Co-management of Rungwa and Katavi – Ugalla corridor forests

The added value chain for wild edible mushrooms in Katavi and Tabora regions

Stage 1: Baseline data, training, and strategy

Adansonia-Consulting, Dr. Urs Bloesch, 7 June 2022

Front page photograph: Mushroom picking in Mlele Beekeeping Zone along German road with Mgombe mushroom group.

Content

Acknowledgement

I sincerely thank ADAP for entrusting me with this third mushroom study in Katavi and Tabora regions. I am very grateful to Romanus Mwakimata and Twinzi Henrico, ADAP project managers from Rungwa and Katavi-Ugalla corridor projects, respectively. My warmest thanks go to the three mushroom trainers Abdala Liingilie, natural resources officer, Matana Levi, livelihood and natural resources officer, and Abas Gwambaye Ngalagale, TFS forest officer Mlele for their support and engagement in the mission. My special thanks go to Mr. Ebrantino Mgiye, TFS zonal commander in western Tanzania, for his advice and for supporting the mission. I also extend my warmest thanks to all trainees and the local authorities and communities for their active participation and commitment and their hospitality.

Abbreviations

ADAP	Association for the Development of Protected Areas
DFO	District Forest Officer
BKZ	Beekeeping Zone
FORVAC	Forestry and Value Chains Development Programme
FR	Forest Reserve
JFM	Joint Forest Management
NWFP	Non-wood forest products
RAS	Regional Administrative Secretary
RTI	Research Triangle Institute
SIDO	Small Industries Development Organisation
TARI	Tanzania Agricultural Research Institute
TBS	Tanzania Bureau of Standards
TFS	Tanzania Forest Service Agency
VEO	Village Executive Officer
WCS	Wildlife Conservation Society
WEO	Ward Executive Officer

Executive summary

This third mushroom consultancy was carried out from 14 to 27 January 2022 in Katavi and Tabora regions. The consultancy focussed on a) practical training of mushroom group members on appropriate picking and handling of mushrooms, b) discussion of the mushroom value chain with key stakeholders, and c) further elaborating the strategy. The mushroom trainers then proceeded with the training of the remaining mushroom groups and the implementation of the mushroom activities including additional market interviews.

The demonstration trainings for the trainers (2 ADAP, 1 Tanzania Forest Service Agency-TFS) were conducted for the mushroom group members from Mtakuja, Mgombe, and Utende (Katavi-Ugalla corridor project), representatives from the mushroom groups from Ipwaga, Mapili, Ilunde (Rungwa corridor project) and Mkola, Mwenge, Kapumpa and Majojoro (Rungwa corridor project under a Wildlife Conservation Society's subaward).

In total 104 members, whereof 24 men and 80 women, were trained on the spot. The training topics focussed on a) the use of a knife for picking mushrooms (b) joint mushroom species sorting and identification (c) transport and appropriate containers (d) properly preserving and drying mushrooms. After the demonstration trainings, the three trainers complemented the training for all mushroom groups. In total 445 mushroom group members, whereof 111 men and 334 women, were trained during this mushroom season.

The delayed delivery of the four solar dryers from SIDO allowed only some practical testing for this mushroom season of the two solar dryers installed at the Kitunda and Illunde offices of the Rungwa Corridor project. According to preliminary testing from the Rungwa Corridor project, the use of the solar dryers – compared to the traditional drying method – appears to a) reduce the drying time and b) prevent post-harvest loss by non-human mushroom consumers (insects) and contamination by microorganism and egg-laying insects.

Several key stakeholders of the mushroom value chain were met during the consultancy to discuss their interest in participating in the development of a market strategy and their specific roles.

According to the two surveys in 2021 and 2022, out of the 63 market retailers, 52 are only entrepreneurs, 10 are farmers and entrepreneurs and one is a picker and seller. Young women are the predominant age group involved in the market mushroom business. Out of the 63 interviewed sellers, 57 purchase the mushrooms from pickers who bring them to the market, four from middlemen, while two retailers buy the mushrooms from both, pickers and middlemen.

There is a constant demand for mushrooms throughout the year. 32% of the retailers are selling mushrooms also in the off-season. The best-selling mushroom species are from three genera including Kansolele (*Termitomyces microcarpus*), Wange (*Cantharellus isabellinus* und *C. symoensii*), Usikobha (*Lactarius xerampelinus*), and Umpalala (*Lactarius kabansus*).

The selling price for fresh mushrooms per bucket of 20 litres varies between 11,000 TSh and 20,000 TSh depending on the species and their acceptability in the market. The selling price for fresh mushrooms is roughly 55% higher than the buying price which offers interesting sales revenues to the retailers. The average selling price for dried mushrooms is about 60 to 80% higher than for fresh mushrooms but highly depends on the mushroom species with sales revenues of up to 100% for some species.

The customers are mostly from the local locality but seven retailers mentioned that some larger bulk buyers are coming from big cities (Dar es Salaam, Mwanza, and Zanzibar) mainly for dried mushrooms.

Capacity building is essential for establishing a well-functioning mushroom value chain with informed, trained and well-organised actors and should be carried out in close collaboration with SIDO. In the next mushroom season, the mushroom producer groups should be further trained with additional training topics including proper use of solar dryers, packaging of dried mushrooms, quality and hygienic aspects, organisational and business issues. On the other hand, the retailers will be trained in the next season in species identification, preserving and stocking mushrooms, quality, and hygienic aspects.

All three missions confirmed the high abundance of mushrooms in the miombo woodlands of Katavi and Tabora regions in the rainy season with 52 edible species recorded.

The development of an added-value chain for wild edible mushrooms will be beneficial at different levels:

- Additional income for the mushroom pickers by facilitating their access to the market for fresh and dried mushrooms;
- The revenue obtained from the forests will give a monetary value to the forests thereby inciting the mushroom pickers and the local communities to the conservation of the miombo ecosystems;
- The mushroom retailers will receive more regularly fresh and dried mushrooms which were harvested sustainably, identified with certainty (no risk of poisoning), are of high quality (clean), processed by respecting high hygienic standards, and properly packed (dried mushrooms);
- Wild edible mushrooms may offer an interesting niche for the private sector in the selling and consumption of fresh and dry mushrooms (supermarkets, hotels, restaurants…) and the preservation and packaging of the product (small and medium enterprises).

The development of a comprehensive market strategy will consider the lessons learnt from similar initiatives in Tanzania and elsewhere on the African Continent. The successful development of an added value chain for mushrooms requires that all key stakeholders participate actively in the process and have an interest in a better-developed market system. The mushroom pickers, the retailers, and individual sellers should be organised in professional associations to facilitate the interactions between the different stakeholders.

A first step was undertaken by organising the mushroom pickers in producer groups. As a next step, the producer groups should be incorporated into professional associations like the Kululu Natural Initiative Association (beekeeping and mushrooms) for the Rungwa River corridor to support the interest of the mushroom producer groups.

TFS should consider the amendment of the current rules regarding the picking of mushrooms in Forest Reserves to have a legal framework that is more practicable and in support of the promotion and marketing of wild edible mushrooms. Entry and harvest permits should be established for the whole mushroom producer group which needs to be registered at district level.

Small Industries Development Organisation (SIDO) should be involved in the capacity-building activities of the mushroom producer group in the next mushroom season including training on the packaging, labelling, and financial issues (access to loans).

Finally, a workshop will be organised in Tabora at the beginning of the next mushroom season with all key stakeholders and resource persons from similar initiatives to jointly

define a market strategy for wild edible mushrooms from Katavi-Ugalla and Rungwa corridors. In addition, a one-week promotion booth at the principal market of Tabora will be jointly organised with SIDO and TFS supported by a media campaign (television, radio, and newspapers) for promoting the consumption of the nutritious wild edible mushrooms.

This report presents and discusses the mission findings as well as the main activities implemented by the two projects in this mushroom season after the consultancy.

1. Introduction

The Association for the Development of Protected Areas (ADAP) is implementing the projects entitled *Community forest management of the Rungwa respectively Katavi-Ugalla corridor* in Tabora and Katavi regions in western Tanzania. The projects aim to support and accompany villages bordering Rungwa River and Mulele Hills Forest Reserves (FR) in establishing together with the Tanzania Forest Service Agency (TFS) a co-management for the protected areas. Through a subaward from the Wildlife Conservation Society (WCS), ADAP supports as well the development of honey and mushrooms added-value chains for the villages giving land to the Kululu village forests (Northern Corridor).

This Joint Forest Management (JFM) encourages forest adjacent communities to play a role in forest management through forest protection. In return for these efforts, they receive a range of concrete benefits, such as rights to harvest forest products, share revenue from forest harvesting, retain fines as well as confiscated materials/produce, use of local water sources and so on (Forestry and Beekeeping Division, 2007, 2013).

Sustainable community-based forest management will improve the livelihoods and resilience of the local communities through the development of income-generating activities based on non-wood forest products (NWFP) thereby inciting the local population to the conservation of the miombo forest ecosystems. In addition to the promotion of honey, wild edible mushrooms have been identified as another promising added-value chain.

Two previous studies in Sikonge District in March 2020 and in Mlele District in February/March 2021 mainly focussed on a) a preliminary inventory of wild edible mushrooms and b) the assessment of the mushroom consumption pattern by the adjacent populations and their marketing potential (Bloesch 2020, 2021). For an introduction to mushrooms in the miombo woodlands of Western Tanzania and the presentation of the study areas as well as the preliminary results from the socio-economic study at the community and market level we refer to Bloesch (2020, 2021).

The specific objectives for this consultancy were set as follows (see terms of reference in Annexe A):

1) On-the-spot training of ADAP (2) and TFS (1) trainers for the subsequent training of all mushroom group members in the proper handling of mushrooms from the following villages:

- Utende, Mgombe, Kanoge, Wachawaseme, Mtakuja, Kaulolo, Nsenkwa, Masigo (Katavi-Ugalla project);
- Ipawaga, Mapili, Ilunde, Isegenezya, Mwenge, Mkola, Mgambo (Rungwa River project);
- Mwitikio, Majojoro, Kapumpa, Kintanula, Mwamagembe (Kululu village forest).

2) Meet the key stakeholders to discuss all requirements for establishing a wild mushroom added-value chain.

3) Elaborate a first strategy for successfully establishing an added-value chain from the picking, up to the selling of wild mushrooms.

This report presents and discusses the mission findings as well as the main activities implemented by the two projects in this mushroom season after the consultancy. This report considers also the data and preliminary findings from the first two mushroom surveys and further elaborates the strategy for the development of an added-value chain for wild edible mushrooms.

2. Methodology

The field mission of the consultant was carried out from 14 to 27 January 2022. The field team was composed of Dr. Urs Bloesch, Adansonia-Consulting, and the three mushroom trainers Abdala Liingilie, ADAP natural resources officer, Matana Levi, ADAP livelihood and natural resources officer, and Abas Gwambaye Ngalagale, TFS forest officer Mlele (see organisations and people met during this consultancy in Annexe B). The mushroom trainers then proceeded with the training of the remaining mushroom groups and the implementation of the mushroom activities including additional market interviews.

Under the supervision of the consultant a) the English version of the leaflet was reviewed by the project teams and translated into Swahili, b) designed and formatted by the graphic design company *Zone 2*, and then printed by Ediprim, Switzerland.

2.1 Practical training

For the practical training of mushroom pickers in the miombo woodland, the Training of Trainers (ToT) model was applied. The demonstration trainings for the trainers were conducted for the mushroom group members from Mtakuja, Mgombe, and Utende (Katavi-Ugalla corridor project), representatives from the mushroom groups from Ipwaga, Mapili, Ilunde (Rungwa corridor project), and Mkola, Mwenge, Kapumpa and Majojoro (Kululu village forest, WCS). In total 104 members, whereof 24 men and 80 women, were trained on the spot (see Table 1 below). The selection of the training sites considered the abundance of mushrooms since at some locations mushrooms were quite scarce due to low rainfall.

Table 1: Number of mushroom group members trained from the different villages during this field mission.

Village	Men	Women	Total
Matakuja	6	9	15
Mgombe	12	20	32
Utende	6	22	28
Ipwaga, Mapili	0	14	14
Ilunde	0	5	5
Mkola, Mwenge, Kapumpa, Majojoro	0	10	10
Total members trained	**24**	**80**	**104**

For proper picking and handling of mushrooms the following topics were taught practically in the forest (see Fig. 1):

***Mushroom foray*:** Careful picking is very important to meet high quality and hygiene standards for successful marketing of mushrooms. Picking of mushrooms should be done by cutting off the mushrooms with a knife near the base of the stipe and the remaining soil at the base of the stipe should be cut off to keep the mushrooms clean in the container thereby avoiding any later washing. Mushrooms traditionally plucked by hands are often soiled with earth and may disturb litter and mineral soil layer and mycelium. Cutting by knives ensures that the mycelium remaining in the soil is protected from physical damage and desiccation from direct sunlight.

Only fresh and undamaged mushrooms should be collected; defective mushrooms should be avoided and left in the field. Young and immature mushrooms should not be picked to ensure their reproduction and thereby supporting sustainable mushroom production and

regular harvesting. Too old and partially spoiled mushrooms should not be picked to avoid contaminating the whole batch in the container.

Unknown mushrooms should be kept away from edible ones which are known. Mushrooms not harvested should neither be touched nor be destroyed; they should be left intact to leave nature to take its course.

Species identification: All collected mushrooms were sorted on the ground, i.e. the same species were put together in a pile (see photograph on front page). The species were then identified together and their key characteristics such as colour (and possible changes), latex (colour and possible colour changes), shape of cap and stipe, ring, flesh and smell were discussed. The mushroom leaflet in Swahili will help in the species identification by giving a detailed description of the macromorphological features of 12 common wild edible mushrooms.

Fig. 1. Practical mushroom training along German road in Mlele Beekeeping Zone.

Container**:** Well ventilated traditional woven baskets made (see Fig. 2) out of organic material (e.g. bamboo or wild palm leaves) are the suitable utensils for picking mushrooms (USAID / RTI 2020). The newly available recyclable bags could be also used. Non-ventilated containers such as plastic bags or buckets accelerate the decomposition of the mushrooms and should not be used. Mushrooms should not be stacked in layers to avoid quick spoilage (USAID / RTI 2020). The same principle should also be applied to the packaging of mushrooms for their transport from the collection centres to the market.

Fig. 2. Woven basket made out of organic material from Ilunde.

***Sun-drying*:** Every mushroom should be first split into two halves to see if there are no maggots inside. Mushrooms should then be cut into slices of 3-4 mm in thickness for accelerating the drying process. Fully dried mushrooms break very easily. Not fully dried mushrooms are decaying rapidly due to mould fungi infestation. Dried mushrooms should be preserved in clean and hermetically sealed containers to prevent them from absorbing air moisture which would accelerate the spoiling of the mushrooms by microorganisms. Properly dried and stored mushrooms have a longer shelf life which will enhance the self-consumption of this highly nutritional diet during the off-season in benefit of the food and nutrition security of the local communities (see Chelela et al. 2014).

Poisonous mushrooms: Mushrooms in exotic tree plantations should not be picked even when they resemble some of the well-known edible mushrooms to avoid the potential risks of mushroom poisoning. These introduced poisonous mushrooms are strictly host-specific occurring in plantations of exotic trees such as pines and eucalypts but completely incapable of living in symbiosis with indigenous trees in miombo woodlands (USAID / RTI 2020).

ADAP ordered four solar dryers from SIDO Shinyanga for properly drying the mushrooms respecting high quality and hygienic standards. In addition, a simple and mobile solar dryer was produced locally in Inyonga (see Fig. 4).

2.2 Discussions with key stakeholders

Several key stakeholders of the mushroom value chain were met during the consultancy including the TFS zonal commander of western Tanzania, both regional offices from Small Industries Development Organisation (SIDO) in Mpanda and Tabora, the Tanzania Agricultural Research Institute (TARI) Tumbi Centre in Tabora Municipality, Amory supermarket in Tabora town, the Regional Administrative Secretary of Tabora and the local authorities of the villages trained during the consultancy (see people met during the consultancy in Annexe B). During the discussions with the stakeholders, their interest in participating in the development of a market strategy of wild edible mushrooms and their specific role in the value chain was discussed.

2.3 Supplementary market assessment

For the market study we slightly revised the questionnaire from the previous surveys. The questionnaire includes 18 questions focussing mainly on the species sold, source of supply, purchase, and selling price. In addition, the demographic features of the interviewees are recorded (see English questionnaire for market assessment in Annexe C).

Due to time constraints of this short consultancy, only 5 face-to-face interviews with market sellers were conducted at Tabora markets (see Fig. 5) which allowed the two ADAP trainers to get familiarised with the questionnaire. For further complement, later on, Abdala Liingilie conducted additional interviews in Mpanda (20), Sikonge (8), and Tabora (8) markets resulting in 41 interviews whereof 37 female and 4 male sellers.

2.4 Species identification

For the mushroom species identification we followed the methodology described in Bloesch (2021). Several literature sources were used for the species identification including AGCD (1994), Härkönen et al. (2003, 2015), and Ndong et al. (2011). The nomenclature follows the Index Fungorum (http://www.indexfungorum.org/names/Names.asp).

The edibility of each eatable mushroom was evaluated by the locals in comparison with other mushrooms. For the edibility rating we followed Härkönen et al. (2003):

* = edible species
** = good edible species
*** = edible, delicious

3. Results

The six practical demonstration trainings allowed the trainers to get familiar with the approach and to manage different topics for proper handling of mushrooms focussing on a) the use of a knife for picking mushrooms (b) joint mushroom species sorting and identification (c) transport and appropriate containers (d) properly preserving and drying of mushrooms.

The mushroom pickers were very motivated and participated very actively in the training. They brought in their traditional knowledge and were very open to learn more about

mushrooms. The presence of a TFS officer allowed for discussing the rules regarding the picking of mushrooms in forest reserves.

After the demonstration trainings, the three trainers complemented the training for all mushroom groups. In total 445 mushroom group members, whereof 111 men and 334 women, were trained during this mushroom season (see Table 2 below).

Table 2: Total number of mushroom group members trained during this mushroom season.

Village	District	Men	Women	Total
Kintanula	Itigi	19	35	54
Mwamagembe	Itigi	1	26	27
Majojoro	Sikonge	11	11	22
Mgambo	Sikonge	-	26	26
Mkola	Sikonge	3	6	9
Mwenge	Sikonge	-	10	10
Mwitikio	Sikonge	-	15	15
Kapumpa	Sikonge	-	14	14
Ilunde	Mlele	-	7	7
Ipwaga	Mlele	1	31	32
Kanoge	Mlele	14	18	32
Kaulolo	Mlele	15	17	32
Masigo	Mlele	5	26	31
Mapili	Mlele	1	6	7
Mgombe	Mlele	10	22	32
Mtakuja	Mlele	8	7	15
Nsenkwa	Mlele	10	15	25
Utende	Mlele	8	22	30
Wachawaseme	Mlele	5	20	25
Total		**111**	**334**	**445**

In total there are 27 mushroom producer groups whereof 10 in Katavi-Ugalla corridor (all registered) and 17 in the Rungwa River corridor (partially registered).

The delayed delivery of the four solar dryers from SIDO allowed only some practical testing for this mushroom season of the two solar dryers installed at the Kitunda and Illunde offices of the Rungwa Corridor project (see Fig. 3). The two SIDO dryers for the Katavi-Ugalla project installed in Utende and Nsenkwa villages arrived late at the end of the mushroom season. Due to the limited availability of mushrooms towards the end of the season, only a few testing of the solar dryers was carried out by the Katavi-Ugalla project.

Prior to the testing of the SIDO solar dryers of the Rungwa Corridor project, the collected mushrooms were cleaned and cut into slices. The use of a fan allowed for better air circulation which accelerated the drying process. The resulting drying time took 2 to 4 days but greatly depended on the sunlight intensity. The dried mushrooms retained their typical smell and their colour changed only slightly.

Fig. 3. SIDO Solar dryer installed at Kapumpa.

Fig.4. Locally made movable and simple solar dryer from Inyonga.

The results of the market survey from 2022 are analysed together with the survey from 2021 and presented in the discussion chapter.

Fig. 5. Interview of mushroom sellers alongside a road at Tabora Township.

All mushroom species mentioned by the locals during the discussions and/or found in the field (markets) from the surveys from March 2020, February/March 2021, and January 2022 surveys are listed in Annexe D. Several new species were found during this field mission including e.g., *Pulveroboletus africanus* (Badou et al. 2018) with vivid yellow colours with leather brown to greyish-brown appressed scales (see Fig. 6). Out of 123 species recorded, 69 could be identified at the species level. 52 species are edible.

Fig. 6. Pulveroboletus africanus from Msimbo FR.

The **most common families** are as follows:

***Amanitaceae* (9):** A striking characteristic is a sac-like volva at the stipe base, which surrounds the developing fruit body. Nine species of *Amanita* have been identified whereof seven could be named scientifically. This genus is ectomycorrhizal living symbiotically with trees.

***Boletaceae* (18):** Usually boletes have a robust appearance with a hemispherical cap, and a well-developed stipe. Typical of boletes is that instead of gills they have tubes. Many species are bright-coloured, and often bruised pore surface and exposed flesh show rapid and bright colour changes. Most bolete species are associated with trees in an ectomycorrhizal relationship.

***Cantharellaceae* (14):** Fruit bodies are fleshy but firm, small to medium-sized, often trumpet- or funnel-shaped. Chanterelles are the prominent species of the miombo woodlands and are also very abundant in the project area with an impressive diversity of 14 species whereof eight species could be named scientifically. Most of them are eaten and are among the most valued edible mushrooms and they can be preserved fresh for several days. All chanterelles are ectomycorrhizal.

Russulaceae (33): The flesh is brittle, not fibrous, breaking equally in all directions when crushed. This family is the most speciose including 18 *Lactarius* species (milk caps) exuding white, watery, or coloured milk latex when cut or broken and 15 *Russula* species. Many of them are edible although some species are only eaten by some people while others reject them. All of them are ectomycorrhizal.

***Tricholomataceae* (10):** This tropical genus is typified by its symbiotic life together with termites. Termites cultivate the mycelium in their nests and fruit bodies can be seen arising on or near the mounds. A typical characteristic is the stipe which is prolonged downwards into a long, thin, root-like extension called a pseudorrhiza ("false root") connecting the fruit body with the underground termite nest. Seven *Termitomyces* species could be named scientifically whereof only two species including the popular *Termitomyces microcarpus* (Kansolele) were found in the field due to their predominant fructification period in the early rainy season.

4. Discussion

All three consultancies confirmed the high abundance of mushrooms in the miombo woodlands of Katavi and Tabora regions in the rainy season with 52 edible species recorded. However, the abundance of mushrooms in the forests and their availability in the markets depends on the rainfall pattern any dry spell will stop the growth of the mushrooms which makes it difficult to predict the appearance of mushrooms.

Capacity building is essential for establishing a well-functioning mushroom value chain with informed, trained and well-organised actors and should be carried out in close collaboration with SIDO. In the next mushroom season, the mushroom producer groups should be further trained with additional training topics including proper use of solar dryers, packaging of dried mushrooms, quality and hygienic aspects, organisational and business issues. On the other hand, the retailers will be trained in the next season in species identification, preserving and stocking mushrooms, quality and hygienic aspects.

According to preliminary testing from the Rungwa Corridor project, the use of the solar dryers – compared to the traditional drying method – appears to a) reduce the drying time and b) prevent post-harvest loss by non-human mushroom consumers (insects) and contamination by microorganism and egg-laying insects. The maintenance and use (access) of the solar dryers should be defined with each mushroom group.

The use of a moisture meter would allow measuring the moisture content in the dried mushrooms thereby optimising the drying process and attaining uniform moisture for the preservation.

Overall, 63 market interviews were conducted in the 2021 and 2022 mushroom seasons[1] whereof 5 men and 58 women (see table 3 below).

Table 3. Total of market face-to-face interviews from 2021 and 2022

Market	Interviewees		Total
	Men	Women	
Tabora (different markets)	2	23	25
Sikonge	1	10	11
Inyonga	1	6	7
Mpanda	1	19	20
Total	**5**	**58**	**63**

[1] Mushroom season usually lasts from December to March (April) and corresponds to the main rainy season.

According to the two surveys in 2021 and 2022, out of the 63 market retailers, 52 are only entrepreneurs, 10 are farmers and entrepreneurs and one is a picker and seller. Young women are the predominant age group involved in the market mushroom business. Out of the 63 interviewed sellers, 57 purchase the mushrooms from pickers who bring them to the market, four from middlemen, while two retailers buy the mushrooms from both, pickers and middlemen.

There is a constant demand for mushrooms throughout the year. 32% of the retailers are selling mushrooms also in the off-season. The best-selling mushroom species are from three genera including Kansolele (*Termitomyces microcarpus*), Wange (*Cantharellus isabellinus* und *C. symoensii*), Usikobha (*Lactarius xerampelinus*), and Umpalala (*Lactarius kabansus*).

The selling price for fresh mushrooms per bucket of 20 litres varies between 11,000 TSh and 20,000 TSh depending on the species. The selling price for fresh mushrooms is roughly 55% higher than the buying price which offers interesting sales revenues to the retailers. The average selling price for dried mushrooms is about 60 to 80% higher than for fresh mushrooms but highly depends on the mushroom species with sales revenues of up to 100% for some species. However, we have to consider that the retailers were asked for the buying and selling price per bucket of 20 litres although the bought bucket often comprises several mushroom species and the selling unit is often a small pile of mushrooms (frequently sold at 500 TSh). The customers are mostly from the local locality but seven retailers mentioned that some larger bulk buyers are coming from big cities (Dar es Salaam, Mwanza, and Zanzibar) mainly for dried mushrooms.

Many retailers suggested that training on proper picking to avoid dirty/sandy mushrooms and appropriate drying and packaging is highly needed. Another often mentioned concern of retailers is to have a reliable and stable market (demand) to ensure a regular supply.

The development of an added-value chain for wild edible mushrooms will be beneficial at different levels:

- Additional income for the mushroom pickers by facilitating their access to the market for fresh and dried mushrooms;
- The revenue obtained from the forests will give a monetary value to the forests thereby inciting the mushroom pickers and the local communities to the conservation of the miombo ecosystems;
- The mushroom retailers will receive more regularly fresh and dried mushrooms which were harvested sustainably, identified with certainty (no risk of poisoning), are of high quality (clean), processed by respecting high hygienic standards, and properly packed (dried mushrooms);
- Wild edible mushrooms may offer an interesting niche for the private sector in the selling and consumption of fresh and dry mushrooms (super markets, hotels, restaurants…) and in the preservation and packaging of the product (small and medium enterprises).

We will follow the Market Systems Development (MSD) approach to design and develop the value chain (DCED 2020). The successful development of an added value chain for mushrooms requires that all key stakeholders participate actively in the process and have an interest in a better-developed market system. Furthermore, the market should be more organised and formalised by bringing the actors closer together. The mushroom pickers, the retailers, and individual sellers should be organised in professional associations to facilitate the interactions between the different stakeholders.

A first step was undertaken by organising the mushroom pickers in producer groups. As a next step the producer groups should be incorporated into professional associations like the Kululu Natural Initiative (beekeeping and mushrooms) for the Rungwa River corridor to

support the interest of the mushroom producer groups. Such professional associations should also regularly exchange with similar entities like the association of small and medium enterprises initiated by SIDO in Tabora. The ADAP projects will act as a facilitator to align key players and functions of a market system to produce sustainable results but should not implement directly the activities.

The development of a comprehensive market strategy will consider the lessons learnt from similar initiatives in Tanzania and elsewhere on the African Continent. Under the USAID Landscape Conservation in Western Tanzania, the establishment of a safe and sustainable wild edible mushrooms value chain in the context of the Gombe-Masito-Ugalla miombo ecosystem was assessed (USAID / RTI (2020). Another interesting study was carried out in the miombo woodlands of Mbinga and Nyasa districts in southern Tanzania under the Forestry and Value Chains Development Programme (FORVAC) focussing on the business feasibility and potential of a wild edible mushroom value chain (Vyamana 2021).

As discussed with the key stakeholders met, a workshop will be organised in Tabora at the beginning of the next mushroom season with all key stakeholders and resource persons from similar initiatives to jointly define a market strategy for wild edible mushrooms from Katavi-Ugalla and Rungwa corridors. The core problem(s) for the marketing of mushrooms should be clearly identified together. The supporting functions (e.g. proper mushroom drying technics or media campaign), the relevant rules (e.g. entry and harvesting permits for protected areas, hygienic standards), and the role of each key player should be well understood. The development of a comprehensive marketing strategy can profit from the large experience of the beekeeping value chain established with the support of ADAP in Mlele and Sikonge districts.

In addition, a one-week promotion booth at the principal market of Tabora will be jointly organised with SIDO and TFS supported by a media campaign (television, radio, and newspapers) for promoting the consumption of the nutritious wild edible mushrooms. This promotion campaign was discussed with the stakeholders and was warmly welcomed.

Nowadays, wild edible mushrooms are more and more recognised by TFS as an important NWFP of miombo woodlands since their sustainable harvest could benefit the conservation of the miombo ecosystems. TFS should consider the amendment of the current rules regarding the picking of mushrooms in FRs to have a legal framework that is more practicable and in support of the promotion and marketing of wild edible mushrooms. Entry and harvest permits should be established for the whole mushroom producer group which needs to be registered at district level.

The Small Industries Development Organisation (SIDO) is a parastatal organisation under the Ministry of Trade, Industry and Investment. It is a leading institution in promoting the development of small and medium-sized enterprises (SMEs) for sustainable industrialisation in Tanzania. Their experience in the organisation of agricultural producers, traceability of products, private sector involvement, and their technical advice for the drying process and the appropriate packaging (no plastic) of dried mushrooms will be essential for the development of the value chain. They will formally introduce the project to the Tanzania Bureau of Standards (TBS) for the control of the relevant food safety and quality regulations standards once the products are ready. The costs for the certification by TBS are around 3 million TSh and should be included in the budget for the next season. SIDO should be involved in the capacity-building activities of the mushroom producer group in the next mushroom season including training on the packaging, labelling and financial issues (access to loans). SIDO offers loans to small enterprises/ entrepreneurs to support their business activities.

Furthermore, as discussed with TARI Tumbi in Tabora we suggest that their laboratory will carry out a nutritious analysis of the main edible mushrooms. The amount of the key components will be used for the labelling of the packed mushrooms.

The mushroom leaflet elaborated during the last consultancy and printed in April 2022 will support the promotion and marketing of mushrooms and its Swahili version will be used for future training of mushroom pickers and vendors. It includes a brief presentation of the project and provides guidance regarding mushroom identification, recommended picking techniques, appropriate containers for the foray and transport, and proper drying techniques and will be an important reference for the different actors of the value chain. The English version of the leaflet will target the English spoken audience (authorities, technical services, private sector, hotels, developing agencies, donors...).

5. Conclusions

This third mushroom consultancy further confirmed the high abundance and rich diversity of edible fungi in miombo woodlands and the widely untapped potential of this NWFP in Tanzania. The demand for mushrooms in Tabora, Sikonge, and Inyonga markets often exceeds the supply. The sustainable and proper use of wild edible mushrooms will not only enhance the livelihoods of the local communities but also incite the locals for better conservation of the miombo ecosystems which provide income and food to the adjacent communities.

A better organisation of the actors in professional associations will enhance the interactions between the actors and thereby the functioning of the value chain. Improved stocking and preservation techniques will contribute to a more regular supply of mushrooms during the mushroom season and the off-season. The workshop with all key actors of the value chain at the beginning of the next mushroom season will allow us to jointly define the strategy and the role of each actor.

6. Recommendations

The following **recommendations are aimed at both ADAP projects** and cover the period up to the end of the next mushroom season in April 2023 (the lead entity is given in brackets). The corresponding activities and their timeline are shown in table 4. The planned stakeholder workshop for defining a market strategy in December 2022 will further refine some of the activities.

Some of the following recommended activities were elaborated just after the consultancy to be implemented during this mushroom season. The activities which were meanwhile implemented are marked with an asterisk (*).

1) * Proceed with on-the-spot training of mushroom pickers in properly picking and identifying mushrooms (Rungwa and Katavi-Ugalla projects).
2) Map mushroom middlemen and their purchase and selling contacts (Katavi-Ugalla project).

3) * Complement the market survey[2] in Tabora (10), Mpanda (10), Sikonge (5) and Inyonga (5) markets (Katavi-Ugalla project).
4) Purchase organic woven baskets for harvesting mushrooms (Fig. 2) (Rungwa and Katavi-Ugalla projects).
5) Exchange regularly with SIDO Katavi and Tabora regions on the progress in establishing an added-value chain for wild edible mushrooms (Rungwa and Katavi-Ugalla projects).
6) (*)[3] Register all mushroom groups at the district level as a mandatory step before clarifying with TFS the procedure for getting entry and picking permits for wild mushrooms at a group level (Rungwa and Katavi-Ugalla projects).
7) * Print and disseminate the mushroom leaflets in English and Swahili for the promotion and marketing of mushrooms as well as for the training of mushroom pickers and vendors (Adansonia-Consulting and Rungwa and Katavi-Ugalla projects, Bloesch (2022).
8) Write a scientific article for an ethno-mycological journal focussing on the species inventory and the two baseline surveys (Adansonia-Consulting, ADAP).
9) (*)[4] Joint on-site testing, experimentation, and adjustments of solar dryers with mushroom pickers (Rungwa and Katavi-Ugalla projects).
10) (*)[5] Produce simple mobile solar dryers for each village similar to the solar dryer used by the Tabora local groups supported by SIDO and Tumbi College (see Fig. 4, Rungwa and Katavi-Ugalla projects).
11) Organise mutual visits between representatives of our mushroom groups with the Tabora producer groups (Rungwa and Katavi-Ugalla projects).
12) Conduct preservation tests (shelf life) of fresh mushrooms (different species) with interested mushroom pickers (Rungwa and Katavi-Ugalla projects).
13) Identify appropriate packaging material for dried mushrooms (no plastic) and attractive labelling (branding) in close collaboration with SIDO (Rungwa and Katavi-Ugalla projects).
14) Train mushroom producer groups in properly drying mushrooms using solar dryers, packaging of dried mushrooms, quality and hygienic aspects, and organisational and business issues in close collaboration with SIDO (Rungwa and Katavi-Ugalla projects).
15) Train mushroom retailers in species identification, in properly preserving and stocking mushrooms, and in quality and hygienic aspects (Rungwa and Katavi-Ugalla projects).
16) Carry out a workshop with all key stakeholders and resource persons from similar initiatives to define a market strategy for wild edible mushrooms from Katavi-Ugalla and Rungwa corridors (Rungwa and Katavi-Ugalla projects, lead tbd, Adansonia-Consulting).
17) Jointly organise with SIDO and TFS a one-week promotion booth at the principal market of Tabora supported by a media campaign (tv, radio, newspapers) for promoting the consumption of wild edible mushrooms (Rungwa and Katavi-Ugalla projects, lead tbd, Adansonia-Consulting); if funds and staff available smaller campaigns could be led in Mapanda, Inyonga and Sikonge.
18) Testing market demand in Tabora (and possibly other cities) for properly dried and packed mushrooms supported by a market promotion campaign (Rungwa and Katavi-Ugalla projects, lead tbd).
19) Conduct a nutritious analysis of the main edible mushrooms (fresh and dried) at TARI Tumbi in Tabora (Rungwa and Katavi-Ugalla projects, lead tbd).

[2] Approximate number of interviews in brackets.
[3] Only registration of mushroom groups was done for most of the mushroom groups.
[4] Only done by the Rungwa Corridor project.
[5] Only one simple mobile solar dryer produced in Inyonga (Katavi-Ugalla corridor project).

20) Establish a labelled photo library of mushrooms sorted by genus and species (Adansonia-Consulting).

21) * Purchase of 1 Tanzanian mushroom book (Katavi-Ugalla project) and 2 Zambian mushroom books Härkönen et al. 2003, 2015.

22) Purchase 2 moisture meters for the projects to better survey the drying process.

23) Support the creation (Katavi-Ugalla Project) and functioning of a mushroom marketing association in each project area for facilitating the organisation of an added-value chain (e.g. mushroom depots, transport, regular exchange within and between mushroom pickers, middlemen, and retailers) (Rungwa and Katavi-Ugalla projects).

24) (*)[6] Ensure systematic communication within the projects, between the projects and ADAP, and with key stakeholders (all).

25) Elaborate and implement a monitoring system for mushroom value chain (actors contact data, quantities of mushrooms harvested, consumed and sold by members of mushroom groups) (Rungwa and Katavi-Ugalla projects, lead tbd).

26) Include recommendations in annual and monthly planning of project activities and include the responsibility of each activity (Rungwa and Katavi-Ugalla projects).

27) (*)[7] Regular organisation of video conferences to discuss progress in the implementation of activities (ADAP and Adansonia-Consulting).

Table 4. Tentative timetable for promoting and marketing activities of wild edible mushrooms for both ADAP projects

Activity	Season 2022		Off-season 2022			Season 2022/23		
	F	M/A	M/J	J/A	S/O	N/D	J/F	M/A
1)* Proceeding training of mushroom pickers								
2) Mapping mushroom middlemen								
3)* Supplement market survey								
4) Purchase organic baskets								
5) Regular exchange with SIDO on progress made in mushroom value chain								
6) (*) Register all mushroom groups at district level and clarify with TFS permits								
7)* Printing and dissemination of mushroom leaflets								
8) Elaboration of article for ethno-mycological journal								
9) (*) Joint on-site testing of solar dryers								
10) (*) Production of simple mobile solar dryers								
11) Mutual visits between our mushroom groups and Tabora producer groups								
12) Preservation tests (shelf life) of fresh mushrooms								
13) Identification of appropriate								

[6] Ongoing

packaging and labelling of dried mushrooms (with SIDO)								
14) Training mushroom groups (drying, packaging, quality and hygiene, organisational and business issues) with SIDO								
15) Training of retailers in identification, preserving, quality and hygiene and business issues with SIDO								
16) Market strategy workshop with key stakeholders								
17) One-week promotion booth at Tabora								
18) Testing market demand for properly dried mushrooms								
19) Mushroom nutritious study at TARI Tumbi in Tabora								
20) Establish a labelled photo library								
21)* Purchase of mushroom books								
22) Purchase of 2 moisture meters								
23) Creation and functioning of mushroom association								
24) (*) Ensure systematic communication								
25) Monitoring system for mushroom value chain								
26) Inclusion recommendations in annual and monthly planning								
27) (*) Regular organisation of video-conferences								

7. References

AGCD (1994) Les champignons comestibles de l'Ouest du Burundi - UBWOBA No. 34, Coopération Belge, 123 p.

Badou, S., De Kesel, A., Raspé O., Ryberg, M., Guelly, A. & Yorou, N. (2018) Two new African siblings of Pulveroboletus ravenelii (Boletaceae). *MycoKeys* 43: 115–130. doi: 10.3897/mycokeys.43.30776; http://mycokeys.pensoft.net

Bloesch, U. (2020) Abundance and marketing potential of wild mushrooms. Community-based forest management of the Rungwa corridor. ADAP, Geneva.
Bloesch, U. (2021) Co-management of the Katavi – Ugalla corridor forests Wild mushrooms of Mulele Hills Forest Reserve. Use and marketing potential (24 February – 10 March 2021).

Bloesch, U. (2022) Wild edible mushrooms from Western Tanzania. Leaflet. ADAP, Geneva.

Chelela, B., Chacha, M. & Matemu, A. (2014) Wild edible mushroom value chain for improved livelihoods in Southern Highlands of Tanzania. *American Journal of Research Communication*, 2 (8): 1-14.

DCED (2020, 6 April) Market systems and the poor. Retrieved from https://www.enterprise-development.org/implementing-psd/market-systems/

Forestry and Beekeeping Division (2007) Community based forest management guidelines. Ministry of Natural Resources and Tourism, Dar es Salaam.

Forestry and Beekeeping Division (2013) Joint Forest Management Guidelines. Ministry of Natural Resources and Tourism, Dar es Salaam.

Härkönen, M., Niemelä, T. & Mwasumbi, L. (2003) Tanzanian mushrooms. Edible, harmful and other fungi. *Norrlinia* 10: 1-200.

Härkönen, M., Niemelä, T., Mbindo, K., Kotiranta, H. & Piearce, G. (2015) Zambian mushrooms and mycology. *Norrlinia* 29: 1-207.

Ndong, H., Degreef, J., De Kesel, A. (2011) Champignons comestibles des forêts denses d'Afrique centrale. Taxonomie et identification. *Abc Taxa,* Volume 10: 1-254.

USAID / RTI (2020) Promotion of Good Agricultural Practices (GAPs) and Access to Processing Technologies for Edible Wild Mushrooms. Landscape Conservation in Western Tanzania. RTI International.

Vyamana, V. (2021) Assessment of mushroom value chain, business feasibility, and business potential in Mbinga and Nyasa Districts. FORVAC Technical Report.

Annexe A: Terms of Reference

Training of mushroom groups and marketing of edible mushrooms

Terms of References

1. Background information

The Katavi-Ugalla and Rungwa River corridor projects aim to support and accompany villages that border Mlele and Rungwa river Forest Reserves in establishing co-management of these reserves in order to ensure a sustainable biodiversity conservation as well as offering more opportunities to the local communities through, developement of income-generating activties from forest products. The projects will be implemented along two lines, the first aiming to facilitate the establishment of village institutional structures for the management of the reserves, the second to support the development of income-generating activities for the benefit of the neighboring communities focusing on honey and wild edible mushrooms.

In a preparatory study, Dr Urs Bloesch from Adansonia Consulting carried out two field surveys in March 2020 and February/March 2021 focussing on (a)the inventory of wild edible mushrooms and their current uses in both project areas and (b) their marketing potential.The present terms of reference for a second study focusses on the training of mushroom groups and on the development of an added-value chain for wild mushrooms for both projects. Then we expect an intensive marketing study to follow after this stage.

2. Objectives

A. Meet the key stakeholders (SIDO, TFS, TBS, etc.) to sum up all the requirements for successfully marketing of wild edilbe mushrooms.
B. Elaborate a strategy for an added-value chain for wild edible mushrooms considering all regulations for picking and selling mushrooms.
C. On-the-spot training of ADAP's trainers and head of the mushroom pickers groups in properly picking, transporting, preserving and stocking mushrooms and in the correct handling of solar dryers and packaging of dried mushrooms demonstrated practically with mushroom pickers from two villages in each project area.

1. Training of mushroom pickers

Once trained and having practised in two villages of each project area, the trainers will then train the other mushroom groups. This first training will be given only to people who already practise mushroom picking to avoid poisoning.

The groups of mushroom pickers will be from:

- Utende, Mgombe, Kanoge, Wachawaseme, Mtakuja, Kaulolo, Nsenkwa and Masigo (Katavi-Ugalla project)
- Ipawaga, Mapili, Ilunde, Isegenezya, Mwenge, Mkola, Mgambo (Rungwa River project)
- Mwitikio, Majojoro, Kapumpa, Kintanula, Mwamagembe (WCS)

2. Implementation of the consultancy

Field work : January 2022
Follow-up and regular exchanges wit the staff: January to May 2022
Reporting requirement: short verbal debriefing to the project team and TFS officer or District Forest Officer after accomplishing the field work.
Report: The consultant will evaluate the training, elaborate guidelines to reach the markets and and give recommendations in two reports (one for ADAP projects, one for WCS funding) in English language before May 2022.
Means of work in the field: the car of the project or motorbikes will be at the disposal of the consultant for his field work; Village Game Scouts and technical assistance staff of the project will be available to support the training. In addition, the project will ensure the participation of a TFS and SIDO officer for at least some days.

3. ADAP's role to accompany the consultancy

Material purchased for the consultancy : cotton bags/baskets, containers, two dryers (one by project), vacuum seeling machines, plastice bags, printed leaflets in Swahili and English.
Activities undertaken by field staff before the consultancy:

1. Selection of one skilled mushroom picker in each group to become trainers
2. Clarification of the picking permits with TFS
3. Consolidation of mushroom pickers/formation of groups for Kintanula and Mwamagembe as well as Ipwaga and Mapili
4. Mapping of middlemen and their purchase and selling contacts

4. Proposal

The proposal should:

- Present the methodology
- Present the topics of the training
- Give a planning
- Establish the costs separated by project and funding (Katavi-Ugalla corridor in CHF, Rungwa Corridor in CHF, WCS funds in USD)

The proposal should be submitted before 21 December 2021 to sandy@adap.ch

Annexe B: Organisations / people met during the consultancy

Organisation	People met
Amici Design	Deborah Da Silva, founder / creative director Alex Lasway, designer & website developer
Amory supermarket	Kaidi Nassur, employee
ADAP Katavi-Ugalla Project	Twinzi Henrico, acting project manager Abdala Liingilie, natural resources officer Anthony Julius, driver
ADAP Rungwa Corridor Project	Romanus Mwakimata, project manager Matana Levi, livelihood and natural resources officer Gabinus Tandika, driver Saidi Haji, driver
Local authorities and technical services	Msalika Robert Makungu, RAS, Tabora Fred Masanja, DFO Sikonge Jacob Kamili Kalibili, WEO Ilela Huruma Mbisi, acting VEO Mgombe Mathew Edward Juakali, VEO Mtakuja Josephate Scolasika , VEO Utende
SIDO	Salome Mwasomola, acting Katavi regional manager Charles Iganja, engineer, Katavi Samwel Neligwa, regional manager Tabora Ashura Mwazembe, trainer of trainers, Tabora Abubakary Yusufu Mnenta, credit officer, Tabora
TARI Tumbi	Emmanuel Mrema, Director
TFS	Ebrantino Mgiye, zonal commander western Tanzania Abas Gwambaye Ngalagale, forest officer Mlele

Annexe C: Revised market questionnaire

First Section: Introduction

1. Name …….

2. Sex

Male ( )
Female ( )

3. Age

15-29 ( )
30-44 ( )
45-54 ( )
55-64 ( )
65-74 ( )
75-84 ( )
85-94 ( )

4. What is your occupation?

a) Your main occupation ……
b) Additional occupation (if any) ……
c) When did you started selling mushroom?.....

5. Contacts?.....

6. Location of the business (market, shop, alongside the road, any other places)
……

Second Section: Mushroom Information

7. What are the mushroom species you are selling?
……
……

8. Where do you get the mushrooms and from whom? (pickers or middlemen)
……
……

9. How much mushrooms are you selling per day and per species in a good day?

No	Fresh mushrooms	quantity
1		
2		
3		

No	Dry mushrooms	quantity
1		
2		
3		

10. In which month (s) are you selling mushrooms?

…….

11. What is the buying and selling price per species and selling unit (fresh/dry)?

Mushroom species	Price	Rain Season		Dry Season
		Fresh mushrooms	Dried mushrooms	Dried mushrooms
	Buying price			
	Selling price			
	Buying price			
	Selling price			
	Buying price			
	Selling price			
	Buying price			
	Selling price			

12. Who are the customers?

……

13. What are you doing with not sold fresh mushrooms?

……

……

14. What is the shelf time of fresh and dried mushrooms?

No	Mushroom species	Shelf time	
		Fresh	Dried
1			
2			
3			
4			
5			

15. In which month (s) mushrooms are highly demanded?

…….

16. What are the mushroom species with high demand? (fresh and dry).

…….

…….

…….

17. What are the problems you are facing in that mushroom business?

……

……

18. How mushrooms business could be better promoted?

……

……

Annexe D: Species list from Mlele and Sikonge districts (from forays and discussions of 3 surveys, 22/5/22)

Mushroom species	Kinyamwezi	Kikonongo	Swahili	Edibility	Locality/habitat; remarks
Agaricaceae					
Agaricus aff. *arvensis*	*Lolemilwa ng'ombe, Umtegeta*	*Umtegeta*, *Umande*	*Ulimi wa ng'ombe*	* d	Kululu forest area, Rungwa River FR, Mulele Hills FR; cultivated land on dung
Agaricus bingensis	*Wasefu, Utapa*	*Unvamiti*, *Unyang'ombe*		* d	Rungwa River FR, Mulele Hills FR; on termitaria in forest and agricultural fields
Agaricus trisulphuratus				not eaten	Mulelel Hills FR
Agaricus sp. 1		Umkwilima		not eaten	Mulelel Hills FR
Agaricus sp. 2				not eaten	Kululu forest area
Chlorohyllum molybdites		*Unyang'ombe*		* d[5]	Mulele Hills FR
Coprinus cinereus sensu lato	*Umpumwe*	*Utapa?*		* d	Kululu forest area, Mulele Hills FR
Lepiota sp. 1				not eaten	Mulele Hills FR (slit in der outer wall of a house)
Lepiota sp. 2				not eaten	Rungwa River FR; tufted on dead wood
Macrolepiota dolichaula	*Kaumwenda*			not eaten	Rungwa River FR, Mulele Hills FR
Macrolepiota africana				not eaten	Msimbo FR
Amanitaceae					
Amanita afrospinosa	Ukivuu			not eaten	Rungwa River FR, Mulele Hills FR
Amanita loosei	Ulelema	Ulelema		*** d	Market Tabora, Kululu forest area, Rungwa River FR, Mulele Hills FR; beginning rainy season
Amanita mafingensis	Umgongolo[1a], Wisani, Unyungwe	Umgongolo[1a]		* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR; Tabora market; early rainy season
Amanita masasiensis	Umgongolo[1a]	Umgongolo[1a], Umafuta		* d[5]	Kululu forest area, Mulele Hills FR
Amanita miomboensis				not eaten	Kululu forest area
Amanita aff.rubescens?				not eaten	Wembele hunting camp; Mulele Hills FR, Rungwa River FR
Amanita tanzanica	*Umgongolo*[1a]	*Umgongolo*[1a]		* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR; early rainy season
Amanita sp. 1	Umpunda			* only d	Rungwa River FR

Amanita sp. 2				not eaten	Mulele Hills FR
Boletaceae					
Afroboletus luteolus				not eaten	Kululu forest area, Rungwa River FR, Mulele Hills FR
Boletus pallidissimus				not eaten	Kululu forest area, Rungwa River FR, Mulele Hills FR
Boletus spectabilissimus[3]		*Ndui*		not eaten	Kululu forest area, Rungwa River FR, Mulele Hills FR
Suillus granulatus	*Ikikuku*[1c]	*Ikikuku*[1c]		not eaten	Wembele hunting camp, Mulele Hills FR
Suillus sp. 1				not eaten	Mulele Hills FR
Boletus sp. 1				not eaten	Kululu forest area
Boletus sp. 2				not eaten	Kululu forest area
Boletus sp. 3				not eaten	Rungwa River FR, Mulele Hills FR; context and tubes turn quickly blue when exposed
Boletus sp. 4				not eaten	Mulele Hills FR
Boletus sp. 5		Ndui		not eaten	Mulele Hills FR
Boletus sp. 6				not eaten	Mulele Hills FR
Boletus sp. 7				not eaten	Mulele Hills FR
Boletus sp. 8				not eaten	Mulele Hills FR
Boletus sp. 9				not eaten	Rungwa River FR
Boletus sp. 10				not eaten	Msimbo FR
Boletus sp. 11				not eaten	Mulele Hills FR
Boletus sp. 12				not eaten	Rungwa River FR
Pulveroboletus africanus				not eaten	Msimbo FR, Rungwa River FR
Cantharellaceae					
Cantharellus addaiensis	Wijogoro (nyekundu) Kakungulumee	Kakungulumee, Umgongo, Ukungulume	Wange nyekundu	* d[5]	Wembele hunting camp, Kululu forest area, Rungwa River FR, Mulele Hills FR
Cantharellus afrocibarius			Wange njano	*** d	Rungwa River FR, Mulele Hills FR (fleshy species like C. isabellinus, clumped)
Cantharellus congolensis	*Utowa*, *Wikese*	*Utowa*, *Ungukwe*		** d[5]	Tabora market, Kululu forest area, Rungwa River FR, Mulele Hills FR
Cantharellus isabellinus	Ungukwe, Wikese	Ungukwe, Wange wapee	Wange mweupe	*** b?&d	Market Tabora, Kululu forest area, Rungwa River FR, Mulele Hills FR
Cantharellus platyphyllus	Wijogoro (nyekundu) Kakungulumee	Kakungulumee, Wange wazaa	Wange nyekundu	*** d	Wembele hunting camp, Kululu forest area, Rungwa River FR
Cantharellus pseudocibarius	Wijogoro (njano)		Wange njano	**	Wembele hunting camp (small cap, slender stipe, like C. addaiensis but yellow; former Cantharellus sp. 1)
Cantharellus	Ungukwe			***	Mulele Hills FR, Tabora market

rufopunctatus					
Cantharellus symoensii	Wijogoro Wikese? Kakungulumee	Kakungulumee, Wange wazaa / wanjano	Wange nyekundu	***	Wembele hunting camp, Kululu forest area, Rungwa River FR, Mulele Hills FR; Mpanda market
Cantharellus sp. 2				?	Rungwa River FR (caramel colour)
Cantharellus sp. 3			Wange nyekundu	?	Mulele Hills FR (bright red cap and bright yellow stipe)
Cantharellus sp. 4			Wange njano	**	Mulele Hills FR (slender stipe, caps not clumped)
Cantharellus sp. 5					Mulele Hills FR (brownish)
Cantharellus sp. 6		Umgongo		**	Mulele Hills FR (yellow / red, small)
Cantharellus sp. 7					Mulele Hills FR (red, partially white stipe)
Coprinaceae					
Coprinus sp. 1					Kululu forest area
Coriolaceae					
Cyclomyces tabacinus[2]				not eaten	Kululu forest area
Funalia polyzona[2,7]	*Mavikuku*	*Mavikoko*		not eaten	Kululu forest area, Mulele Hills FR
Pycnoporus sanguineus				not eaten	Wembele hunting camp, Kululu forest area, Rungwa River FR, Mulele Hills FR; on dead wood
Trametes sp. 1[2]	*Vikukoa*	*Vikukoa*		not eaten	Mkola; on dead wood
Trametes sp.2[2]	Ikikuku[1c]	Ikikuku[1c]		not eaten	Mkola; on dead wood
Clavulinaceae					
Clavulina albiramea	Ukalezuu	Umwenda	Kilezu chamwa guku, Ulim wa ng'ombe	** d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR; whitish creamy (formerly C. wisoli)
Clavulina sp. 1	Mandevu, Umwenda			*	Rungwa River FR; pinkish orange
Cortinariaceae					
Cortinarius aff.violaceus					Mlele BKZ
Gymnopilus aff.penetrans					Kululu forest area
Ganodermataceae					
Humphreya eminii				not eaten	Wembele hunting camp, Kululu forest area
Ganoderma sp. 1				not eaten	Kululu forest area
Hygrophoraceae					
Hygrocybe aff.				not eaten	Mulele Hills FR

persistens					
Hymenochaetaceae					
Phellinus rimosus[2]	Chikukuu	Nduvi		not eaten	Rungwa River FR, Mulele Hills FR
Phellinus sp. 1				not eaten	Mulele Hills FR
Pluteaceae					
Volvariella volvacea		*Unjwa ng'ombe*		* d	Kululu forest area, Mulele Hills FR
Pleurotaceae					
Pleurotus tuber-regium				not eaten	Mulele Hills FR
Polyporaceae					
Hexagonia sp. 1				not eaten	Rungwa River FR (dry sample)
Polyporus sp. 1				not eaten	Rungwa River FR
Russulaceae					
Lactarius denigricans	*Uskowha, Ukikova*[1d]	*Uskowha, Usikobha*[6], *Utovaa*[6]	*Umpalala wa dume*	* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius densifolius	*Uskowha, Utovaa*[6]	*Uskowha, Vikova, Ungusu, Ukikova*[1d]		** d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius edulis	*Uskowha*	*Uskowha, Utovaa*[6], *Vikova Ungusu Ukikova*[1d], *Machikova*		** d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius heimii	Uskowha	Uskowha, Usensuka		* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius kabansus[4]	Umpalala	Umpalala		*** b?&d	Wembele hunting camp, Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius luteopus	Makanga lutova	*Usekese*, *Kamkungulu*		* d	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius pumilus			Umulandula[8]	* d[5]	Rungwa River FR, Mulele Hills FR
Lactarius medusae	*Uskowha*	*Uskowha, Usensuka*		* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius tanzanicus	Ulimba, Usensuka	Usensuka	Molalile[8]	* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Lactarius volemoides	Usensuka,			* d[5]	Wembele hunting camp, Rungwa River FR, Mulele Hills FR

Lactarius xerampelinus	Ukakeku Ukikova[1d] Usikobha[6]	Ukikova[1d]		** d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR, Msimbo FR; Mpanda, Tabora markets
Lactarius sp. 1				not eaten	Mulele Hills FR
Lactarius sp. 2		Usekese		not eaten	Mulele Hills FR
Lactarius sp. 3		Ukikova[1d]		not eaten	Mulele Hills FR; fishy smell
Lactarius sp. 4		Umkusu		not eaten	Mulele Hills FR
Lactarius sp. 5				not eaten	Mulele Hills FR (clear viscid milk)
Lactarius sp. 6				not eaten	Market Tabora
Lactarius sp. 7				not eaten	Mulele Hills FR
Russula albofloccosa				not eaten	Wembele hunting camp, Rungwa River FR, Mulele Hills FR
Russula cellulata	Utyelele			* d[5]	Rungwa River FR, Mulele Hills FR
Russula ciliata		Umaharage, Umgongo		* b&d	Rungwa River FR, Mulele Hills FR
Russula compressa		*Umaharage*		* d	Kululu forest area, Rungwa River FR, Mulele Hills FR
Russula harkoneniana				not eaten	Rungwa River FR, Mulele Hills FR
Russula congoana	Umpotya	Umaharage		* d[5]	Kululu forest area, Mulele Hills FR
Russula hiemisilvae		Iliminya ng'ombe		* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Russula oleifera				not eaten	Msimbo FR
Russula aff. roseovelata		*Lolemilwa ng'ombe*, *Umsuzi*		* d[5]	Rungwa River FR, Mulele Hills FR; on pastures
Russula roseoviolacea	Ukakuva, Futwambula Uyungwe	Ukakuva, Iliminya ng'ombe	Ulimi wa ng'ombe	* d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR; market Tabora
Russula sejuncta				*	Rungwa River FR
Russula sp. 1	Uyungwe ng'ombe	Uyungwe ng'ombe		***	Kululu forest area
Russula sp. 3				not eaten	Msimbo FR
Russula sp. 4				not eaten	Mulele Hills FR
Russula sp. 5				not eaten	Rungwa River FR
Schizophyllaceae					
Schizophyllum commune		*Makikuku*		not eaten[2]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Sclerodermataceae					
Scleroderma verrucosum				not eaten	Kululu forest area, Rungwa River FR

Sclerodermum sp. 1				not eaten	Rungw River FR
Scleroderma sp. 2				not eaten	Kululu forest area
Tricholomataceae					Termitomyces on termitaria mainly on cultivated land
Termitomyces aurantiacus	*Untele, Utyelele,Umtuli*	*Utyelele, Umtuli, Umswale*		** d	Kululu forest area, Rungwa River FR, Mulele Hills FR
Termitomyces clypeatus	*Utyelele*	*Utyelele, Ufumapatali, Umtuli, Uvumbu*		** d	Kululu forest area, Rungwa River FR, Mulele Hills FR
Termitomyces eurrhizus		*Ufumapatali, Uswale, Uvumbu*[1b]		** d	Rungwa River FR, Mulele Hills FR
Termitomyces letestui	*Uhima, Ufumapatali*	*Uhima,Uswale Ufumapatali Uvumbu*[1b]		** d	Market Tabora, Kululu forest area, Rungwa River FR, Mulele Hills FR
Termitomyces microcarpus	Kansolele	Kansolele		*** d	Tabora, Sikonge markets, Kululu forest area, Rungwa River FR, Mulele Hills FR
Termitomyces singidensis	*Uvumbu*[1b]	*Vusenge*		** d[5]	Kululu forest area, Rungwa River FR, Mulele Hills FR
Termitomyces tyleranus			*Umtuli*, *Utapa*	** d	Kululu forest area
Termitomyces sp. 1					Tabora town along foot path
Termitomyces sp. 2		Umkwilima		** d	Rungwa River FR; on dry wood!
Tricholoma sp. 1				not eaten	Mulele Hills FR
Family not known	*Kibamila mbanga*	*Kibamila mbanga*			Kululu forest area
	Ukema wifulele			?	Kululu forest area
			Def ya babu	?	Kululu forest area
			Kidevu cha babu	?	Kululu forest area
		Utapa		** d	Mulele Hills FR (growing on rotten woods / roots)

123 species in total whereof 90 recorded in the field; 52 edible species

Legend:
Locality: miombo woodlands when not otherwise specified;
Mushrooms written in *italic*: not seen in the field / market;
b = edible after parboiling; d = also eaten dried
1a) Mgongolo = Umgongolo; plural Wigongolo; 1b) Plural Mavumbu; 1c) Plural Makikuku; 1d) Ukikova / Ukikoba: plural Makikova; 1e) Ungukwe = Ukukwe / plural Mkukwe
2) Powder used against cough;
3) When touching this mushroom the person will be lost in the forest;
4) Can be eaten raw.
5) Eaten in some villages, but not in others
6) Utovaa = Utobha?; Usikobha = Usikova
7) For treating pancreas sickness
8) Kiha language