Eating from the Wild:

Turumbu Indigenous Knowledge on Non-Cultivated Edible Plants, Tshopo District, DRCongo

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ABSTRACT

Documenting and revalorizing the rapidly disappearing indigenous knowledge on wild edible plants is essential to promote health and preserve diversity. Focus group discussions were organized within 3 Turumbu-villages to document wild foods known, availability, preparation methods and uses. Preferences in taste, commercial, nutritional and cultural value, were discussed during participatory ranking exercises. Results show 85 species within 70 genera and 455 4 families. Fruits of *Anonidium manni* and *Landolphia owariensis*, and (unfolded) leaves of *Megaphrynium macrostachyum* and *Talinum triangulare* are most appreciated. Inventories and preference rankings should be completed with nutritional analyses and market studies to set priorities for participatory domestication.

KEYWORDS Domestication, Ethnobotany, Wild Edible Plants, Under-Utilized Crops

INTRODUCTION

Biodiversity conservation is of utmost importance for agriculture and world food supply. However, existing biodiversity is still under-utilized to expand food production. About 30,000 of the more than 250,000 currently described plant species are edible, whereas about 7,000 have been cultivated or collected by humans for food at one time or another (FAO, 1997). Several thousands of species may thus be considered to contribute to food security, but the value of many species is under-estimated. Data on national food energy supplies aggregated at global level show that only about 30 species provide 95% of the dietary energy or protein needs of the world (FAO, 1997). Considering national levels, about 103 (Prescott-Allen and~~&~~ Prescott-Allen, 1990) to 120 (FAO, 1997) plant species are found to 'feed the world.'

Until now, Africa has been the source of only a few food crops with 'universal' importance (sorghum, oil palm and upland rice), besides some crops with local or regional importance such as yam, cowpea, African eggplants or date palm. There exist, however, a number of other useful species that are only known and used by local communities (Van Damme & Termote, 2008).

Knowledge on wild edible plants (WEPs) in Africa has been developed during centuries of trial and error, and transmitted over generations (Malaisse and~~&~~ Parent, 1985). In many areas, WEPs play a major role in supplementing staples with micronutrients (Grivetti and~~&~~ Ogle, 2000; Herzog et al., 1994; Maundu, 1996) or constitute a 'safety net' during periods of food shortage (Keller et al., 2006, Malaisse and~~&~~ Parent, 1985; Shackleton and~~&~~ Shackleton, 2004; Van Damme, 1998). However, social change and acculturation processes prevailed in Africa for some time now. Knowledge on WEPs is declining and even disappearing with increasing contact with modernization and western lifestyles (Keller et al., 2006; Lykke et al., 2002; Maundu, 1997; Ogoye-Ndegwa and~~&~~ Aagaard-Hansen, 2003).

Traditional leafy vegetables are often associated with poor rural lifestyle and low status. This leads to a general decline in their use when people can afford other foods (Chweya and& Eyzaguirre 1999; Clark et al., 2004; Lykke et al. 2002). Formerly well-balanced diets are disturbed when traditional products are replaced by imported or newly introduced species, whereby deficiencies in nutrients may develop (Herzog et al., 1994; Lykke et al., 2002; Weinberger and& Swai, 2006).

In addition, replacing traditional foods by 'modern feeding habits' also results in the loss of genetic diversity in traditional food species and a decline in cultural diversity (Maundu, 1996). Documenting and revalorizing the indigenous knowledge on WEPs is thus urgently needed to maintain and promote nutritional health and to preserve genetic and cultural diversity (Terashima and& Ichakawa, 2003). Moreover, some WEPs may offer good opportunities for commercialization and niche market development, and thus income generation, if properly exploited (Weinberger and& Swai, 2006).

Until now, only a few fragmented studies concerning WEPs were conducted in Kisangani and surroundings (Bokdam and& Droogers, 1975; Bola and& Szafranski, 1991; Liengola, 2001; Mosango and& Isosi, 1998; Mosango and& Szafranski, 1985; Nyakabwa et al., 1990; Kawukpa &and Angoyo, 1994). To (re)valorise traditional knowledge on local WEPs, University of Ghent, in collaboration with University of Kisangani, carried out a WEP-project in the District Tshopo (2004 – 2010). The project objectives are to (1) inventory all WEPs known and used in the District; (2) analyse their nutritional value; and (3) study their socio-economic and cultural importance, with the overall aim to select 5 to 10 priority species for participatory domestication and development. The research is executed in a participatory way to take into account local people's opinions in the choice of species for domestication in addition to nutritional and commercial characteristics of the species.

The objectives of this initial study were to 1) inventory WEPs known and used by the Turumbu, one of the major ethnic groups in the district; and 2) document local preferences in taste and economic, nutritional and socio-cultural values of the WEPs.

Scientific and vernacular names, plant parts used, modes of preparation, specific uses, seasonality patterns in collection and use, and commercialisation possibilities of the WEPs are presented here, together with the results of participatory ranking exercises.

STUDY AREA AND POPULATION

Tshopo District and '*Collectivité* Turumbu'

Tshopo District, situated in the Oriental Province of the DRCongo, includes 7 territories. The Isangi territory comprises 13 '*Collectivités*,' operational units at the basis of the hierarchical administration system. The Turumbu live in the '*Collectivité* Turumbu,' limited in the north by the Banalia Territory and Aruwimi river, in the east by the Lindi river, in the south by the Congo river and in the west by the Basoko Territory (fig. 1).

Data on surface area or population numbers of the '*Collectivité*' are contradictory: 4600 km² with 40,421 inhabitants on the 1st of July 2004 according to the National Institute of Statistics (Ministère du Plan, 2005) or 3674 km² with 61,905 inhabitants in 2007 according to the Isangi Territory Report (2008).

The hot and humid climate is classified as Af in Köppen's typology. Annual rainfall in Yangambi amounts to 1828 mm (PNUD/UNOPS, 1998) and is well-distributed over the whole year (Libendele, 1976). The mean temperature of 23.5°C shows very small annual variations (PNUD/UNOPS, 1998).

Tshopo District is situated in the Guineo-Congolian regional center of endemism with mixed moist semi-evergreen forests (White, 1983). The Yangambi biosphere reserve, covering more than half of the 'Collectivité Turumbu,' is dominated by secondary forests with

Pycnanthus angolensis (Welw.) Warb. and *Fagara macrophylla* Engl., mixed semi-deciduous secondary rain forests, primary rain forests with *Gilbertiodendron dewevrei* (De Wild.) J.Léonard, climax forests with *Brachystegia laurentii* (De Wild.) Louis ex Hoyle and marshland forests (UNESCO, 2008).

The Turumbu

The Turumbu and their culture have hardly been studied. Their principal activity is agriculture complemented by hunting, fishing, gathering and cattle-raising. The Turumbu are also specialized in handicrafts such as vans, baskets, mortars and canoes. Traditionally, huts are constructed using clay and leaves. Only 8% of houses are constructed in durable materials (bricks and corrugated iron) (Kienia'h Bikitwa, 1999).

Since the colonial period, the Turumbu practice a mixed cropping system comprising rice, maize, cassava and plantains (Ntamulyango, 1975).

Their main meal consists of cassava and/or plantains: boiled cassava tubers, '*chikwangue'* (cassava paste), '*fufu*' (paste made of cassava flour), '*lituma'* (pounded plantains and/or cassava) or '*makemba*' (boiled plantain) (Tshibaka-Mukendi, 1975; own observations), combined with leafy vegetables such as cassava leafs ('*pondu*'), amaranth ('*muchicha'*), spinach ('*ndunda*') or sweet potato leaves ('*matembele*'). According to the season, this is supplemented with products from hunting, fishing and gathering (plants, mushrooms, caterpillars, ants, honey, etc.). The main fat source is palmoil. Generally, only one meal per day is taken in the afternoon or evening. In the morning, leftovers from the previous day can be warmed up (Tshibaka-Mukendi, 1975).

A survey conducted in 1995-1996 (before the 1996 - 2003 civil strife) showed that, over the whole Oriental Province, the mean energy content of the diet was 1758.24 kcal/inhabitant/day, far below the 2300 kcal recommended by FAO (PNUD/UNOPS, 1998). The diet, mainly composed of carbohydrate-rich foods (67.91%), shows a deficiency in

proteins (5.65%). Lipid-rich foods cover the remaining 26.44% of the diet (PNUD/UNOPS, 1998).

MATERIAL AND METHODS

Heywood (1999) defines non-cultivated plants as: '*plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human action*'. In accordance with him, we consider as 'wild' all plants that are gathered (not cultivated), even if some of them grow on cultivated rather than on uncultivated or forest land.

Data collection

All research protocols have been approved and executed in collaboration with University of Kisangani.

Given the lack of reliable information on number and exact location of the Turumbu villages, we opted for a non-probabilistic reasoned sample of 3 research villages (De Pelsmacker and~~&~~ Van Kenhove, 2006), with sampling directed by:

1) accessibility (villages in the region are mostly situated along the main road);

2) consisting of 1 tribe (no co-habitation of different tribes because this might influence knowledge and use of WEPs);

3) at least 30 households living in the village;

4) full consent and collaboration of the village chief (and participants) after clear presentation of research objectives and protocols.

Ethnobotanical research was carried out in Yaoseko (August 2007, 00°35'03"N, 024°56'14"E, 34 km east of Kisangani, group 'Yawenda', 184 households), Yasekwe (September 2007, 00°37'16"N, 024°37'16"E, 61 km east of Kisangani, group 'Yawenda', 115

households) and Yalungu (July 2006 and& September 2007, 0°46'22"N, 024°32'59"E, 92 km east of Kisangani, group 'Yelongo', 120 households), (figure 1).

An exploratory qualitative approach was used to document all WEPs known at village level and to gain insight in their uses, preparation methods, seasonality patterns and commercialization. According to Rennie and Singh (1996) focus group discussions are claimed to generate results of less apparent precision, but greater evidential value, than more common quantitative survey techniques. The decision to opt for participatory focus group discussions stems from the fact that in an initial phase, with almost no basic ethnobotanical data available, we were interested in an inventory of all WEPs known and used per village/ethnic group, rather than in more in depth individual informants' knowledge.

Focus groups were organized in each village over 5 to 7 days (according to number of WEPs known and in function of the participant's other activities). Each focus group was composed of key informants knowledgeable in plant uses, chosen in collaboration with the village headman (Cotton, 1996) and other, interested villagers. Following Alexiades (1996), the latter were encouraged to participate, because group discussions also serve as social occasions to facilitate transmission of cultural knowledge across generations. The focus group in Yaoseko counted 6 men and 1 women; these totaled 6/2 and 8/2 in Yasekwe and Yalungu, respectively.

During the first session in each village, we asked participants to enumerate all 'wild' plants they know and use as food ('free listing', Cotton, 1996). Plant names were recorded in their native language '*Turumbu*' and a per village a list of WEPs was compiled. In each village, all species mentioned on the list were collected during field trips with the key informants ('Walks in the Wood', sensu Alexiades, 1996) to constitute a reference herbarium collection.

During subsequent focus group sessions, participants discussed uses, preparation methods, seasonality patterns, commercialization and possible inconveniences for each species on the

list of WEPs of their village. Discussions were guided by a 'topic list' prepared in advance by the researchers (Cotton, 1996) and answers were recorded upon group consensus.

Finally, in each village, two new groups were formed (men and women apart) for participatory ranking exercises. The men's groups were composed of 5, 4 and 7 participants, the women's groups of 7, 4 and 9 participants for Yaoseko, Yasekwe and Yalungu, respectively. At first, each group had to weigh four characteristics of WEPs: taste, economic value, socio-cultural value and nutritional value; to obtain their relative importance. Weighing was done by distributing 50 palm kernels over the four characteristics, in such a way that the more important a characteristic was according to the group members, the more kernels it was given. Thereafter, researchers asked the group to cite the 10 most important wild fruits. These fruits were subsequently ranked once for each characteristic (adapted from Cotton's (1996) 'direct matrix ranking'). Ranking was done by distributing 50 palm kernels over the 10 fruits. In this way, for example,- fruits with a better taste received more kernels than less tastier fruits. This procedure allowed illiterate villagers to take part in the exercise, which was also repeated with 10 wild vegetables.

Data analysis

Species used as WEP

Herbarium specimens were identified with the aid of the 'Flore d'Afrique Centrale (Congo-Kinshasa, Rwanda and& Burundi)' (Bamps, 2000 -) and deposited at the National Botanic Garden of Belgium, Meise (acronym BR). Species names were verified on the IPNI (International Plant Names Index) –website and allocated to botanical families according to the APGII-system.

In what follows, when we refer to vernacular Turumbu names of WEPs, the term '*folkspecies*' will be used. When referred to a scientific name, we will use the term '*species*'. According

to Holman (2002), a one-to-one correspondence (1 folkspecies = 1 scientific species) may not always be assumed:

1) Bokdam and~~&~~ Droogers (1975) found, in the region of Kisangani, that some plants have different vernacular names for different plant parts used (e.g., the fruit may have another name than the whole tree or liana **(overdifferentiation))**;

2) one vernacular name (or folkspecies) may include several scientific species, usually species which are morphologically very similar **(underdifferentiation)**.

Non-food uses of the WEPs

The number of WEPs having uses in categories other than food was counted. The different use categories were adapted from Cook (1996) to meet field realities of the research area. Secondly, the total number of use citations (one use cited in one village = one use citation), food uses included, were calculated for each plant species (with: total number of use citations = number of use citations in Yalungu + number of use citations in Yasekwe + number of use citations in Yaoseko).

Because non-food uses were not the primary scope of the study, these should be considered as tentative. Only when a WEP figured on the list of WEPs in the respective villages, we asked about other, non-food uses of the species.

Participatory rankings

The number of kernels a WEP received for a given characteristic was multiplied by the relative importance of the characteristic (i.e., the number of kernels the characteristic obtained during weighing). These results, obtained per WEP for each of the four characteristics, were summed to find the global weighted ranking result of each folkspecies (adapted from Cotton's (1996) 'direct matrix ranking').

To obtain an aggregated result for the 6 (= 3 villages x 2 groups (men and women)) fruit ranking exercises, the number of times a species appeared in the top three for a given characteristic was counted as well as the number of times a species appeared in the top three of the global weighted ranking. The same procedure was followed for the 6 vegetable rankings.

RESULTS

Species used

Table 1 presents the plant species known and used as food in the Turumbu villages studied. 81 folkspecies were identified as 85 scientific species, distributed over 70 genera and 44~~5~~ families. Some folkspecies refer to several scientific species. ~~e.g. t~~The Malvaceae family, for example, comprises 5 *Cola*-species, but locally these occur as 2 folkspecies~~.~~ (*'Losakanu'* is the Turumbu name for *Cola bruneelii*, *C. congolana*, *C. marsupium* and *C. urceolata;* '*angbongbolia'* for *C. acuminata*). The Apocynaceae family contains most WEPs (7 (folk)-species), followed by Malvaceae (6 species, 3 folkspecies), Dioscoreaceae (5 (folk)species) and Araceae, Euphorbiaceae and Fabaceae (each with 4 (folk)species) (table 1).

The number of plants used in all 3 villages, in paired villages and in each simple village is shown in figure 2. Of all plants inventoried, 53% are used in the 3 villages. Similarities between paired villages vary from 56% to 73%.

Plant parts used (table 2)

Most WEPs are used for their fruits (38), followed by leaves (23), seeds (10) and tubers (8). Some WEPs have several plant parts used for food, e.g. fruits of *Cola bruneelii* are eaten raw, whereas leaves are prepared as leafy vegetables.

Specific food uses

The 96 plant parts mentioned can be employed raw or prepared as 106 different specific food uses (table 3), with fruit uses being most important, followed by leafy vegetable uses.

Preparation methods

Leafy vegetables are prepared in 3 different ways. The traditional method consists of wrapping them in leaves of species from the Marantaceae family and to put this package above boiling cassava in the cooking-pot until ready (steaming). Another, similar method is to wrap the vegetables in Marantaceous leaves and put the package close to the fire until done. According to one's own specific taste, salt or chili pepper can be added before consumption. However, the most frequent practice consists of chopping and boiling the vegetables, discarding (or not) the boiling water, adding palm oil, fish or meat, salt, chili pepper or other condiments and let the whole cook.

Seeds of *Antrocaryon nannanii*, *Treculia africana* and *Panda oleosa* are eaten as a snack (nut) or pounded into a paste to season dishes. Seeds of *A. nannanii* are consumed raw; those of *P. oleosa* can be eaten raw or roasted, but need to be roasted before processing them into a paste. Seeds of *T. africana* are always roasted. The hard shell is removed prior to consumption or preparation into a condiment paste.

Seeds of *Tetracarpidium conophorum* (conophor nut) are boiled (rarely roasted) to reduce bitterness. When water is drunk within one hour after consumption, one experiences a very bitter sensation in the mouth.~~the mouth tastes very bitter.~~ Some people claim that the raw nuts are poisonous.

Fruits of *Dacryodes osika* and *Canarium schweinfurthii* are dropped in hot, non-boiling water for ten minutes, in a similar way as their cultivated counterpart 'safou,' *Dacryodes edulis.*

Young leaves, bark or fruits of *Scorodophleus zenkeri* and *Hua gaboni* are used as a substitute for onion and/or garlic. Both species, called 'tropical garlic trees', are highly appreciated by the Turumbu. Leaves of *S. zenkeri* are also prepared as a leafy vegetable.

Roots of *Carpolobia alba* are chewed either raw or roasted ~~to restore physical force~~as of strengthener, for example, during intensive labour.

Seeds of *Gilbertiodendron dewevrei* are used as a hunger food. Seeds are boiled, peeled and grated into a flour to prepare a paste wrapped in Marantaceous leaves like '*chikwangue*' (made of cassava). According the information gathered, their last use dates back to the Simba rebellion in 1964. With the 1960 war of independence and the following civil wars in Congo, people fled and subsisted on whatever they found in the forest without depending on cultivated plants.

Dioscorea tubers are a good source of dietary starch, but care should be taken before consuming them. Some *Dioscorea* spp. are extremely poisonous and species are morphologically very similar. Informants warned that tuber ~~-~~toxicity sometimes depends on the development stage. In Yalungu, for instance, ~~,-~~informants mentioned ~~-~~the following for 'elenge' (*D. dumetorum*): '*When leaves start to dry, the tuber is edible; when leaves are totally dry and start to fall, the tuber is a poison and you will die*'.

Seasonality

Most fruits are available from July till October. Tubers and (leavy) vegetables are available the whole year round (table 1).

Trade

Although sometimes rather occasionally, almost half of the WEPs known by the Turumbu (47%) can be sold internally within the village or to passing travellers (table 1). During a

preliminary market survey, 14 of these species were recorded on the markets of Kisangani (Everaert, 2008).

Non-food uses of WEPs

Besides being used as food, 64 of the 85 WEPs have one or more other uses: 44 plants have medicinal values; 22 species have uses in the category technology, materials and arts; 19 species have cultural values; 9 species are used as fuels, 8 species for house construction, 5 species as bait, 4 species as fodder, and 3 species are used as poison (table 4).

The total number of use citations per plant species (food uses included) is~~are~~ shown in the ~~last~~penultimate column of table 1. *Gilbertiodendron dewevrei* and *Pentadiplandra brazzeana* show the highest number of use citations (15), followed by *Anonidium mannii*, *Clitandra cymulosa*, *Landolphia owariensis*, *Costus lucanosianus*, *Megaphrynium macrostachyum* and *Piper guineense*, each with 12 use citations.

Participatory Ranking

The aggregated results of the ranking exercises are shown in tables 5 and 6. Only species which appeared more than once in the top three for at least one characteristic are included in the tables.

In the fruit category, *Anonidium manni* scores best on each characteristic and ranks first in the weighed global ranking. *Landolphia owariensis* ranks second in the weighed global ranking and scores best (together with *A. mannii*) on taste and economic value. In the vegetables category, *Talinum triangulare* scores best on characteristics taste and nutritional value, *Megaphrynium macrostachyum* on economic and nutritional value, and *Hua gaboni* on socio-cultural value. In the global weighed ranking, *M. macrostachyum* preceeds *T. triangulare*.

Surprisingly, the ~~different~~ ranking exercises with men and women in the same village do not show great differences. Differences seem much higher between villages, although this could not be tested statistically.

Besides their food uses, 'preferred' species have also many other values and can thus be seen as 'multi-purpose' species (table 4).

DISCUSSION

Turumbu WEP knowledge

Compared to the inventory results of Bokdam and Droogers (1975), Bola and Szafranski (1991), Liengola (2001), Mosango and Isosi (1998), Mosango and Szafranski (1985), Nyakabwa et al. (1990) and Kawukpa and Angoyo (1994), 18 species were cited for the first time as WEP in the region: *Celosia leptostachya, Dictyophleba lucida, Landolphia villosa, Raphia sese, Crassocephalum crepidioides, Dioscorea alata, Dioscorea liebrechtsiana, Alchornea cordifolia, Desmodium setigerum, Cola congolana, Penianthus longifolius, Musanga cecropioides, Zanthoxylum macrophyllum, Pancovia laurentii, Bacopa* sp., *Smilax anceps, Vitex congolensis* and *Cissus dinklagei*.

The single author (Liengola, 2001) who did ethnobotanical research within the '*Collectivité* Turumbu', interviewed 31 individual informants and registered 58 WEPs. The present study confirmed the food use of 37 of these species (table 2), whereas 14 species[1] were not found in our study. For 7 species[2], identical vernacular names correspond to different scientific species names in our study. Whether this is due to identification differences or underdifferentiation of the local plant classification system, cannot be checked because herbarium references are lacking in Liengola (2001).

With respect to indigenous knowledge on plant uses, the Turumbu agriculturalists are quite interesting. They know far more WEPs (85) than the Ngandu (69) and Boyela (50) agriculturalists (both Bantous of the Equator Province, DRCongo; Takeda, 1990; Takeda and~~&~~ Sato, 1993), and slightly less than the Mbuti (84) or Efe (92) hunter-gatherers (both Pygmies of the Ituri forest, DRCongo; Terashima ~~&~~and Ichakawa, 2003). This is surprising, because Pygmies have been the first inhabitants of the Congo basin forest. Based on their closer relationship and longer experience with the forest, one would expect them to know and use a lot more WEPs than the Turumbu, Bantous, who immigrated into the area, only some hundreds of years ago and generally rely more on agriculture for their livelihood. Adding the 14 species Liengola (2001) found to our own 85 WEPs, the Turumbu even seem to know more WEPs than the Mbuti and Efe Pygmies. In addition, the Turumbu exhibit a more uniform pattern of plant use for food than the Pygmies. Terashima and Ichakawa (2003) in their comparative study of 2 Mbuti and 2 Efe communities found similarity values that were always lower than 52%. Similarity values in our study vary from 56% to 73% (figure 2).

Continuum cultivated - non-cultivated plant species

Focus group discussions revealed some people still gathering *Dioscorea* tubers in the forest, whilst others have over time domesticated them. In accordance with Leonti et al. (2006), we discovered that distinguishing between cultivated and non-cultivated species is not easy since there exists a continuous spectrum between totally wild and fully domesticated species.

As we are interested in wild foods from the local populations' point of view, we opted to include *Colocasia esculenta* and *Xanthosoma sagittifolia* in our list of wild food plants. Originally introduced as food crops from Asia and tropical America, they became naturalized and omnipresent in wild stands (Safo Kantanka, 2004). Similarly, the fruits of *Capsicum frutescens* and *Solanum aethiopicum* are collected both from wild and cultivated stands.

Including these species in the list is justified since this does not contest the above defined concept of 'wild'.

Continuum foods - medicines

The difficulty that the Turumbu sometimes have in distinguishing between food and medicinal plants is not surprising. People who traditionally gather wild plants know about additional properties, beneficial for health. For example, *Piper guineense* fruits are used to season dishes, whereas a decoction from the leaves and/or lianescent stem is consumed with sugar as tea substitute. The same decoction is used to treat general pain, lumbago, cold or cough. Similarly, the decoction of dried *Alchornea cordifolia* leaves is consumed as a tea substitute and/or as treatment for anaemia. Leonti et al. (2006) already stated that medicine can be food and food can be medicine. It has been documented that different plant parts of the same plant can be used for different purposes, but also that people eat certain foods 'to stay in good health' (dualism of foods as medicines) (Flyman and~~&~~ Afolayan, 2006). Wild-gathered vegetables and fruits may, therefore, not only be good supplements to the mainly starchy diets (providing additional proteins, vitamins and minerals), but can also compensate for the lack of pharmacologically active substances, which cultivated species may have lost during domestication (Leonti et al., 2006).

Nutritional potential

Not all WEPs mentioned to us are consumed on a regular basis (Lykke et al., 2002). Food consumption surveys should therefore indicate which WEPs contribute most to the daily requirements in energy, proteins, lipids, vitamins and minerals. Takeda (1990) observed that only 47.8 % of WEPs known by the Ngandu were regularly consumed. Similarly, the Mbuti use ~~ca. 100~~ 84 WEPs, but 80% of their consumption came from just 8 species (Ichikawa, 1993). In some regions, children consume a lot more WEPs than adults (Redzic, 2006).

Numerous authors stress the high nutritional values of wild foods (e.g. Burlingame, 2000; Ogoye-Ndegwa and& Aagaard-Hansen, 2003; Keller et al., 2006). For our study area, we may cite the case of the overexploited wild vegetable *Gnetum africanum*, which is very rich in proteins and minerals (Na, K, Ca, Mg, Fe) and contains all essential amino acids (Okafor, 1995). Herzog et al. (1994) argue that it is not only the high nutrient content, but mainly the fact that wild fruits provide rare nutrients and are an important source of variation and complementation, that make them so important in the African diets. However, wild foods are more and more 'forgotten' and disappear due to social change, urbanization and westernization of African cultures. As a consequence, diets will become more monotonous and deficiencies in nutrients that are now available in adequate amounts may develop (Herzog et al. 1994).

In our own research area, we found -a- lack of information concerning the nutritional values of wild species. With regard to the four locally 'most preferred' species, we found only some reliable, but outdated nutritional information was available for waterleaf (*Talinum triangulare*) in Leung et al. (1968). Matsumoto-Oda and Hayashi (1999) report values on macro-elements in a fruit pulp and seeds mix of *Landolphia owariensis*, but the Turumbu do not eat seeds, only the pulp of the *Landolphia* fruits. Although much-consumed and very appreciated, no nutritional data are available for *Anondium mannii* nor *Megaphrynium macrostachyum*. On the one hand, providing reliable information about nutritional values of wild plants should help (re)valorize the WEPs and preserve them from being forgotten. On the other hand, less 'healthy' wild foods will be detected. *Pteridium aquilinum*, for example, which is also consumed by the Turumbu, contains a number of poisonous and antinutritional compounds such as sesquiterpenoids, ecdysone, cyanogenic glycosides, tannins and phenolic acids (van der Burg, 2004). Nutritional analyses of 'promising' species are thus essential before implementing wider programs to promote WEP consumption.

Commercial potential

The fruits of *Landolphia owariensis*, the bark and fruits of *Anonidium mannii* and the leaves of *Megaphrynium macrostachyum* (wrapping material) can be found in Central African markets (Hoare, 2007; Everaert, 2008). Leaves of Marantaceae species traded during 12 months in the Mbandaka market (Equatorial Province, DRCongo) yielded a total value of USD $3,446 (Ndoyo and& Awono, 2005). The four locally 'most-appreciated' species, thus show a certain potential for income generation. Obviously, more research is needed to assess their actual performance and future opportunities in local and regional markets.

Market surveys and value chain analyses should be used to evaluate commercial potential of WEPs (Leakey, 1999). Farmers who are informed about nutritional characteristics, market demand and consumer preferences can make a better informed choice of which wild foods to gather or domesticate/cultivate. In addition, they are able to set their own price for these niche products instead of 'taking' international market prices as for coffee or cocoa. The latter prices , which are far often too low if one cannot rely on the economies of scalescale advantages (Van Damme and& Termote, 2008). Given the growing interest in new foods, essential oils, pharmaceutical products, etc. in western cultures, some species may also have potential to enter in international markets in the long-term (e.g. the (essential) oils of *Canarium schweinfurthii*).

Evaluating the nutritional value, the economic potential, cultural preferences and if necessary the pressure on natural resources as a consequence of overexploitation of wild stands of the WEPs will allow for priority setting and thus choosing the right species for participatory domestication and development. There is more and more evidence that participatory domestication of high potential WEPs is a viable strategy to 1) ameliorate nutrition security; 2) increase and diversify farmers' income; and 3) protect the natural environment from

overexploitation, thus conserving biodiversity (Leakey, 1999; Leakey et al., 2003; Tchoundjeu et al., 2006). To provide the incentives to actively plant and manage trees, markets have to be developed and expanded. Clearly, increased dialogue and collaboration between ethnobotanists, agroforestry researchers, food scientists, socio-economists and marketing specialists is necessary to ensure that WEPs can be valorised and (re)adopted.

CONCLUSION

This study contributes to the understanding of knowledge and use of WEPs by the Turumbu of the Isangi Territory, DRCongo. Focus group discussions in 3 Turumbu villages resulted in a comprehensive list of 85 WEPs and their different uses. Participatory ranking exercises, mapping preferences in taste, economic, nutritional and cultural values, revealed that the fruits of *Anonidium manni* and *Landolphia owariensis*, the unfolded leaves of *Megaphrynium macrostachyum* and leaves of *Talinum triangulare* are most appreciated by the Turumbu.

Although we used a qualitative approach, we were able to document 27 WEPs more than Liengola (2001), who used a quantitative approach by interviewing 31 individual informants within the Turumbu community. This confirms the hypothesis that qualitative techniques are especially valuable in regions where basic ethnobotanical data are hardly available and when one is interested in a global overview of plants used for certain finalities, rather than in the mean knowledge of individual informants. Results of qualitative investigations can then further be used in developing tools for quantitative research. However, the fact that Liengola (2001) documented 14 species we could not confirm in our study indicates that even our list is not yet exhaustive: multiplying research sites could add new information.

Besides continued documentation of WEPs and mapping of cultural preferences, there is a huge need for further research on nutritional values of WEPs, dietary patterns and the role of wild foods herein as well as market studies to assess the economic potential and future

opportunities of these wild foods. –More attention should also be given to studies on the impact of gathering wild plants on the natural environment in the region, to provide sustainable harvest and use options. All these elements will help to set priorities for participatory domestication and further development of the most 'promising' species.

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[1] *Dialium polyanthum* Harms, *Lagenaria siceraria* (Molina) Standl., *Buchnerodendron speciosum* Gürke, *Mostuea hirsuta* (T.Anderson ex Benth. & Hook.f.) Baill. ex Baker, *Thaumatococcus daniellii* (Benn.) Benth. & Hook.f., *Psidium guineense* Sw., *Blighia welwitschii* (Hiern) Radlk., *Synsepalum bequaertii* De Wild., *Aframomum angustifolium* (Sonn.) K.Schum., *Garcinia kola* Heckel, *Homalium africanum* (Hook.f.) Benth., *Pentaclethra macrophylla* Benth., *Heisteria parvifolia* Sm., *Aframomum melegueta* K.Schum.

[2] *Crassocephalum sarcobasis* (DC.) S.Moore, *Pancovia harmsiana* Gilg, *Cola selengana* R.Germ., *Urera trinervis* (Hochst.) Friis & Immelman, *Amaranthus viridis* L., *Ancylobotrys amoena* Hua and *Landolphia jumellei* (Pierre ex Jum.) Pichon

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TABLES AND FIGURES

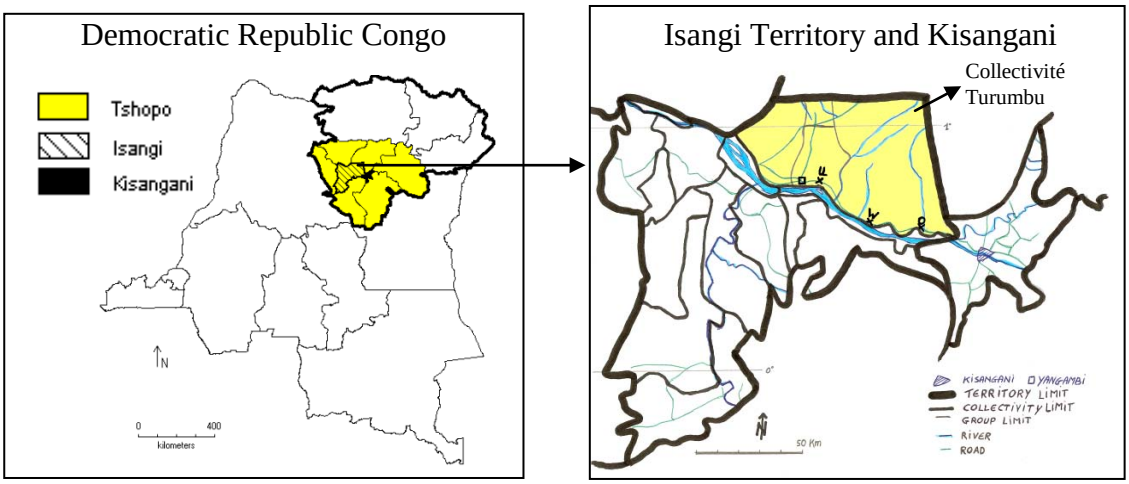

Figure 1: Geographical position of the study area. Left: Tshopo District is one of the four Districts of the Oriental Province and counts 7 territories (Bafwasende, Banalia, Basoko, Isangi, Opala, Ubundu and Yahuma). Right: the 'Collectivité' Turumbu is one of the 13 'Collectivités' of the Isangi Territory. The study villages Yalungu (U), Yasekwe (W) and Yaoseko (O) are indicated on the map.

Source: left: DIVA-GIS (DRCongo); right: ~~and~~ adapted from d~~D~~e Saint Moulin and~~&~~ Kalombo ~~Tshibanda,~~ (2005 ~~(Isangi~~).

Table 1: Wild Edible Plants known and used by the Turumbu, Isangi Territory, DRCongo

Botanical family	Scientific name	Vernacular name[1]	Herbarium reference (PAS)[2]	Plant part(s) used as food[3]	raw or cooked[3]	Specific use[3]	Availability	Trade[4]	Total number of uses citations [5]	Liengola, 2001
Achariaceae	*Caloncoba subtomentosa* Gilg	lisende (o)	196	fruit pulp	raw	fruit	NSP 2x/an°		*3*	X
Amaranthaceae	*Amaranthus dubius* Mart. ex Thell.	ngbelengbele (o) lonenge (w,o)	249, 302	leaves	cooked	leafy vegetable	permanent		6	
	Celosia trigyna L.	iphowuphowu (w,o)	218	leaves	cooked	leafy vegetable	permanent	x	2	X
	Celosia leptostachya Benth.	iphowuphowu (w,o)	1006	leaves	cooked	leafy vegetable	permanent	x	2	
Anacardiaceae	*Antrocaryon nannanii* De Wild.	bokongo, kongo (u,w,o)	993	seeds	raw	- nut - condiment	July - Oct.		(4)	X
Annonaceae	*Anonidium mannii* (Oliv.) Engl. & Diels	anguto (u,w,o)	198, 270, 316	fruit pulp	raw	fruit	July – Oct.	xxx	(12)	X
Apocynaceae	*Clitandra cymulosa* Benth.	inono (u,w,o)	263, 337	fruit pulp	raw	fruit	July – Oct.	xxx	(12)	
	Dictyophleba lucida (K.Schum.) Pierre	iyoyoliki (u) liyoliyoliki (w) iyayawoliki (o)	122, 235, 997	fruit pulp	raw	fruit	July – Oct.	x	(3)	
	Landolphia foretiana (Pierre ex Jum.) Pichon	lingbotoma (o)	197	fruit pulp	raw	fruit	July – Oct.		*3*	
	Landolphia owariensis P.Beauv.	lilolo (u) liyo (w,o)	336, 984 228, 272	fruit pulp	raw	fruit	July – Oct.	xxx	(12)	X
	Landolphia villosa J.G.M.Pers.	libii (u) lilombo (w) Inono (w)	293, 1001	fruit pulp	raw	fruit	July – Oct.	xx	5	
	Landolphia sp1	ngilaseka (u,w)	327	fruit pulp	raw	fruit	July – Oct.	x	5	
	Saba comorensis (Bojer ex A.DC.) Pichon	lilombo (u,o) libii (w)	240 303	fruit pulp	raw	fruit	July – Oct.	xx	(5)	
Araceae	*Anchomanes giganteus* Engl.	likondoyaolimo (o)	222	young sprouts	cooked	vegetable	permanent		*1*	
	Colocasia esculenta (L.) Schott	maniango (o)		tubers	cooked	starch	permanent	x	*1*	
	Xanthosoma sagittifolium (L.) Schott	yopho (o)		- tubers - leaves	cooked cooked	starch leafy vegetable	permanent	x	*2*	

Arecaceae	*Laccosperma secundiflorum* (P.Beauv.) Kuntze	(boloke bo) Likawu (u,o)	229, 319	leaf button	cooked	vegetable	permanent		8	X
	Raphia sese De Wild.	ikolo, fande (u)	312	- fruit pulp - tree sap	cooked raw	fruit beverage (palm wine)	permanent		*6*	
Asteraceae	*Crassocephalum crepidioides* (Benth.) S.Moore	limbiti (u,w,o)	20, 332	leaves	cooked	leafy vegetable	permanent	x	(4)	
Burseraceae	*Canarium schweinfurthii* Engl.	bobele, ibele (u,w,o)	232	fruit pulp & skin	cooked	fruit	July – Oct.	xx	(9)	X
	Dacryodes osika (Guillaumin) H.J.Lam.	ibele sawu, isawusawu (u,w,o)	239	fruit pulp & skin	- cooked - roasted	fruit fruit	July – Oct.	xx	(5)	
Clusiaceae	*Mammea africana* Sabine	boliti (o)	244	fruit pulp	raw	fruit	July – Oct.		*2*	X
Costaceae	*Costus lucanusianus* J.Braun & K.Schum.	bokako (bobaye) (u,w,o)	13, 224, 266, 309	- stem - flower	raw raw	fruit fruit	permanent July – Oct.		(12)	X
Dennsteadtiaceae (pteridophyta)	*Pteridium aquilinum* (L.) Kuhn	lilele (o)	205	immature fronds	cooked	condiment	permanent		*4*	
Dichapetalaceae	*Dichapetalum mombuttense* Engl.	ekpalanganga (u,o) lisungulingba/lisunguliteti (w,o)	11, 17, 311 211, 267	fruit pulp	raw	fruit	permanent		(5)	X
Dioscoreaceae	*Dioscorea alata* L.	l~~L~~engu (o) i~~I~~lumbelumbe (w)	243	tubers	cooked	starch	permanent	xx	2	
	Dioscorea baya De Wild.	i~~I~~kuse (u,w,o)	989, 1000	tubers	cooked	starch	permanent	xx	(3)	
	Dioscorea dumetorum (Kunth) Pax	e~~E~~lenge (u) y~~Y~~ayii (w,o)	119 290	tubers	cooked	starch	permanent	xxx	(3)	
	Dioscorea liebrechtsiana De Wild. & T.Durand	b~~B~~osondi (u,w,o)	330, 996, 1004	tubers	cooked	starch	permanent	xxx	(3)	
	Dioscorea minutiflora Engl.	i~~I~~keke (u,w,o)	18, 121, 216, 277, 310, 987, 999	tubers	cooked	starch	permanent	xx	(3)	
Euphorbiaceae	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.	liondje (u,w,o)	16, 23, 213, 297	dry leaves	cooked	decoction (tea subst.)	permanent		(9)	
	Erythrococca atrovirens (Pax) Prain var. *flaccida* (Pax)	likile (w,o)	241	leaves	cooked	leafy vegetable	permanent		5	

	Radcl.-Sm.									
	Euphorbia hirta L.	ngotoindika (o)	226	flower	raw	fruit	permanent		*3*	
	Tetracarpidium conophorum (Müll.Arg.) Hutch. & Dalziel	botito, tito (u,w,o)	262, 338	seeds	- cooked - roasted	nut nut	July – Oct.	xxx	(4)	X
Fabaceae (Caesalpinioideae)	*Gilbertiodendron dewevrei* (De Wild.) J.Léonard	mbolu, lofete (u,w,o)	118, 245, 269, 317	seeds	cooked	starch	July – Oct.		(15)	
	Scorodophloeus zenkeri Harms	bofili (u,w,o)	259, 283, 315	- young leaves - bark	cooked cooked	- leafy vegetable - condiment condiment	permanent permanent	xxx	(10)	X
Fabaceae (Papilionoideae)	*Desmodium setigerum* (E.Mey.) Benth. ex Harv.	ikpesaamuku (o)	217	roots	Raw	fruit	permanent		*2*	
	Dewevrea bilabiata Micheli	lofembembo (u,o)	201,319	young leaves	cooked	condiment	permanent		2	X
Gnetaceae	*Gnetum africanum* Welw.	fumbwa (u,w,o)	247	leaves	cooked	leafy vegetable	permanent	xxx	(5)	
Huaceae	*Hua gabonii* Pierre ex De Wild.	lofiongi (u,w) longowu (w,o)	248, 276, 318	- young leaves - bark - whole fruits	cooked cooked cooked	- leafy vegetable - condiment condiment condiment	permanent	xx	(9)	X
Irvingiaceae	*Irvingia smithii* Hook.f.	bosombo (w,o)	255, 301	- seed - fruit pulp	raw raw	nut fruit	June – Oct.		5	
Malvaceae	*Cola acuminata* (P.Beauv.) Schott. & Endl.	a~~A~~ngbongbo(lia) (u,w,o)	261, 265, 326	seeds	raw	nut	July – Oct.	xxx	(10)	X
	Cola bruneelii De Wild.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	24, 123, 236, 306	- fruit pulp - leaves	raw cooked	fruit leafy vegetable	permanent permanent		(10)	X
	Cola congolana De Wild. & T.Durand	losakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	4, 289	fruit pulp	raw	fruit	permanent		(8)	
	Cola marsupium K.Schum.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	204	fruit pulp	raw	fruit	permanent		(8)	
	Cola urceolata K.Schum.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	124, 194	fruit pulp	raw	fruit	permanent		(8)	
	Hibiscus acetosella Welw. ex Hiern	damudamu (u)	335	leaves	cooked	decoction (tea subst.)	permanent		*3*	

Marantaceae	*Megaphrynium macrostachyum* (Benth.) Milne-Redh.	(bolokebo)likongo, beye (u,w,o)	237, 275, 323	leaf buds	cooked	vegetable	permanent	xx	(12)	X
	Trachyphrynium braunianum (K.-Schum.) Baker	ikokombeshalia, bolikabwalima (w) ikokombeibaye (o)	281 223	seeds	raw	fruit	permanent		4	
Melastomataceae	*Tristemma mauritianum* J.F.Gmel.	lituma lilokonda (u,w,o)	1, 214, 286	whole fruit	raw	fruit	permanent		(6)	X
Menispermaceae	*Chasmanthera welwitschii* Troupin	ndénde (u) tongatobolondi (w)	331	fruit pulp & skin	raw	fruit	June – Sept.		2	X
	Penianthus longifolius Miers	lLokumbo (o)	200	fruit pulp	raw	fruit	permanent		*4*	
Moraceae	*Musanga cecropioides* R.Br. ex Tedlie	BbokomboBbokombo (o)	221	young sprouts	cooked	vegetable	permanent		*3*	
	Treculia africana Decne. ssp. *africana* var. *africana*	bBombimbo, limbimbo (u,w,o)	203, 296, 325	seeds	roasted	- nut - condiment	permanent		(3)	X
Pandaceae	*Panda oleosa* Pierre	bakale (u,w,o)	2, 199, 285	seeds	- raw - roasted	nut - nut - condiment	permanent†	xx	(5)	X
Passifloraceae	*Passiflora foetida* L.	maveve (u,w,o)	225, 292, 314	fruit pulp & seeds	raw	fruit	permanent		(4)	X
Pentadiplandraceae	*Pentadiplandra brazzeana* Baill.	etekele, amelalokulu (u,w,o)	210, 282, 307	fruit pulp	raw	fruit	permanent	xxx‡	(15)	X
Phyllantaceae	*Hymenocardia ulmoides* Oliv.	bokelele(w,o)	227, 280	young leaves	cooked	decoction (tea subst.)	permanent		8	
Phytolaccaceae	*Hilleria latifolia* (Lam.) H.Walter	lokobo (u,w,o)	14, 256, 300, 333	leaves	cooked	leafy vegetable	permanent		(6)	X
	Phytolacca dodecandra L'Hér.	lisingo (u,w,o)	322	leaves	cooked	leafy vegetable	permanent		(4)	X
Piperaceae	*Peperomia pellucida* (L.) Kunth	lombaye lolitoko (u)	120	leaves	cooked	leafy vegetable	permanent		*1*	
	Piper guineense Schumach. & Thonn.	iketu (u,w,o)	19, 233, 273, 321	- leaves - liana - whole fruits	cooked cooked raw	decoction (tea subst.) decoction (tea subst.) condiment	permanent permanent July – Jan.	xxx	(12)	X
Plantaginaceae	*Bacopa* sp.	ingawungawu (w)	295, 995	leaves	cooked	decoction (tea subst.)	permanent		*1*	

	Polygalaceae	*Carpolobia alba* G.Don	lokembia (w,o)	288	roots	- raw - roasted	strenghtener strenghtener	permanent	xx	32	X
	Portulacaceae	*Talinum triangulare* (Jacq.) Willd.	melelu (u) sese (w,o)	8, 313 219, 299	leaves	cooked	leafy vegetable	permanent	x	(5)	X
	Rubiaceae	*Sabicea johnstonii* K.Schum. ex Wernham	damudamu (o)	230	whole fruit	raw	fruit	permanent		*2*	
		Sherbournia bignoniiflora (Welw.) Hua	lLosabola (u,w,o)	6, 212, 264, 305	- fruit pulp & seeds - leaves	raw cooked	fruit decoction (tea subst.)	permanent permanent		(7)	X
	Rutaceae	*Zanthoxylum macrophyllum* Nutt. var *preussii* Engl.	bBolongo (o)	258	bark	cooked	decoction (tea subst.)	permanent		*5*	
	Sapindaceae	*Chytranthus macrobotrys* (Gilg) Exell & Mendonça	botokolo, tokolo (u,w,o)	246, 329	seeds	cooked	nut	July – Oct.	x	(3)	
		Pancovia laurentii (De Wild.) Gilg ex De Wild.	botende, ntende (u,w,o)	260, 1002	fruit pulp	raw	fruit	July – Oct.	x	(5)	
	Sapotaceae	*Chrysophyllum lacourtianum* De Wild.	bolinda, lilinda (u,w,o)	207, 291, 334	fruit pulp	raw	fruit	July – Oct.	xxx	(6)	X
		Synsepalum brevipes (Baker) T.D.Penn.	bokokolo, ikokolo (w,o)	254	fruit pulp	raw	fruit	June – Aug.	xx	3	X
		Synsepalum stipulatum (Radlk.) Engl.	bonga, tonga (u,w,o)	9, 21,251, 287, 324	fruit pulp	raw	fruit	April - July	xxx	(4)	X
	Smilacaceae	*Smilax anceps* Willd.	likako (u,w,o)	252, 988, 1005	tubers	cooked	starch	permanent	xx	(4)	
	Solanaceae	*Capsicum frutescens* L.	mMbase ikukunde (w,o)	220, 274	whole fruit	raw	condiment	permanent	xx	7	X
		Solanum distichum Schumach. & Thonn.[#]	iIkalu (w,o)	206, 278, 992	fruit juice	cooked	decoction (tea subst.)	permanent		2	
		Solanum aethiopicum L. "gilo group"	lLosuke (w,o)	994	whole fruit	cooked	- vegetable - condiment	permanent permanent	x	5	X
	Tiliaceae	*Desplatsia dewevrei* (De Wild. & T.Durand) Burret	bokomba, likamba (u) lisuli (w,o)	 257, 271	seeds	raw	nut	permanent		(8)	X
	Urticaceae	*Myrianthus arboreus* P.Beauv.	bongunguna (u) bohuma (w,o)	304 209, 298	fruit pulp	raw	fruit	July – Oct.	xx	(6)	X

	Myrianthus preussii Engl.	bohuma bolukund (w) bohuma petit (o)	990 238	fruit pulp	raw	fruit	June – Sept.		1	
	Urera thonneri De Wild. & T.Durand	likile (u)	22, 985	leaves	cooked	leafy vegetable	Permanent		*1*	
Verbenaceae	*Vitex congolensis* De Wild. & T.Durand	ebite (o)	242	leaves	cooked	decoction (tea subst.)	Permanent		*3*	
Vitaceae	*Cissus dinklagei* Gilg & M.Brandt	wese (o)	202	stem sap	raw	beverage (water subst.)	Permanent		*1*	
	Cyphostemma adenocaule (Steud. ex A.Rich.) Desc. ex Wild & R.B.Drumm.	bombeye (o)	215	whole plant	cooked	decoction (tea subst.)	permanent		*3*	
Zingiberaceae	*Aframomum laurentii* (De Wild. & T.Durand) K.Schum.	bongongoo, soso (u,w,o)	5, 234, 268, 308	fruit pulp & seeds	raw	fruit	permanent	x	(76)	X

[1] (u), (w) and (o) vernacular name(s) under which the plant species is known and used in Yalungu, Yasekwe and Yaoseko, respectively.
All vernacular names have their corresponding plurals by changing the prefixes, e.g. 'ikeke' becomes 'tokeke', 'liyo' becomes 'ayo', etc.

[2] Vouchers are stored under the reference: PAS followed by the respective numbers; PAS 1 – 25, PAS 118 – 124, PAS 304 – 338 and PAS 984 – 985 have been collected by the first author in Yalungu; PAS 264 – 303 and PAS 986 – 996 have been collected by the first author in Yasekwe; PAS 194 – 263 and PAS 997 – 1007 have been collected by the first author in Yaoseko

[3] When more than 1 plant part is used per plant species, they are separated with dashes, idem for more than one preparation method per plant part used and more than one specific use per preparation method.

[4] x = species traded in 1 village, xx = species traded in 2 villages, xxx = species traded in the 3 villages

[5] *numbers in between brackets*: total number of uses cited in the 3 villages; *numbers underlined*: total number of uses cited in the 2 villages where the species has at least one food use; *numbers in italic*: total number of uses cited in the only village where the species has at least one food use. The numbers into brackets can only be compared with other numbers into brackets. Idem for the numbers underlined and those in italic.

° Period not known by the focus group members, but appears two times a year

† Fruits mature between June and Oct., they putrefy the whole year round on the ground and can be gathered at any time of the year. The more the fruit flesh is rot, the easier the access to the kernel.

‡ It are not the edible fruits of *Pentadiplandra brazzeana* that are commercialized, but the roots for medicinal purposes.

The non-prickly semi-domesticated *Solanum distichum* may well be treated as a cultivar-group of the prickly wild progenitor *Solanum anguivi* Lam.(Lester & Seck, 2004).

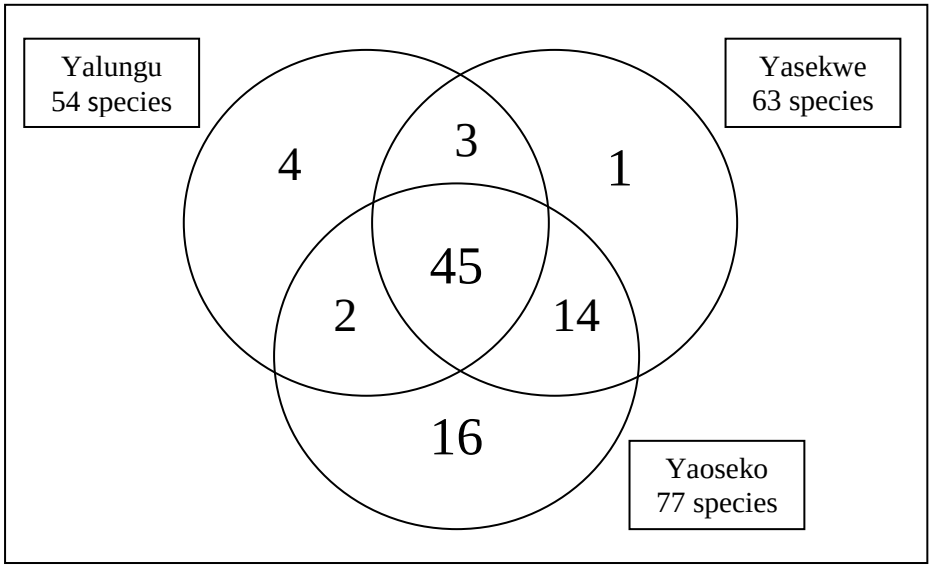
Yalungu
54 species
Yasekwe
63 species
Yaoseko
77 species
4
3
1
45
2
14
16

Figure 2: Number of WEP-species used in all three Turumbu villages surveyed (inner circle), and in only two or one village (outer circle segments); behind each village name, the total number of species identified in this village is given.

Table 2: WEP-parts used by the Turumbu, Isangi Territory, DRCongo

Plant parts used	Number of plants
fruits	38
leaves	23
seeds	10
tubers	8
stem & stem sap	4
bsark	3
leaf buds	2
young sprouts	2
flowers	2
roots	2
immature fronds	1
whole plant	1
TOTAL	**96**

Table 3: Specific uses of the WEPs used by the Turumbu, Isangi Territory, DRCongo

Specific use	Number of plants
fruit	39
leafy vegetables	15
condiment	13
tea substitute	11
nut	10
starch	9
other vegetables	5
strenghtener	2
water substitute	1
palm wine	1
TOTAL	**106**

Table 4: Non-food uses of the WEPs used by the Turumbu, Isangi Territory, DRCongo

Botanical family	Scientific name	Vernacular name[1]	Use category	Specific use[2]
Achariaceae	*Caloncoba subtomentosa* Gilg	lLisende (o)	construction fodder	branches: sticks for houses (o) host tree for edible caterpillars (o)
Amaranthaceae	*Amaranthus dubius*- Mart. ex Thell.	ngbelengbele (o) lonenge (w,o)	fodder cultural	porc feed (o) leaves: chasing bad spirits/witches (o,w) leaves: ancestral benediction (o)
Anacardiaceae	*Antrocaryon nannanii* De Wild.	bokongo, kongo (u,w,o)	fuels	firewood (w)
Annonaceae	*Anonidium mannii* (Oliv.) Engl. & Diels	anguto (u,w,o)	medicinal cultural	bark: serpent bite (o,u), eye injuriy (o), foot wounds (o,u), stop bleeding and pain after childbirth (w,u), lumbago (u) bark: ancestral judgement of guilt (u)
Apocynaceae	*Clitandra cymulosa* Benth.	inono (u,w,o)	tech & mat[3] medicinal bait	latex: making balls (o,u,w), ngong sticks (o), repair flat tyres (o,u,w) latex: intestinal worms (o) apes feed in traps (u)
	Landolphia foretiana (Pierre ex Jum.) Pichon	lingbotoma (o)	tech & mat	latex: making balls (o), repair flat tyres (o)
	Landolphia owariensis P.Beauv.	lilolo (u) liyo (w,o)	tech & mat bait	latex: for making balls (o,w,u), ngong sticks (o,w), repair flat tyres (o,w,u) apes feed in traps (u)
	Landolphia villosa J.G.M.Pers.	libii (u) lilombo (w) Inono (w)	tech & mat bait ~~bait~~	latex: making balls (u), repair flat tyres (u) apes feed in traps (u)
	Landolphia sp1	ngilaseka (u,w)	tech & mat bait	latex: making balls (w), repair flat tyres (w) apes feed in traps
	Saba comorensis (Bojer ex A.DC.) Pichon	lilombo (u,o) libii (w)	medicinal	roots: gonorrhoea (o) fruit juice: haemorrhoids (o)
Arecaceae	*Laccosperma secundiflorum* (P.Beauv.) Kuntze	(boloke bo) Likawu (u,o)	medicinal tech & mat construction	leaves: serpent bite (o) liana: mats (o,u), beds (u) and fish fykes (o) leaves: roof thatching (u)
	Raphia sese De Wild.	ikolo, fande (u)	construction tech & mat fodder	palm leaves: roof thatching (u) leaf veins: brooms (u) palm leaves: local beds (u) host tree for edible larvae (u)
Asteraceae	*Crassocephalum crepidioides* (Benth.) S.Moore	limbiti (u,w,o)	cultural	*'bolenge'* reduce female domination (love charm) (u)
Burseraceae	*Canarium schweinfurthii* Engl.	bobele, ibele (u,w,o)	tech & mat medicinal fuels cultural	varnish (w) bark: back ache (o) resin: candles (o,w,u) resin: smoke to chase bad spirits (u)
	Dacryodes osika (Guillaumin) H.J.Lam.	ibele sawu, isawusawu (u,w,o)	fuels	firewood (w,u)
Clusiaceae	*Mammea africana* Sabine	boliti (o)	cultural	stimulate children to start to walk (o)
Costaceae	*Costus lucanusianus* J.Braun & K.Schum.	bokako (bobaye) (u,w,o)	cultural medicinal tech & mat	eating young leaf: problem solving (o) stem sap: measles (o,w); injuries (w), syrup to add other medicinal substances (u) young plant: anti-poison (o) leaf sap: amoeba (o) bark: cords for transporting firewood (w)
Dennsteadtiaceae (pteridophyta)	*Pteridium aquilinum* (L.) Kuhn	lilele (o)	medicinal	young leaves: eye injuries (o) young bud: remove thorns in feet (o)

			tech & mat	whole plant: conservation of fish (o)
Dichapetalaceae	*Dichapetalum mombuttense* Engl.	ekpalanganga (u,o) lisungulingba/lisung uliteti (w,o)	tech & mat medicinal	branches: traps (w) fruit juice: back ache (u)
Euphorbiaceae	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.	liondje (u,w,o)	medicinal bait cultural	young leaves: dental caries (o) leaves: anaemia (u) fruits: bait/poison for fish ~~-~~(w,u) ~~-~~and birds (u) leave: wound healing after circumcision (u)
	Erythrococca atrovirens (Pax) Prain var. *flaccida* (Pax) Radcl.-Sm.	likile (w,o)	medicinal	leaves: bruises (o), eye injuries (w) bark: eye injuries (w)
	Euphorbia hirta L.	ngotoindika (o)	medicinal	whole plant: amoeba (o), intestinal worms (o)
	Tetracarpidium conophorum (Müll.Arg.) Hutch. & Dalziel	botito, tito (u,w,o)	social	children put nut skin ~~nut~~ on forehead to play (u)
Fabaceae (Caesalpinioideae)	*Gilbertiodendron dewevrei* (De Wild.) J.Léonard	mbolu, lofete (u,w,o)	construction fuels tech & m~~M~~at cultural medicinal	wood: planks (w,o,u) leaves: roof thatching (o,u) firewood (w) bark: 'sombotiti' local mortar (w, o) trunk: mortar (o) seeds: children's toy (u) bark: for good health and glad skin of newborn (o) bark: back ache (u)
	Scorodophloeus zenkeri Harms	bofili (u,w,o)	poison medicinal	fish poison (o) bark: hernia (u), filariasis (u), ascaris (= roundworm infection) (u)
Fabaceae (Papilionoideae)	*Desmodium setigerum* (E.Mey.) Benth. ex Harv.	ikpesaamuku (o)	cultural	root: luck charm for winning e.g. foot match (o)
Gnetaceae	*Gnetum africanum* Welw.	fumbwa (u,w,o)	medicinal	leaves: cholera (o) leaves/liana: diarrhoea (o)
Huaceae	*Hua gabonii* Pierre ex De Wild.	lofiongi (u,w) longowu (w,o)	medicinal poison cultural	fruit juice: amoeba (o) leaves: cataract (u) fruit/bark: fish poison (o) leaves in nose dog for good hunting (u)
Irvingiaceae	*Irvingia smithii* Hook.f.	bosombo (w,o)	medicinal	root: strenghtener (o) bark: back ache (o), intestinal worms (w)
Malvaceae	*Cola acuminata* (P. Beauv.) Schott. & Endl.	a~~A~~ngbongbo(lia) (u,w,o)	cultural medicinal	seeds: luck charm (o,w,u); solving problems (u) seeds: male potency (o,u) seeds: hernia (o)
	Cola bruneelii De Wild.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	medicinal tech & m~~M~~at	roots: joint problems, rheumatism (o,u) leaves: stimulating maternal milk production (o) branch: children's toy (gun) (o)
	Cola congolana De Wild. & T.Durand	losakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	medicinal tech & m~~M~~at	roots: joint problems, rheumatism (o,u) leaves: fish bone in throat (o) leaves: stimulating maternal milk production (o) branch: children's toy (gun) (o)
	Cola marsupium K.Schum.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	medicinal tech & m~~M~~at	roots: joint problems, rheumatism (o,u) leaves: fish bone in throat (o) leaves: stimulating maternal milk production (o) branch: children's toy (gun) (o)
	Cola urceolata K.Schum.	l~~L~~osakanu, sakanu (u,w,o) limbabaliyekondo (w,o)	medicinal tech & m~~M~~at	roots: joint problems, rheumatism (o,u) leaves: fish bone in throat (o) leaves: stimulating maternal milk production (o) branch: children's toy (gun) (o)
	Hibiscus acetosella Welw. ex Hiern	damudamu (u)	medicinal cultural	leaves: anaemia (u) decoction of leaves as Christ's blood in church (u)

Marantaceae	*Megaphrynium macrostachyum* (Benth.) Milne-Redh.	(bolokebo)likongo, beye (u,w,o)	construction tech & mat	leaves: roof tatching (o,w,u) leaves: packing material, plates (o,w,u) stems: mats, beds (o,w,u)
	Trachyphrynium braunianum (K. Schum.) Baker	ikokombeshalia, bolikabwalima (w) ikokombeibaye (o)	tech & mat cultural	leaves: packing the bait (o) stems: good luck for fishermen (w)
Melastomataceae	*Tristemma mauritianum* J.F.Gmel.	lituma lilokonda (u,w, o)	cultural medicinal	fruit: avoiding serpent bites (o, u) leaves: intestinal worms (o)
Menispermaceae	*Penianthus longifolius* Miers	lLokumbo (o)	medicinal tech & mat	root: back ache (o), male potency leaves: small part on bow to direct arrows (o)
Moraceae	*Musanga cecropioides* R.Br. ex Tedlie	bBokombo (o)	tech & mat	trunk: beds (o), praus (o)
Pandaceae	*Panda oleosa* Pierre	bakale (u,w,o)	medicinal	fruit: eye injury (o) bark: buboes (= inflammation of lymph nodes due to an STI or bubonic plague) (u)
Passifloraceae	*Passiflora foetida* L.	maveve (u,w,o)	medicinal	measles (o)
Pentadiplandraceae	*Pentadiplandra brazzeana* Baill.	etekele, amelalokulu (u,w,o)	medicinal poison	root: back ache, lumbago (o,w,u) malaria (o), shingles (o), warm abscess (o), gonorrhea (u), dental caries (u), measles (u), scabies of dogs (u) bark: fish poison (o,u)
Phyllantaceae	*Hymenocardia ulmoides* Oliv.	bokelele(w,o)	medicinal construction fuels	bark: serpent bite (o) leaf decoction: stimulating maternal milk production (o) branch: houses/fences (o,w) firewood (w), charcoal (w)
Phytolaccaceae	*Hilleria latifolia* (Lam.) H.Walter	lokobo (u,w,o)	medicinal	leaves: asthma (o), swellings (o), felon (u)
	Phytolacca dodecandra L'Hér.	lisingo (u,w,o)	medicinal	stem: dental cariës (u)
Piperaceae	*Piper guineense* Schumach. & Thonn.	iketu (u,w,o)	medicinal	leave decoction: back ache (o,w), cough (o) roots: general pain (w) fruits: cough (w) liana/fruits: back and thorax ache (u)
Polygalaceae	*Carpolobia alba* G.Don	lokembia (w,o)	medicinal	male potency (o)
Portulacaceae	*Talinum triangulare* (Jacq.) Willd.	melelu (u) sese (w,o)	medicinal fodder	leaves: thorns in feet (o) porc feed (u)
Rubiaceae	*Sabicea johnstonii* K.Schum. ex Wernham	damudamu (o)	medicinal	fruit: anaemia (o)
	Sherbournia bignoniiflora (Welw.) Hua	lLosabola (u,w,o)	cultural medicinal	leaves: reduce female domination (love charm)(o) leaves: gastritis (u) roots: cough (u)
Rutaceae	*Zanthoxylum macrophyllum* Nutt. var *preussii* Engl.	bBolongo (o)	medicinal	bark decoction: back ache (o), malaria (o), cough (o), general weakness (o)
Sapindaceae	*Pancovia laurentii* (De Wild.) Gilg ex De Wild.	botende, ntende (u,w,o)	tech & mat fuels	latex: balls for children (o) firewood (w)
Sapotaceae	*Chrysophyllum lacourtianum* De Wild.	bolinda, lilinda (u,w,o)	construction fuels medicinal	trunk: house pillar (w) firewood (w) bark: stimulating maternal milk production (u)
	Synsepalum brevipes (Baker) T.D.Penn.	bokokolo, ikokolo (w,o)	medicinal	bark: back ache (o)
	Synsepalum stipulatum (Radlk.) Engl.	bonga, tonga (u,w,o)	fuels	firewood (w)

Smilacaceae	*Smilax anceps* Willd.	likako (u,w,o)	cultural	liana around house protects against nightmares (o)
Solanaceae	*Capsicum frutescens* L.	mMbase ikukunde (w,o)	medicinal	leaves: abscess (o), felon (o), ear inflammation (o) Fruit: constipation (o), enema mother after childbirth (w)
	Solanum aethiopicum L. "gilo group"	lLosuke (w,o)	medicinal	fruit: anti-poison (o) roots: to close fontanel of newborns (o)
Tiliaceae	*Desplatsia dewevrei* (De Wild. & T.Durand) Burret	bokomba, likamba (u) lisuli (w,o)	cultural tech & mat	fruit: protect fishermen (w), drive away hippopotamus (u), chasing mosquitoes (o), permits pregnant women to enter the tomato fields (o) bark: basks (u)
Urticaceae	*Myrianthus arboreus* P.Beauv.	bongunguna (u) bohuma (w,o)	medicinal cultural fuels	leaves: anti-poison (o) bark: anti-domination product (o) firewood (w)
Verbenaceae	*Vitex congolensis* De Wild. & T.Durand	ebite (o)	construction medicinal	sticks for houses or fences (o) leaves: tuberculosis (o)
Vitaceae	*Cyphostemma adenocaule* (Steud. ex A.Rich.) Desc. ex Wild & R.B.Drumm.	bombeye (o)	medicinal	leaves: head ache (o) roots: abscess (o)
Zingiberaceae	*Aframomum laurentii* (De Wild. & T.Durand) K.Schum.	bongongoo, soso (u,w,o)	medicinal	fruit: filariasis (o), syrup to add other medicinal substances (u,o) fruit pulp: general pain (w)

[1] (u), (w) and (o) vernacular name(s) under which the plant species is known and used in Yalungu, Yasekwe and Yaoseko, respectively.
[2] (u), (w) and (o) other uses registrated in Yalungu, Yasekwe and Yaoseko, respectively.
[3] category: technology, materials and arts

Table 5 : Aggregated results of the participatory ranking exercises for fruits. Numbers represent number of times a plant species appeared in the top three for the different characteristics (taste, economic value, socio-cultural value or nutritional value) and in the global weighted ranking.

Fruits	Taste	Economic Value	Socio-cultural value	Nutritional value	Global weighted ranking
Aframomum laurentii	0	1	2	0	0
Anonidium mannii	**4**	**5**	**4**	**6**	**6**
Chrysophyllum lacourtianum	0	3	1	4	2
Landolphia owariensis	**4**	**5**	0	3	4
Pentadiplandra brazzeana	3	1	2	0	1
Synsepalum stipulatum	3	1	1	0	0
Tetracarpidium conophorum	2	2	0	3	2

Table 6 : Aggregated results of the participatory ranking exercises for vegetables. Numbers represent number of times a plant species appeared in the top three for the different characteristics (taste, economic value, socio-cultural value or nutritional value) and in the global weighted ranking.

Vegetables	Taste	Economic Value	Socio-cultural value	Nutritional value	Global weighted ranking
Celosia spp.	3	1	0	4	2
Crassocephalum crepidioides	0	0	2	1	0
Gnetum africanum	0	2	1	0	2
Hilleria latifolia	0	0	2	0	0
Hua gaboni	5	4	**5**	1	2
Megaphrynium macrostachyum	4	**6**	2	**6**	**6**
Scorodophloeus zenkeri	1	4	4	1	1
Talinum triangulare	**6**	2	0	**6**	**4**