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Indigenous Knowledge of Edible Tree Products - The Mungomu Tree in Central Mozambique

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
1. INTRODUCTION	5
2. METHODOLOGY OF THE STUDY	5
3. PRINCIPAL FINDINGS OF THE FIELDWORK	7
3.1 Geographic Distribution of Mungomu	7
3.2 Annual Cycle of Mungomu	7
3.3 Socio-economic importance of the different parts of the Mungomu	8
3.4 Other Oleaginous Species.....	9
3.5 Traditional Technologies for Processing Ngomu	10
3.6 Ngomu and Gender Relationships.....	11
3.7 Changes in the Uses of Ngomu over Time.....	11
4 OTHER WILD PLANTS.....	12
5 EXPERIENCES WITH MUNGOMU IN OTHER COUNTRIES OF THE REGION	13
6 CONCLUSIONS AND RECOMMENDATIONS	13
6.1 Conclusions	13
6.2 Recommendations.....	14
ANNEX 1 SUMMARY OF THE FIELD WORK TEAM MAIN PRELIMINARY EVIDENCES	15
ANNEX 2 MACOSSA'S EDIBLE FOREST PLANTS	20

EXECUTIVE SUMMARY

This study was the result of a collaboration between the FAO-LINKS and the FAO-SAN projects and Kulima-Chimoio.

Schinziophyton Rautanenii, known as Mungomu in Macossa, is a tree that produces a nut best known as one of the staples of the diet of the Kung Khoi-San tribe in the Kalahari Desert. The nut, known in English as the Manketti Nut, is known to supply up to three quarters of the dietary needs of this tribe. In Mozambique, it occurs irregularly in hot dry country on poor soils, north of the Save River. It is recorded from Chibabava, Nhamatanda, Gorongosa, and Macossa Districts in Central Mozambique, and from Tete, Nampula and Cabo Delgado Provinces. The tree occurs both sporadically and in almost pure stands.

The objective of the study was to review and document the local knowledge base on the Mungomu tree in the district of Macossa and establish whether it varies according to gender, socio-economic status and generational differences. The study also looks at how the nut is used by local people and at its importance for food security.

The study found that the culture of using Mungomu is very much alive in the district of Macossa. All long-term residents knew about the Mungomu tree and its nut Ngomu, and only a few new residents who arrived after the civil war were not aware of it. Consumption however is declining due to the use of oilseeds such as peanuts, and the amount of work involved in cracking the nuts. Traditional methods involve using a small and a big stone to crush the nut, or splitting the nut casing with a stick and an axe blade. These rudimentary systems for cracking the nut were found to be the main barrier to maintaining, or possibly commercializing, the utilization of Ngomu. The kernel is used to enrich sauces, to accompany meat, fish, and vegetables, but also to produce oil. Consumption increases in difficult times, such as droughts and during the civil war.

Interviews revealed that knowledge about the Ngomu did not vary according to the age of the respondents but rather according to where they came from. Farmers living in areas where the tree does not occur knew less about its uses. Although men have a general knowledge about Mungomu tree, women are the main users and managers of Ngomu. They are responsible for its collection, its preparation/processing and its sale.

During the feedback seminar, community leaders expressed interest in continuing activities based around the Mungomu tree, such as planting of the tree, education about its uses, and efforts to improve the technology of cracking the nut. They also expressed a desire to see further studies of other edible native forest plants.

1. INTRODUCTION

During the recent civil war, many areas of Central Mozambique lived without trade goods for years, and much indigenous knowledge was remembered and shared amongst the isolated communities. Surveys done by the Red Cross in the early 90s in Manica and Sofala showed that indigenous foods contributed significantly to the diets of displaced communities during the war. The aim of the study is to review and document the knowledge base on indigenous plants in order to stimulate the production of varied non-timber products from the forests. This could contribute to food security and income, and encourage the conservation and management of forests and biodiversity by local communities.

The study focuses on the Mungomu (*Schinziophyton rautanenii*, ex *Ricinodendron rautanenii*), a tree of the Miombo vegetation group that is known by the peoples of southern



Mungomu Tree

Africa as an important source of food, and a good source of easily-worked wood. The fruit that supplies the edible part is known in Macossa as Ngomu. The fruit has an edible pulp, which is little used in Macossa due to its astringent taste. The nut containing the seed is very hard, and this hardness limits its consumption. The meat of the nut is used as a thickener for sauces of meats and vegetables. The kernel also supplies edible oil that is occasionally used as a cosmetic. The Ngomu under study is largely unknown in the district capital of Macossa to anyone from outside the district. However, consumption by local peoples is constant, with some

areas using more and others less. The study proposes to look at how the nut is used by the local people, and its importance in food and nutritional security, especially as it seems to be used mainly as a “hungry season” food. It also seeks to assess the level of knowledge of the Ngomu and establish whether it varies according to gender, socio-economic status and generational differences.

2. METHODOLOGY OF THE STUDY

The study was performed in five phases. The first phase consisted of a literature review of available material on the Mungomu tree from other countries of the region where the tree occurs (Botswana, Zambia, and Namibia). The second phase was exploratory and had the following objectives:

- introduce the team to the physical, social and economic reality of the district;
- get to know the tree as a forest component, as the tree was unknown to the majority of the team members;
- conduct an introductory seminar to present the study to the local administration and traditional authorities, in order to encourage the collaboration of the indigenous communities with the study;
- collect information from the community on Mungomu and other edible bush plants;

The introductory seminar included representatives from most of the administrative areas and communities of the district. Areas or traditional chieftaincies were visited, including Nhacassoro, Teque-Teque, Mussangadze, Dunda, and Catiqui-Nzaia, as well as the district headquarters. The main sources contacted were administrative and community leaders, community facilitators and teachers.

The seminar was a one-day affair with 28 people including district administration technicians, community leaders, and local facilitators of nongovernmental organizations working in the district. The objectives of the seminar were achieved, including:

- present the objectives and context of the study to the administrative authorities and the community leaders;
- collect information and suggestions to better plan the fieldwork;
- capture the feelings of the communities around the importance of Mungomu in food and nutritional security past and present; and,
- encourage the collaboration of the community leaders for the fieldwork.

During the brainstorming, it became evident that the people who lived furthest from the district headquarters knew more about Mungomu than those who lived closer by. The utility of the fruit and the nut are well known by indigenous communities and its consumption increases at times of crises such as war and drought.

The third phase of the study was the elaboration of the field questionnaire in order to gather the required information, namely:

- knowledge of the indigenous population of the zones where Mungomu occurs, including knowledge of the soils preferred by the tree and the process of germination and initial development.
- knowledge of the annual cycle of Mungomu (leafing out, flowering, fruit set, fruit fall and harvest period).
- utilization of the various parts of the tree (roots, trunk, leaves, fruit, nut).
- identification of animals that compete with man for consumption of the fruit and nut.
- classification and description of the local technologies used for processing ngomu.
- identification of other oilseeds, indigenous and introduced, that can displace Mungomu in eating and nutritional terms.
- verify how the knowledge about Mungomu varies according to gender, age and socio-economic status.
- verify to what extent the knowledge and use of Mungomu changed over the last three to four decades; identify the changes and the mechanisms of transmission of knowledge between generations.

The fieldwork was the fourth phase of the study, during which qualitative interviews, individual interviews, group discussions were carried out and the zones of occurrence of Mungomu were visited. There were also various practical sessions with demonstrations of cracking the nut and preparing a meal based on the nut.

The sample consisted of a total of about two hundred people, 85 women and 115 men covering a wide age range and coming from different localities. The best results came in group discussions rather than individual interviews. In reality, the study of indigenous knowledge is the systematization of a collective cultural experience. Thus participative techniques and group discussions were a fundamental strategy in the fieldwork. Other data collection techniques included mapping with a GPS, digital photos and film clips, observation, experimentation, and process discrimination.

The fifth phase of the study consisted in the analysis and interpretation of data and the elaboration of the report. This phase ended with the presentation of the main findings of the study to the communities involved in a second seminar in Macossa.

3. PRINCIPAL FINDINGS OF THE FIELDWORK (see Annex 1)

3.1 Geographic Distribution of Mungomu

The Mungomu, local indigenous name for the tree under study, exists throughout Macossa and in parts of the District of Gorongosa, where it borders with Macossa. However, the large groves confirmed during the study are in the areas of Nhacassoro, Mussangadze, Teque-Teque/Tropa, Nhamikumi, Ndidza II, Malimanawa, and Nhakawango. Other groves known to the local people but not visited by the team, can be found in Nguawala, Mmonte Danguana, Zembe, Ntsalala in Macossa and Muera and Domba in Gorongosa.

Some groves are very old with large trees while other groves are more recent and in the process of establishment and expansion. A preliminary conclusion is that the multiplication of Mungomu into new regions of the district is a dynamic and ongoing process. The most notable example is the grove forming about 20 Km from Macossa-sede, along the road between Macossa-sede and the EN1, close to Mount Mirione. This expansion phenomenon should be further investigated by foresters.

Mungomu is a tree that develops concentrated groves on higher ground (locally known as “Nthunda”) and sandy, poor soils little used for agriculture. More dispersed occurrences of the tree are on a wider range of soils and locations. According to local knowledge, the animals that eat the fruit pulp (elephants, kudo, sable, amongst others) are responsible for spreading the seed to new areas, in dung or after regurgitation, to initiate the formation of new populations of Mungomu.

Although there are large concentrations of Mungomu in other regions of Mozambique, one of the biggest concentrations occurs in the district of Macossa where the multiplication and development of the plant continues to occur naturally. Indigenous people define Mungomu as a wild plant, which is left to its own devices. Two hypotheses were given as probable cause for multiplication: natural germination after good rains and the “planting” of stakes of Mungomu.

3.2 Annual Cycle of Mungomu

Indigenous knowledge about the annual cycle of Mungomu and other wild plants is solid. However, people from Macossa do not count time as in more modern societies and the twelve-month calendar is little known, especially amongst women. Those interviewed divided the year into the rainy season (maindza) and cool, dry season (malimu), and also referred to planting season, harvest time, and land preparation time.

As to Mungomu, the following phases of the annual cycle were identified:

- the appearance of leaves occurs between October and November, depending on an early or late start to the rains;
- flowering occurs during November and December;
- the fruits also become apparent in November and December; and,
- fruit fall occurs in April and May.

Although the harvest of the ngomu should occur in April and May when the fruits fall, it is generally delayed due to the danger of confronting competing animals (elephants and others), and the high grass that makes access difficult. Therefore harvest normally begins in June, after the passing of bush fires and ends when the grass begins to grow after the rains.

However, in Nhacassoro, where the habit of consuming ngomu is much stronger, harvest begins as the fruit falls in April and May, so that competing animals don't eat all the nuts!

Ngomu is usually stored underneath the traditional grain bins, overhangs or in shallow holes in the ground. There are no insects known to attack the nut in storage therefore it is easily conserved, either in the bush or at the home compound.

3.3 Socio-economic importance of the different parts of the Mungomu



Door made from Mungomu

Not all the parts of the Ngomu are used by the population of Macossa, the roots, the leaves, and the fruit pulp are usually discarded. Several people mentioned eating the fruit pulp, but it was very astringent. This contrasts with the experience in Namibia and Zambia, where the pulp is widely used for making moonshine (illegal distilled alcoholic drinks). Only three parts of the tree are used: the trunk, the nut shell, and the kernel. The trunk is a source of a very lightweight wood, used for the making of doors, musical instruments (“varimba”, “marimba”, “mbira”), cooking utensils (“ndiro”, “luko”), toys, stools, and still condensers (“mukondu”). It is a wood that is very light and easy to work with simple, rudimentary tools. Local people know that it is better to cut “the trees that give no fruit” for wood production.

The hard external shell is used by traditional healers as a component of their divining “bones” (“ntsango”). Hunters use the nut casing as an amulet (a hole is made in the casing and a string tied around the waist) for good luck in hunting and fishing. The nut casing is also used as fuel.

Without doubt, the most important and decisive aspect of Mungomu is the multiple uses of the kernel in the food and nutrition of the local population. The kernel of ngomu is used in five different forms in the indigenous food system.

- The kernel is consumed raw, the most widespread consumption form, especially amongst the younger segments of the population (casual consumption).
- It can be roasted and mixed with salt.
- The kernel can be transformed into a sauce thickener/flavouring, locally known as “nthiro” (the second most common form of using the kernel). The ngomu thickener combines perfectly with all types of meat, vegetables and fish. (One interviewee talked of the high oil content of the ngomu as being capable of causing nausea on overeating, perhaps due to its 58% oil content)
- Oil extracted from the kernel is used in cooking, assuming the same functions as peanut, sunflower, sesame, or other types of edible oil. Ngomu oil could be used by the cosmetics industry in skin creams and is already used by the local women to treat their skin and oil their hair.
- After oil extraction, the press-cake left over is fed to animals as a supplement.



Woman cooking Ngomu

Table: Contents of Ngomu¹

	Organs	Energy	Water	Protein	Fat	Carbohydrate	Fibre	Ash	Ca	P	K	Na	Mg	Fe	Zn	Cu	
Measure		MJ/100g	g/100g (equal to percentage)						mg/100g								
Euphorbiaceae Schinziophyton rautanenii	Pulp	1410	8.6	7.8	0.5	75.0	2.9	5.2	85.0	74.3	2145	2.39	214	2.54	1.68	1.30	
	Kernel	2715	4.2	26.3	58.1	4.6	2.7	4.1	223	869	674	3.35	493	3.42	3.54	2.52	



Cracked ngomu

Although ngomu and its uses were known well before the Makombe War (historical reference point very important to the indigenous people in the region), local people make no association between their knowledge of ngomu and the question of food and nutritional security. In other words, people eat the kernel in its various forms, but are not aware of its nutritional value.

Usually people are not aware of the nutritional value of the different species of fruits, roots, and wild vegetables known and used principally in times of food shortages.

The consumption of ngomu varies, with those living close to a grove eating more and those farther away eating less (or none in normal years). Consumption increases in difficult times such as war and drought, and reduces in normal times due to the distances to the groves, the difficulty of cracking the nut, and the ease of acquisition of competing products. The people in the area of Nhacassoro are the most assiduous eaters of ngomu, with at least one meal a week based on ngomu, while supplies last at the compound or in the bush.

3.4 Other Oleaginous Species

Aside from Mungomu, there are other oil-bearing species known and used for food, including: Nfula (*Sclerocarya birrea*), Maula (*Parinari curatellifolia*), Nthengene (*Ximenia americana*), and Njale/Ngale (*Sterculia appendiculata*). The seeds of these plants have the same food usage as ngomu or peanut. However, they contain less oil compared to ngomu.

Oleaginous crops introduced in Macossa include peanut, sesame and sunflower. Industrial oils of some of these species are available at local shops spread throughout the district. There are also sales of sunflower and sesame oils produced in local presses.

The interviewees did not view the introduction of conventional and industrial oil crops as a threat to the consumption of ngomu. The use of ngomu as oil or sauce thickener has its own particularities that the competing products do not possess. Dishes prepared with ngomu are characteristic and have a particular taste that none of the competing products can offer.

The people of Macossa have a third source of oil and sauce-thickener with functions similar to ngomu or peanut. This source is the seeds of squash, cucumber and watermelon, crops that are produced by most families and widely consumed.

¹ This table is taken from FAO NWFP 5, Edible nuts

3.5 Traditional Technologies for Processing Ngomu

In utilizing ngomu as food, the local population has developed a set of processing technologies that vary in different areas of the district. In the locality of Nhacassoro and the surrounding areas of Gorongosa there was an evolution, bringing improvements in the processing methods. While in the rest of the district the nut is cracked using an axe and a stick with very low productivity, in Nhacassoro, the consumers of ngomu use two rocks, a big one and a small one, to crush the nut, with higher out turn.

There are three basic forms of cracking the nut to get the kernel of the ngomu:

- An axe and stick are used in a very slow process with the added risk of incurring cuts to the hands. It has the advantage of producing a higher percentage of whole nuts. The nut is held against the upturned axe blade and is then hit with the stick.
- A large and a small stone are used to crush the nut, in a much faster process. It has the disadvantage of crushing the kernel as well, with some mixing of the endocarp, or inner shell, with the kernel. This system is mainly used in Nhacassoro.
- The whole nut is roasted in a fire, to facilitate the removal of the outer shell or exocarp. This system is also better known in Nhacassoro.



Woman crashing Ngomu

Once the kernel is extracted with one of the procedures described above, it can be used in various ways, according to the needs of the user. It can be eaten raw or roasted, the kernel can be turned into a paste to use as a sauce thickener/flavouring, or oil can be extracted from it. The processes are as follows:

1. Sauce thickener/flavouring

- a. The nut is cracked using one of the three methods described above.
- b. The kernel is separated from the exocarp using a pointed instrument.
- c. In some cases the endocarp is also separated from the kernel, although this step is omitted in Nhacassoro.
- d. The kernel is roasted, but not in some areas.
- e. The kernel is pounded in a mortar and pestle.
- f. The pounded kernel is removed from the pestle and mixed with water to form a purée.
- g. This purée is combined with meat or vegetables already cooking, and left to simmer for about 30 minutes.

2. Oil Extraction Process 1

- a. The nut is cracked using one of the three methods described above.
- b. The kernel is separated from the exocarp using a pointed instrument.
- c. The kernel is pounded in a mortar and pestle, while a clay pot with water is put on a fire to boil.
- d. The paste is taken from the pestle and put into the boiling water.
- e. Boil off the water.
- f. Remove from the fire and leave the pot to cool.
- g. Separate the oil from the cake by decanting or by using a “likombe”.



3. **Oil Extraction Process 2**

- a. Steps a, b and c are repeated.
- b. Instead of taking the paste from the pestle, the boiling water is introduced into the pestle little by little, while still pounding.
- c. The oil separates from the cake little by little, and is taken off using a “likombe”, a normal spoon, or a chicken feather.

Oil extraction

In Nhacassoro, the owner of a hand-operated oil press used for extracting oil from sunflower and sesame tried to extract oil from the ngomu using the same machine. He had no success, because the ngomu squished through the openings in the pressure cage. The same man prepared a small sample of oil using the traditional method number 1, for display at the second Mungomu seminar.

The evolution of processing over the last three decades has been slow, and in most regions there has only been stagnation. Only in Nhacassoro has there been some innovation in the nut-cracking process, as well as in processing the kernel and oil. The two stones method has substituted the axe and stick method and increased productivity.

The relative isolation of the communities, the lack of mobility and the difficulties of access roads are all barriers that inhibit innovation and diffusion of technology.

It is thus easy to explain how innovation in one area is unknown in others, and that the communities of Nhampalapala and Ndzindza have no knowledge still of the processes of making sauce thickener or of extracting oil from ngomu. The poor circulation and exchanging of information between communities reduces the diffusion of indigenous knowledge.

3.6 Ngomu and Gender Relationships

The division of labour in relation to Mungomu and Ngomu is based on gender. Men cut the trunk and then work with the wood. They locate Mungomu groves and alert women to the availability of Ngomu. On the other hand women, helped by children, harvest, transport and process the Ngomu. Although men sometimes help during the harvest, women are the main actors in the collection, transformation and preparation of the ngomu. As a result, women have a more focused knowledge of the food uses and processing of the kernel. They can describe the processes of cracking the nut, preparing the ngomu paste, and extracting the oil. The centrality of the women in the culture of ngomu consumption makes her the main agent for preservation and transmission of the ngomu culture to the younger generations.



Woman grinding Ngomu

3.7 Changes in the Uses of Ngomu over Time

The people interviewed were unable to tell when the consumption of ngomu started. They only knew that well before the Makombe Wars, which ended in 1917, ngomu was known as edible. It was mainly consumed raw, as it still is in a few areas of Macossa, such as Nhampalapala and Ndzindza. The transformation of ngomu into a sauce thickener/flavouring

and the extraction of oil are relatively recent developments that have occurred about thirty years ago, at the time of the decolonisation of Mozambique. The indications are that the transformation started in Nhacassoro/Gorongosa. From there, these uses spread out to other parts of the region. Today there are diverse forms of consuming ngomu, but it is principally the production of oil and the use of ngomu as a sauce thickener and flavouring that mark a fundamental change in relation to the past.

There are three main constraints to a more extensive use of the ngomu:

1. *Labour intensive.* The difficulty faced by women in cracking the nut case is considered the main constraint to a more extensive consumption of ngomu. Many families reported not consuming ngomu (in normal times) because of the difficulty of cracking the nut. The team saw four of five demonstrations of cracking the nut with the axe and stick method, and the demonstrator injured her hand twice. When interviewers mentioned the existence of a nut-cracking machine in Zambia, there was always a lively interest in knowing more about the machine.

2. *Lack of knowledge.* The second factor that threatens the culture of ngomu is the consequences of the migrations during the war. People who used ngomu were forced to migrate far away while various people with no previous knowledge of ngomu settled in Macossa. These people showed a total lack of knowledge of ngomu and a lack of predisposition to assimilate the local culture, considering Mungomu a wild plant of no importance.

3. *Far from human settlements.* A third factor that discourages the use of ngomu and that could threaten its preservation is that in the majority of cases the groves of Mungomu are very far from the centres of habitation, and long marches are needed to get there due to lack of roads. The Mungomu is concentrated on uplands on poor soil (“nthunda”), while the people are concentrated on low-lying, more fertile soils better for agriculture.

4 OTHER WILD PLANTS

During the interviews questions were also made about other wild plants used for food. The interviewees supplied various names of plants that were found in their area and that they knew the uses of. The names are listed in Annex 2 and include fruits, roots, leaves, and seeds.

There was a group of roots that all the people interviewed mentioned or knew well when asked about them. These are roots that people use heavily in times of food crises. Mungomu is also used more in times of food scarcity, but it does not supply what is considered basic food because it does not have high starch content. The roots include: xicalanyerere, munyendza, nyamufu, minyanya, ndia, and gulambadza. The first two come from trees, while the last three are herbs or vines. Some of these roots are difficult to prepare and are dangerous to the unwary. One root, ndia, needs to be boiled for five days to become safe to eat, and anyone who rushes the procedure can be poisoned and die. Gulambadza is an interesting case. According to information from chief Teque-Teque, this plant, that was cultivated in the recent past, has a reddish pulp and is eaten without any special preparation. In the compound of Teque-Teque, the family was harvesting minyanya, and the team was served a sample. These and other plants could be candidates for domestication or semi-domestication leading to food security based on local resources.

5 EXPERIENCES WITH MUNGOMU IN OTHER COUNTRIES OF THE REGION

At the beginning of the study, a literature review was done to learn of any experience with Mungomu from other countries in the region. The proceedings of a conference on Mungomu that took place in Zambia briefly described oil presses and a ngomu nut cracking machine. It also reported attempts to commercialize ngomu oil, in particular in the cosmetics industry, and comparisons between ngomu oil and other competing oils.

Amongst other information, the search found an improved version of the axe to crack the ngomu, consisting of the blade of a traditional axe mounted on a secure base that permits an output of 500 grams of kernel per hour. The possibilities for commercialization of the ngomu oil received cautious treatment, as there are many questions yet to be answered, as to the qualities of the oil, and the level of demand that is possible. Doubts were also expressed about the nut-cracking machine made in Zambia. Apparently it does not work well on some sizes of ngomu, and at the moment there is not enough market to justify many of them.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In Macossa, there are enormous concentrations of Mungomu. Some groves extend to the neighbouring districts of Gorongosa and Maringue. The general knowledge that the indigenous people possess about Mungomu is also enormous and it varies according to gender and age, with women and older people having a better knowledge of the processing and use of Mungomu.

The study confirmed that Mungomu is well known by the population of Macossa who had already eaten the nut Ngomu. At the district administration level there is little knowledge of Mungomu. Mungomu is also less known where the type of soil is not favourable to its development.

Other oil crops that compete with Mungomu, in particular peanuts, sesame, sunflower and even cotton. Beyond this, there are indigenous oleaginous plants that compete with Mungomu in the local food culture. Some families own hand-powered oil presses to process oil from these crops, while the technologies for processing oil from Ngomu continue to be slow and primitive.

If the knowledge of Mungomu is a generalized phenomenon in the community, the consumption of its nut is less widespread. There is a tendency of a gradual decline in the use of ngomu in feeding the people. The migratory movements, the technological limitations, and the difficult access are the principal factors to explain the decline in consumption of ngomu.

The technologies for processing ngomu, for direct consumption or for oil extraction, remain primitive. This primitive state of the technology is the main constraint to the continuation and increased consumption of ngomu.

Although the consumption of ngomu increases in times of food crises, people do not view it as a critical food element. Plants such as Ndia, Minyanya, Munyendza, Gulambadza and Xicalanyerere, whose roots have large amounts of starch that can replace cereals, are

considered more important for food security. Some of these roots however, have toxicities that require special preparation methods and, since there are no secure standards for their processing, occasional poisoning occurs when they are eaten.

Other countries in the region have been studying wild indigenous plants. These studies cover various types of plants and various products. The need to know more about these studies and to promote exchanges between scientists and local peoples became obvious during this study. The most important lesson is the value given by these countries to the natural resource base and to indigenous knowledge, a process still embryonic in Mozambique.

6.2 Recommendations

Considering the results and conclusions already presented, which were discussed and enriched in the devolution seminar, the follow-up activities are recommended:

- 1) Extension and promotion of Mungomu and other similar natural resources by:
 - a) Pamphlets
 - b) Extension to women on cooking with ngomu
 - c) Education about the nutritional value of ngomu kernel
 - d) Inter-community visits to exchange experience about Mungomu
 - e) Introduction into the local school curriculum.
 - f) Participate in food fairs, where they exist.
 - g) Introduction of a "Mungomu Day" in Macossa.
- 2) Multiplication of Mungomu by:
 - a) Planting with truncheons, in collaboration with the CEF and SPF.
 - b) Experimental community nurseries.
- 3) Development of small projects to:
 - a) Multiply Mungomu
 - b) Process Mungomu
 - c) Commercialize Mungomu products
- 4) Improve the Mungomu processing technology by:
 - a) Promoting contests in technical schools and metalworking companies for the invention of improved instruments or machines to crack ngomu.
 - b) Look for information on the technology of macadamia nut processing from South Africa with an eye to adapting it to Mungomu.
 - c) Promoting exchange visits with Mungomu projects in neighbouring countries.
- 5) Development of a pro-Mungomu movement in the District of Macossa and the city of Chimoio, forming interest groups in the communities and the provincial capital Chimoio in order to protect, transform, and commercialize Ngomu.
- 6) Continued, in-depth research on the biology and sociology of Mungomu.
- 7) Initiate studies to improve the knowledge of other wild plants used locally in Macossa and central Mozambique, especially "ndia", "gulambadza", "minyanya", "munyendza", and "xikalanyerere" because of their interesting role in food security.

ANNEX 1 SUMMARY OF THE FIELD WORK TEAM MAIN PRELIMINARY EVIDENCES

1. Areas of occurrence

a) Confirmed clumps:

Nhacassoro, Mussangadze, Teque-Teque/Tropa, Nhamicuni, Nhacawango;

b) Unconfirmed clumps:

Ndzidza II, Nguawala, Danguana Hill (Zembe), Muera and Domba (Gorongosa);

c) Disperse Trees:

Zembe sede, Nhamagua (Malimanão-Nhamassope), Mirione (by the side of the road: Macossa-Catique Nzaia);

Soil type: Sandy hills locally known as Nthunda.

- There is a vague knowledge about the process of germination and initial development of the Manketti tree;
- Some interviewees informed of the possibility of natural germination in the times of heavy rain;
- Planting from a cutting of the same plant;
- In new areas the animals spread the plant through excrements.

2. Manketti Tree annual cycle

Sprouting of leaves:

- Leaves – from October to December;
- Flowers – from November to December;
- Fruits – from November to December;
- Fruits' fall – from April to May.

Picking Season

- usually in the months from June to July;
- in some areas after the burning-over of the land;
- it is also possible to pick it some time before but there's always the danger of finding wild animals (Nhacawango) and there is difficulty of access (high grass);
- in Nhacassoro it's picked earlier – April/May – to avoid animals picking it first.

3. Uses of Manketti Tree as a forest species

- Root: no uses;
- Trunk: wood for doors, Mucondo (instrument to destill nipa – traditional drink), ndiro (traditional dish), varimba, marimba, luko (wooden spoon), toys and stools;
- Leaves: no uses;
- Fruit: food for wild animals, men (but with the inconvenience of tasting rough – tchenha).

Manketti nut uses

- thick exterior shell: ntasngo (healers), hunting charms (lucky charms) and as firewood;
- thin interior skin: no uses;
- nut kernel: eaten roasted or raw, nthiro (seasoning/starch), oil extraction and skin and hair cream;
- after oil decantation, the husk is used for animal foraging (forage).

Seasons of greater Manketti nut consumption:

- all year long but mainly during picking season.

Specific situations that increase Manketti nut consumption:

- periods of prolonged draught and hunger;
- absence of industrial oils and other oleaginous species;
- eating habits (ex: Nhacassoro).

4. Other competing animals

a) Shell: sindi, wild pig and phana;

b) Flesh: Ndzou (elephant), monkey, ngoma (kudu), hedgehog, gazelle, pala-pala.

5. Processing technology

Grinding (tools):

- Use of axe and stick;
- Use of two stones: one larger on the floor and the other to break;
- In some areas the skin is burned to make the removal of the nut kernel easier.

Flouring

- a) The thick shell is broken using one of the three tools/methods described in 5.1;
- b) Remove the nut kernel using a pointy tool;
- c) Remove the thin skin with a knife, though not in other cases (Nhacassoro);
- d) The nut kernel is roasted (though not in some areas);
- e) Grind it in the mortar;
- f) Remove it from the mortar and mix it with water in the container, stir it until you have a puree;
- g) Put it in the pan with vegetables or meat already cooking and let it cook for about 30 minutes.

Oil extraction

- 1st Process:
- a) The thick shell is split using one of the three tools/methods described in 5.1;
 - b) Remove the kernel nut using a pointy tool;
 - c) Grind it in the mortar while putting a clay pan (tchicalango) of water on the fire;
 - d) Remove it from the mortar (flour) and put it in the pan with the already boiling water;
 - e) Let it boil until the water is totally evaporated;
 - f) Take it out of the fire and let it cool;
 - g) Decant it to a container, separating the oil and the thin skin (husk) or removing the oil with the help of a licombe (traditional spoon).

2nd Process: The process is initiated in the same as the first one but as one grinds the nut kernel one introduces boiled water little by little in the mortar thus, generating oil that is later removed with the help of the licombe (traditional spoon), normal spoon or a chicken feather.

6. Preserving:

- Stored in balconies;
- stored in barns;
- put into pots;
- in holes on the ground.

There are no plagues capable to pierce through the Manketti nut shell.

7. Other competitive oleaginous species

Indigenous/wild:

- Nfuma, Nthenguene, Maula, Ndjale.

Conventional culture:

- peanut, sesame (chitoe), sunflower, pumpkin cucumber and watermelon seed.

Buying oil locally:

- it is possible for there industrial oil and presses locally.

8. Gender aspects

- There is no work distribution and the women are more involved in the picking and in the general process;
- Men know of aspects in generation, location, uses of the plant as species, while women have a deeper knowledge of Manketti nut itself (preparing, technological process, feeding);
- Women are the main agent of cultural transmission to the younger generation for they involve the children in the whole process.

9. Preserving the culture of using Manketti nut

- There are differences in today's consumption compared to the past:
- In the past (ex: the macombes era) only the raw nut kernel was eaten;
- In colonial times the flouting process was initiated;
- Later (after the independence) the process of extracting oil was introduced.

Reasons for the change:

- Introduction of industrial products;
- The cultivation of oleaginous (peanut);
- The difficult process of breaking the thick shell (main deterrent);
- Questions related to modernization;
- Emigration during the war – greater cause for lack of knowledge.

Decrease in knowledge and appreciation

- Knowledge is not decreasing;
- The use is the one prone to decreasing.

Suggestions:

- Continue to divulge the existence of Manketti nut to the new generations.

PRELIMINARY CONCLUSIONS AND RECCOMENDATIONS:

I. Conclusions

- There is a large population of Manketti Trees in the district;
- The general knowledge on Manketti Tree/Manketti nut is alive;
- There are regional differences in their knowledge and use, at district level (know how to do);
- There are differences of their knowledge at gender and age levels;
- The Manketti Tree is more concentrated in higher areas and light soils while the population is concentrated in lower and more fertile areas;
- The grinding process is the cause for greater deterrent in the populations, causing greater lack of interested in its use;
- Another deterrent factor is the appearance of industrial oils;
- The difficult access for harvest/picking Manketti fruit (grass, dense woods, greater distance, animals);
- Easiness to preserve the Manketti nut;
- The population's perception about Nourishment and Nutritional Safety is associated with the lack of cereals (like corn);
- The communities don't associate between Manketti nut as food and its nutritional importance;
- The communities don't assume Manketti nut as food for the purpose of Nourishment and Nutritional Safety, but resort to other plants in moment of food crisis (munhanha, chicalanherere, munhendza);
- It is not possible to establish an association between the prevalence of HIV/AIDS and the consumption of the Manketti nut;
- There is no data that can lead us to conclude that the areas of greater Manketti nut consumption suffer less from malnutrition.

II. Recommendations:

- a) Divulging and appreciating:
 - There's a need to divulge and appreciate the existence and use of the Manketti Tree/Manketti nut within the communities;
 - Introduction in the new local school programmes of the use of local resources including the Manketti Tree;
 - Divulging the Manketti nut in the local and national gastronomy (fairs, restaurants, the Mungomo-Macossa Center and others).
- b) processing technology:
 - Introduction of new improved technologies in the Manketti nut processing, launching contests in the technical professional schools, metalwork industries or even for the local blacksmiths for the invention of an efficient grinding tool;
 - Study the possibility of importing specific machinery for the grinding and oil extraction process.
- c) Nourishment and Nutritional Safety in the families:
 - Divulge the importance/nutritional value of Manketti nut to the families;
 - Promote the exchange of experiences between the areas to standardize the knowledge and the use of Manketti nut;

- Rationalize the use of Manketti nut kernel by divulging ways to prepare/cook it (recipes);
- Possibility to create the trading of Manketti nut for the increase of the family income;
- Identify micro-projects in the areas of greater clumps.

d) Others:

- Possibility to create associations/interest groups both in the community and private ones;
- Need to deepen the study of other indigenous species such as: munhanha, chicalanherere, munhendza, nhamunfo, galumbadza, ndia;
- In the long run the possibility to trade Manketti nut in the local or regional market should be studied, especially in countries with a developed market in this sector;
- Create a network of Manketti Tree association at district level;
- To involve the private sector in the promotion of products made from Manketti nut;
- Considering there is a strong habit and culture of consuming Manketti nut products locally (Macossa), this fact justifies the need for installing small industries for processing Manketti nut with the involvement of the private sector;
- Considering it's a new area for the private local/national sector, it will be necessary to create financial incentives in products and taxes to attract private interest.

ANNEX 2 MACOSSA'S EDIBLE FOREST PLANTS

Name in Cisena or Cibarwe	Scientific Name	Part Used	Other Uses
Bwemba Kole	Cassia Petersiana	Fruit	
Cadzidze		Fruit	
Gulambadza (?)		Root	
Luni	Gynandropsis Gynandra	Leaves	
Maconga			
Madzwiru	Vangueria Tomentosa	Fruit	
Malolo	Annona Senegalensis	Fruit	
Matondo	Cordyla Africana	Fruit	Wood
Matudza	Flacourtia Indica	Fruit	
Matutumbudzi	Landolphia Spp	Fruit	
Maula	Parinari Curatellifolia	Fruit, Nut	
Mbimbire		Fruit	
Mboa	Amaranthus Spp.	Leaves	
Mbwemba	Tamarindus Indica	Fruit	Wood
Mphama			
Muhula			
Mukute			
Mulambe	Adansonia Digitata	Fruit, Nut, Leaves	Fibre
Munhanha		Root	
Munhendza		Root	
Muzanje	Uapaca Kirkiana	Fruit	
Nchonbolio			
Ndhali			
Ndia		Root	
Nfula	Sclerocarya Birrea	Fruit, Nut	Muzinga
Nfuma	Diospyros Mespiliformis e D. Spp	Fruit	Wood
Nguma			
Nhamufu		Root	
Nhanguengua			
Nhongolo		Fruit	
Njale, Ngale	Sterculia Appendiculata	Seed	Wood
Nkando	Bauhinia Petersiana	Seed	
Nkuvu	Vitex Payos	Fruit	
N'sikive banda		Fruit and seed	
Nthalala		Fruit	
Ntheme	Strychnos Spinosa	Fruit	Varimba
Nthenguene	Ximenia Caffra e Americana	Fruit	
Ntherere	Corchorus Spp.	Leaves	
Ntsaladzi	Mimusops Zeyheri	Fruit	
Singiri panda			
Tchunguene			
Uliri		Seed	
Xicalanherere	Elephantorrhiza Goetzi	Root	

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