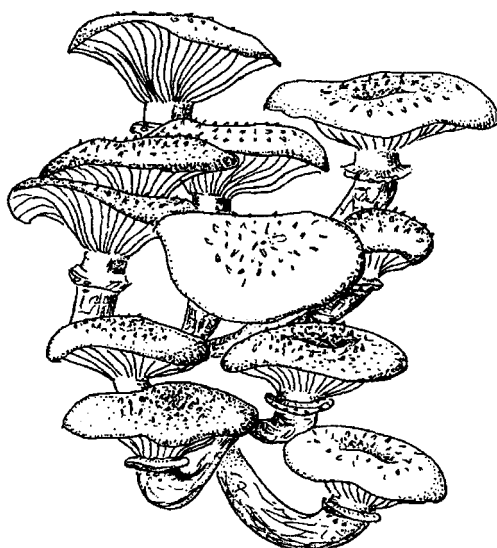


Figure 7. *Armillaria mellea* s. lat., a cosmopolitan wood-rotting fungus, is collected for food in the Usambaras (drawing by Marja Härkönen).

The project has produced the first Tanzanian mushroom guide for forestry schools and universities (Härkönen *et al.*, 1995). It compiles both the international knowledge and the Tanzanian vernacular knowledge on fungi. It also includes some general data about fungi and descriptions of about 30 edible species. There are many more specimens of Tanzanian edible mushrooms collected in connection with this project, but working with them is very slow. The biggest problem is to identify the specimens scientifically, because the descriptions of tropical species exist scattered in small publications from various countries, and the specimens in botanical museums are few and badly preserved. People in Tanzania consume and even sell several species not yet scientifically described.

## DISCUSSION

The importance of non-timber forest products (NTFP) is increasingly recognised due to their economic value as well as high cultural value in developed countries. Living in the birth place of mankind, the people in East Africa have had the longest possible time to study their natural environment and learn to utilise it, which makes the area a rich source of ethnobotanical

information. However, urbanisation and migration in modern Tanzania have cut many of the traditional bonds with nature and knowledge of natural phenomena is no longer handed down from generation to generation as efficiently as in the past. Talking with modern educated people in Tanzania one soon realises that not all people appreciate the vernacular knowledge of the rural people and tend to forget what they have learned in their home villages in their childhood. Instead of undervaluing the rural tradition, Tanzanians should be proud of the vernacular knowledge people have on their environment. There is still much to learn, and collecting the oral tradition in Tanzanian villages and saving it is an urgent task. Above all, Tanzanians themselves should be aware of their rich tradition and be active in collecting the variable knowledge of various ethnic groups living in different habitats. Also the international society should give its support to ethnobotanical research, before the oral tradition is forgotten forever.

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