

ORCHID CONSERVATION PROJECT

Development of Conservation Strategies for the Wild Edible Orchid in Tanzania

**Progress report
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List of acronyms

DALDO	District Agricultural and Livestock Officer.
DNRO	District Natural Resources Officer.
GIS	Geographic Information System.
GPS	Geographic Position System.
HQ	Head Quarters.
NHT	National Herbarium of Tanzania.
NPGRC	National Plant Genetic Resources Centre.
TANAPA	Tanzania National Park Authority.
TPRI	Tropical Pesticides Research Institute.
WCS	Wildlife Conservation Society.

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Executive summary

The wild edible orchid species in Tanzania constitutes valuable genetic resources upon which the rural communities depend for their livelihood. These species provides food and medicines to the communities. As a result of these non regulated uses, the plants in the wild are threatened to extinction. This study was conducted with the aim of promoting in situ and ex situ conservation of the orchid through enhancing the rural community participation. During the report period, the project surveyed the conservation status and the distribution of the orchid in Makete and Mbinga districts, developed the management intervention strategies, developed orchid propagation techniques and created awareness among the rural communities in the area. The study observed high diversity of the edible orchids in Makete as compared to Mbinga, as well in Makete the Kitulo Plateau had the highest number of orchid species compared to other sites, though some orchids species grows out sides this area. On the other hand, the Liwili Kitesa Forest had the largest number of species in Mbinga, however, the forest is not well protected and the orchids are not the key stone species to warrant more conservation measures. The forest has high diversity of other species including the bird species and colobus monkey that if promoted could enhance the uplifting of the conservation status of the forest. The study has identified some of the rare orchid species such as *Harbenaria occlusa* and recommended the need to promote local communities participation in orchid conservation through promoting sustainable use, monitoring of the orchid populations in Makete, biodiversity survey in Liwili Kitesa Forest and uplifting of its conservation status.

1.0. INTRODUCTION

1.1. Background

The Orchidaceae is a large family of about 20,000 epiphytic and terrestrial non-wood perennial plant species. The family is very popular due to attractive color and shape of its flowers as a result, the plants have great ornamental value forming multibillion dollar horticultural industries in Europe and America (Cribb 2004). In Tanzania and some other countries in the southern region of Africa, the orchids are used as food (Kikande) and medicine for the rural communities (Temu and Chihongo 1998; Ruffo 2000; Hamisy and Millinga 2002; Hamisy 2005). The tubers are collected from the wild and processed into a meatless sausage (Kikande) which is consumed locally and sometimes sold in the local markets. Also the tubers are used in the preparation of soup and are included in some tourist hotels menu in Zambia. Due to its potential uses, local trades in the southern highlands of Tanzania have been increasing so fast and some of the products are crossing the border into the neighboring countries (Zambia and Malawi). A sack of orchid's tubers is sold at 250,000 – 300,000 Tanzanian shillings as compared to the 40,000 – 50,000 for the same volume of irish potatoes the major cash crop in the area, hence contributing substantially into financial earning to the poor local communities in Makete and Mbinga Districts in Tanzania.

Regardless of large number of the orchids found in the southern highlands of Tanzania (Devonport & Ndangalas 2003; Hamisy 2005), only few genera and species constitute the edible orchids. Hamisy 2005, identified about five species used a food in Makete and four species used in Mbinga district. These genera are the *Satyrion* , *Disa*, *Habenaria* and *Roeperachian*.

The wild edible orchids in Tanzania grow in the mountainous and grassland areas, where high exploitation pressure is reported to threaten the future existence of these species (WCS 2003; Hamisy 2005). The threats are caused by several a factor among which includes its method of exploitation. The tubers which are the main vegetative part of many edible orchids are dug from the ground and sometimes the collection is associated with forest burning (Hamisy and Millinga 2002; Hamisy 2005). Apart from tuber collection, some of the edible orchid species does not produce flowers as a result removal of tubers makes them more vulnerable to extinction. Convention of the forest/ grassland areas into agricultural land has been the most common phenomenon in Tanzania, as a result of this practice, most of the orchid habitats have been converted into agricultural land and plantation forestry land hence displacing the orchids.

1.2. Main objective

The main objective of the study is to promote conservation of the edible wild orchids in Tanzania through integration of in situ and ex situ conservation

strategies and promote local communities participation in the orchid conservation.

The specific objectives are,

- To develop effective *in situ* conservation and management interventions for the edible wild orchids in Mbinga and Makete Districts in Tanzania.
- To develop appropriate *ex situ* conservation strategies for the edible orchids.
- To promote local communities participation in the orchid conservation.

2.0. THE STUDY AREA

The study was carried out in the Southern Highland areas of Tanzania (Makete district in Iringa region and Mbinga District in Ruvuma region) (Fig. 1). The Southern Highland Area of Tanzania lies within the Zambezi phytogeographic region, with some area falling in the Afromontane region such areas includes the Poroto, Kipengere mountain range and the Matengo plateau.

2.1. Makete District

Makete district is one of the five districts of Iringa region, the district covers 5000 sq km, located between 8° 45' and 9° 45' E and 33° 45' and 34° 50' S. The district has two agro ecological zones, namely the Highlands and the Lowlands. Kitulo plateau belongs to the highland zone at 2310 - 2800 m.a.s.l. The plateau is reported to have about 350 species of the vascular plants including more than 45 terrestrial orchid species many of which have restricted distributions. 31 orchid species are endemic to Tanzania of which 15 species are endemic to Kitulo/ Kipengele and 10 species are restricted to Kitulo/ Poroto (Davenport and Ndangalasi 2003). The climatic condition of the area is characterized by high rainfall season occurring in November - May and dry season during June - October.

2.2. Mbinga District

Mbinga is one of the four districts in Ruvuma region. The district lies between 10° 15' S - 11° 34' S latitudes and 34° 24' - 35° 28' E longitudes with a total area of 8,321 sq km (Temu and Chihongo 1998). Topographically the district lies between 600 - 1,900 masl with four main agroecological zones (Mountainous highlands, rolling hills, Hagati plateau and the coastal strip (Schmied 1989). The natural vegetation of Mbinga is characterized by Zambezi miombo woodlands, Zambezi swamps and riparian forests, Afromontane rain forest and the Afro montane un defined forest (Temu and Chihongo 1989).

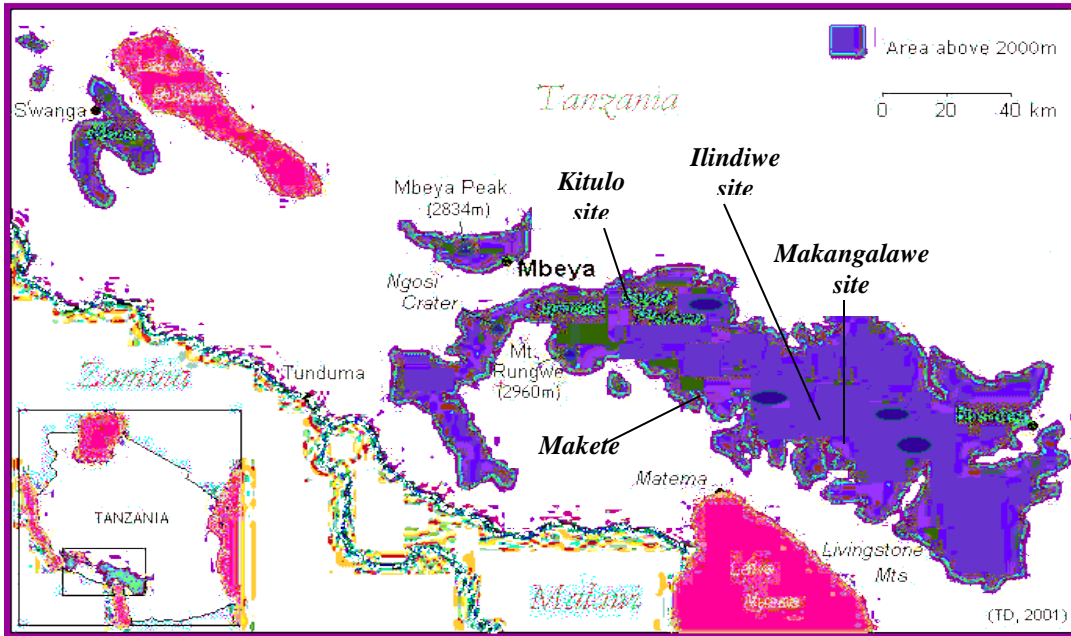


Fig. 1. Map of the Southern Highlands of Tanzania, showing the study sites in Makete District

3.0. ACTIVITIES CARRIED OUT DURING 2006/2007

3.1. Orchid survey/ Inventory in Makete and Mbinga Districts

Field surveys were carried out during August (06 – 25th) 2006 in Makete and Mbinga Districts in Tanzania. The aim of the survey was to determine and map the actual distribution and conservation status of the wild edible orchids in the area. Table one show the details of the study sites.

Table1. Orchid survey sites in Makete and Mbinga districts

District	Village/ Forest	Latitude (S)	Longitude (E)	Altitude (Masl)
Makete	Kitulo NP	09° 06' 195''	033° 52' 305''	2735
	Makangalawe	09° 20' 810''	034° 20' 528''	2400
	Ilindiwe	09° 14' 502''	034° 14' 609''	2370
Mbinga	Mpepo	11° 20' 092''	035° 30' 310''	1500
	Liwili Kitesa	09° 15' 042''	034° 20' 360''	1590

The study involved semi structured interviews with the District Natural Resource officers (DNRO) both in Makete and Mbinga, the Kitulo National Park authority, Kitulo Dairy Farm Authority and the village leaders in Makangalawe, Ilindiwe, Mpepo and Mpapa villages. The interviews lead into the identification of key informants (local guides) who participated well in the field surveys. Modified Whittaker plots were used in the data collection (Comiskey *et al.* 1999; Stohlgren *et al.* 1995: 1998) in which, a plot of 20 m by 50 m (0.1 ha) were established in each site, within which ten sub-plots (2 m by 5 m) were established just inside the periphery of the main plot. Orchid data were collected from four plots in a site determined by a table of random numbers. Plot locations were marked using GPS. The data collected included;

- The available orchid genera and species.
- Orchid diversity and abundances.
- Notes on morphological characteristics.
- Orchid phenology.

Herbarium specimens were collected and taken to the National Herbarium of Tanzania (NHT) for further identifications. Levers of human impact as were as other factors were collected as well.

3.2. Development of the orchid management plans

Meetings were conducted with the DNRO, village leaders (Makangalawe, Ilindiwe) and the Kitulo National Park Authorities in Makete as well as with the DNRO and village leaders (Mpepo and Mitawa) in Mbinga in September (11th – 30th) 2007. The information generated during the field surveys were presented to the District administrative authorities and village leaders in Makete and Mbinga.

3.3. Development of orchid propagation techniques

The orchid tubers were collected during September (11th - 30th) 2007 and brought to the NPGRC for the *ex situ* management trials. The tubers were characterized for tuber length and width then planted into plastic containers using different germination medium (Volcanic soils and Sand soils). The data to be collected includes: days to germination (emerging of two leaves), Days to flowering, days to maturity (drying out), number of tubers per plant and per species, tuber sizes. The seeds will be collected for the seed establishment trials.

3.4. Awareness creation

During the same period (11th - 30th Sept 2007) the meetings were carried out with the District administrative officials (DNROs, DFOs, DALDO), as well as with the village leaders in the study villages in Makete and Mbinga districts (Table 1). The aims of the meetings were to raise awareness and discuss the wild edible orchid conservation needs in the area. In each study village, a group of farmers (ten people in each village) were selected to form the groups which thereafter, received training on the orchid status and needs for conservation. During the same period, local knowledge on orchid preparations and conservation were collected (Annex 6)

4.0. RESULTS AND DISCUSSIONS

4.1. Orchid species diversity and distribution in Makete and Mbinga Districts

This study has recorded a total of 20 orchid species (both edible and non edible), belonging to six genera in Makete and Mbinga districts, Southern Highland areas of Tanzania. This result has encountered low number of orchids compared to the earlier report by Davenport and Ndangalasi (2003) who identified the area as the orchid richest in the country with more than 45 orchid species. The noted variation could be attributed by limited sampling intensity or disappearance of some of the species the fact which needs further investigation. Of the recorded species, thirteen (65 %) from five genera (*Disa*, *Satyrium*, *Habenaria* *Roeperochian* and *Brachycorythis*) constitute the wild edible orchids in Makete and Mbinga districts, Tanzania (Table 2), although during scarcity some of the non edibles species are collected as well.

Table 2. Identified wild edible orchids in Makete and Mbinga districts, Tanzania.

District	Local Name	Scientific name
Makete	Chukande kijike (Lidala)	<i>Disa robusta</i>
	Chikande kidume 2 (Ligosi)	<i>Satyrium antherstonei</i>
	Chikande Ligosi 3 (Kidume)	<i>Satyrium robusta</i>
	Chikande	<i>Satyrium acutirostrum</i>
	Ligosi	<i>Brachycorythis pleistophylla</i>
	Liseku	<i>Disa erubescens</i>
		<i>Disa achrostachya</i>
		<i>Eulophia schweifurthii</i>
		<i>Habenaria xanthochlora</i>
		<i>Satyrium buechananii</i>
	<i>Satyrium classicaule</i>	
Mbinga	Ntetemera	<i>Disa hametopetala</i>
	Sunzalapai	<i>Satyrium buechananii.</i>
	Suheng'enyule	<i>Disa zombica</i>
	Simbegi	<i>Satyrium classicaule</i>
	Kaloba	<i>Roeperochian wentzeliana</i>

The genera *Satyrium* and *Disa* are the leading in numbers of the edible orchids (five edible orchid species each), while *Habenaria*, *Roeperochian* and *Brachycorythis* are represented by one edible species each. The edible orchid genera and species are represented by large numbers of individuals (60 % and 62 % respectively) compared to non edible (Table 3). Makete district had the highest number of both edible and non edible orchid genera and species compared to Mbinga, this is confirmed by Niet and Gehrke (2005) who reported the area to be considered as the centre of diversity for *Disa*, *Habenaria* and *Satyrium*.

Table 3. Proportions of the wild edible orchids in the study sites

Orchid typ	Genera	Kitulo	Makangalawe	Ilundwe	Liwili kitesa	Mpep	Totals	%
Edible	Genera	3	3	2	4	2	14	60
	Species	7	4	2	4	3	20	62
Non edible	Genera	2	3	3	1	0	9	40
	Species	2	3	3	1	0	9	38

Of the study sites/ villages, the highest species diversity was found in the Kitulo Plateau followed by Makangalawe in Makete and Liwili Kitesa Forest in Mbinga. This finding makes the Kitulo Plateau as an important site for orchid conservation, although some of the orchid species were found in other sites could not be found in Kitulo, hence some measures needs to be taken to ensure that those species found out side the conservation area are conserved as well. Further, Liwili Kitesa Forest had the highest number of both edible and non edible orchid species compared to Mpepo, also the species found here are were not found in Makete, making this area a potential for orchid conservation in Mbinga district. Although, the study recorded twenty species of the orchid found in the area, only 15 were found in the plots (Annex 1), this could be as a result of an even distribution or rarity.

The species *Satyrium neglectum* which is none edible was observed to be the most common in Makete and was found in both sites in Makete and Mbinga, while *Roeperochias wentzeliana* was very common in Mbinga. Three of the six edible orchids were confined to Kitulo, while one species (*Habenaria praestans*) was confined only to Makangalawe and Ilundwe in Makete district. Two species were found to be rare and confined to Kitulo and Makangalawe and represented by only one individual. These were *H. occlusa* and *E. schweinfurthii*.

Satyrium neglectum occurred across all the three sites in Makete though it was prevalent in Makangalawe. Five species occurred only in Kitulo. These were *Brachycorythis pleistophylla*, *Habenaria occlusa*, *Satyrium acutirostrum*, *Satyrium atherstonei* and *Satyrium buchananii*. Two species were confined to Makangalawe, i.e. *Disa ochrostachya* and *Eulophia schweinfurthii* while only one species, *Satyrium princeae*, appears confined to Ilindiwe. Cribb and Leedal (1982) describe *H. occlusa* to be confined to Kitulo and Mbeya peak, and reported the species is only found in the Southern Highlands and was first described in 1964 from a plant collected on the Kitulo plateau.

4.2. The orchid management plans

In Makete District, The Kitulo Plateau has been gazetted as the National Park and the communities living in the area has been relocated to other villages (Fig 2). This can be considered as an important step towards orchid and other biodiversity conservation, although some un authorized collections of the orchid were noted and also, the edible orchid populations have suffered a lot of loss due to the past activities in the area. Further, the edible orchids are highly destroyed by the burrowing animals and wild fires. During the study, it was agreed with the TANAPA authority that, the impact of changing management strategies on the plant species including the edible orchids be monitored for two years. As a result, monitoring plan was developed. The information to be generated will assist the Park Authority in the management of the Park.



Fig. 2. A photo of Kitulo National Park area showing the remains of the building after relocation.

On the other hand, in Mbinga, most of the orchids are found in unmanaged forests. Liwili Kitesa forest is the only available forest reserve and had the highest number of orchid species. The interviews with the DNRO, revealed the need for conserving the Liwili Kitesa Forest to secure the orchids and other biodiversity in the area. However, the orchids are not the key stone species to warrant the upgrading of the forest into maximum protection status by the government. In the study it was learned that, the forest has high diversity of other plant species, the area is a breeding area of the migratory birds as well as a hideout of the rare white colobus monkey which are highly hunted by the villagers in the surrounding villages. However, the said data is not well documented. Therefore, it was agreed that, gathering of the general biodiversity data of the forest could convince the policy makers to up grade the protection status of the forest, in this case, the orchids will in directly get the necessary protection. As a result, a plan for biodiversity survey of the Liwili Kitesa Forest was developed.

4.3. Orchid propagation trials

The propagation trials were established at the NPGRC and data collection is going on. The tubers characterization data shows variations in the length and width between species (Table 4). The tubers length ranged from 1 cm – 9 cm while the width ranged from 1.0 cm – 5.0 cm. *Satyrium volkensii* had the highest mean length (6.02 cm) and width (3.35 cm) followed by *Satyrium buchananii* (5.30 cm length and 2.60 cm width). These values have great potential on the orchid domestication and improvement. In terms of size, *Satyrium volkensii* and *S. buchananii* could be more preferable although other factors may play some parts in the farmers' preference.

Table 4. Characterization of the orchid tubers length and width

Collector NO.	Species Name	Tubers length (cm)		Tubers width (cm)	
		Mean	Range	Mean	Range
HS/ 7	Roeperochian wentzeliana	1.65	1.0 – 2.0	1.17	1.0 – 2.0
HS/6	Disa ochrostachya	4.47	3.0 – 6.0	2.57	2.0 – 3.0
HS/5	Satyrium acutirostrum	3.12	1.0 – 4.5	2.12	1.0 – 3.0
HS/4	Satyrium buchananii	5.30	3.0 – 9.0	2.60	2.0 – 4.0
HS/3	Disa robusta	4.90	2.5 – 8.0	3.00	1.5 – 5.0
HS/2	Satyrium atherstonei	3.20	2.5 – 4.0	2.25	2.0 – 3.0
HS/1	Satyrium volkensii	6.02	4.0 – 9.0	3.35	2.5 – 5.0

4.4. Awareness creation

The interview and meetings with the DNRO's DALDO's TANAPA and farmers helped to create awareness on the need to conserve the orchids in the area. This was followed by the establishment of farmer groups to be used to promote on farm conservation through further training on orchid propagation techniques following the accomplishment of propagation trials. It was learned that the local communities knows the importance of conserving the orchid and during collection period, they always collect tubers from the plants they describe as females and leaving the males who are fewer. However, during time of scarcity, collection is done to all the males and females. One brochure "The potential of Liwili Kitesa Forest for Conserving biodiversity in Mbinga District" was developed for awareness creation on the importance of conserving the forest for the benefit of the orchids and other biological diversity available there in.

Documentation of Kikande preparation procedures was carried out. This involves collection of the tubers, cleaning and removal of the vegetative buds. Pounding of the tubers. Preparation of the baking powder (burning of the bean straws). Cooking of the orchid flour using solution containing the local baking powder. When it is hard, the orchid is left over night to solidify. Then it is cut into small pierces and cooked with groundnut source (Annex 5).

5.0. Conclusions

The study recorded 20 orchids species in the area, a number which is lower than previous records (45), the fact about the variations is yet to be found.

High diversity of Orchids was observed in Makete compared to Mbinga. In Makete, the Kitulo Plateau had the largest number of orchid species compared to other sites suggesting that, the established of the Kitulo National Park will enhance the conservation of a large number of orchids although some of the species were found out site the reserve.

Although Liwili kitesa forest had low number of orchid species compared to Makete, the area had the highest number compared to Mpepo in Mbinga and has some species which are not available in Makete. However, the orchids are not the key stone species to warrant strong decisions. However, availability of other important species such as birds and white colobus monkey can be a strong support for the conservation of the area.

Apart of the establishment of the National Park, still some levels of orchid harvesting were observed, this indicated the need for involving the local communities surrounding the National Park in the conservations activities.

6.0. Recommendations

More surveys and monitoring are needed to identify all the available orchid species, and generate data for the park authority use in the management of the park.

Promote local communities participation in the conservation activities through promoting conservation and sustainable use through development of on farm management interventions.

Monitor the status of the orchid populations in Kitulo National Park after the gazetement of the reserve.

Establish the biodiversity status of the Liwili Kitesa Forest to convince the policy maker to change the conservation status of the forest.

7.0. References:

- Comiskey, J., Dallmeier, F. and Shahroukh, M. 1999.** Draft vegetation sampling protocols for the Selva Maya. Biological monitoring in the Selva Maya. Smithsonian Institution / Monitoring and Assessment of Biodiversity Program (SI/MAB). <http://www.afn.org/~wscfl/selva/biomoneng.pdf> [accessed 10 March 2006].
- Cribb, P. 2004.** *Phragmipedium kovachii* – an amazing discovery and highly threatened Orchid. *Orchid Conservation News* 4: 22–25.
- Cribb, P.J. and Leedal, G.P. (eds) 1982.** *The mountain flowers of Southern Tanzania*. Rotterdam, A.A. Balkema Publishers.
- Davenport, T.R.B. and Ndangalasi, H.J. 2003.** An escalating trade in orchid tubers across Tanzania's Southern Highlands: assessment, dynamics and conservation implications. *Oryx* 37: 55-61.
- Hamisy, W.C. 2005.** *Development of conservation strategies for the edible wild orchids in Tanzania - A report for the ecogeographic survey* Published at <http://www.rufford.org/rsg/Projects/WilliamHamisy.html> [accessed 15 April 2007].
- Hamisy, W.C and Millinga, L.P. 2002.** In-situ conservation of plant genetic resources in Rungwe and Makete Districts, Southern Highlands, Tanzania. National Plant Genetic Resource Centre. 2003. Plant Genetic Resources and Biotechnology in Tanzania; Part II: Policy, Conservation and Utilisation. *Proceeding of the Second national Workshop on Plant Genetic Resources and Biotechnology, 6 – 10th May, 2002, Arusha, Tanzania*. Peramiho Printing Press, Ruvuma.
- Niet, T. and Gehrke, B. 2005.** Rare terrestrial Orchids on Mbeya peak, southern Tanzania. *Journal of East Africa Natural History* 94: 279 – 285.
- Ruffo, C., Birnie, E. and Tengnäs, B. (eds) 2002.** *Edible wild plants of Tanzania*. Technical Handbook No. 27 Nairobi, Kenya, Regional Land Management Unit (RELMA), Swedish International Development Cooperation agency (Sida).
- Stohlgren, T.J., Bull, A.K. and Otsuki, Y. 1998.** Comparison of rangeland vegetation sampling techniques in the Central Grassland. *Journal of range management* 51: 164 – 172.
- Stohlgren, T.J., Falkner, M.B. and Schell, L.D. 1995.** A modified-Whittaker nested vegetation sampling Method. *Vegetatio* 117: 113 – 121.
- Southern Highlands Conservation programe.** *Key Sites*
www.southernhighlandstz.org/keysites.html as viewed on 17 May 2007.

Annex 1. Orchid species and their number of individuals in the twelve sampled plots.

Species name	Kitulo				Makangalawe				Ilundwe				Mpeopo				Liwili Kitesa			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>Brachycorythis pleistophylla</i> ^e	0	1	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Disa erubescens</i> ^e	0	0	0	0	9	13	5	11	5	0	3	0	0	0	0	0	0	0	0	0
<i>Disa ochrostachya</i> ^e .	0	0	0	0	1	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0
<i>Disa robusta</i> ^e	0	0	4	4	0	0	0	0	0	0	9	0	1	0	0	1	3	1	0	0
<i>Eulophia schweinfurthii</i>	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
<i>Habenaria macrura</i>	0	0	7	0	2	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0
<i>Habenaria praestans</i>	0	0	0	0	10	0	10	0	35	0	28	0	0	0	0	0	0	0	0	0
<i>Habenaria oclusa</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Roeperocharis wentzeliana</i>	0	0	7	0	6	7	0	1	0	0	0	0	8	4	6	10	0	3	0	1
<i>Satyrium acutirostrum</i>	11	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Satyrium atherstonei</i> ^e	3	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Satyrium bucharanii</i> ^e	4	1	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Satyrium crassicaule</i> ^e	42	0	9	0	0	6	0	6	0	0	0	0	1	0	2	3	0	0	1	4
<i>Satyrium neglectum</i>	5	1	0	0	10	12	9	53	16	0	0	0	0	0	0	0	0	0	0	0
<i>Satyrium princeae</i>	0	0	0	0	0	0	0	0	17	0	11	0	0	0	0	0	0	0	0	0

e – Denotes edible Orchids

Annex 2. Species checklist

Edible Orchids		
Family	Name	Vernacular Name
Orchidaceae	<i>Brachycorythis pleistophylla</i> Reichb.f.	Ligosi (Male) ¹
Orchidaceae	<i>Disa erubescens</i> Rendle	Liseku ¹
Orchidaceae	<i>Disa ochrostachya</i> Reichb.f.	Edible
Orchidaceae	<i>Disa robusta</i> N.E.Br.	Ligosi, Manseke, Liiseke ¹
Orchidaceae	<i>Eulophia schweifurthii</i> Kraenzl	Ndulamo ¹
Orchidaceae	<i>Habenaria xanthochlora</i> Reichb.f.	Ndulamo ¹
Orchidaceae	<i>Satyrium atherstonei</i> Reichb.f.	Lidala (Female) ¹
Orchidaceae	<i>Satyrium buechananii</i> Schltr.	Ligosi (Male) ¹ , Sunzalapai ²
Orchidaceae	<i>Disa zombica</i>	Suheng'enyule ²
Orchidaceae	<i>Disa harmetopetala</i>	Ntetemela ²
Orchidaceae	<i>Satyrium robusta</i>	Ligosi ¹
Orchidaceae	<i>Roeporocharis wentzeliana</i> Kraenzl	Kaloba ² , Masekele ¹
Orchidaceae	<i>Satyrium acutirostrum</i> Summerh.	
Orchidaceae	<i>Satyrium crassicaule</i> Rendle	Simbeghi ² , Masekelele, ¹
Non Edible Orchids		
Family	Name	Vernacular Name
Orchidaceae	<i>Eulophia odontoglossa</i> Reichb.f.	
Orchidaceae	<i>Habenaria macrura</i> Kraenzl	Masekelele ¹
Orchidaceae	<i>Habenaria prastans</i> Rendle	Dinu, Linu ¹
Orchidaceae	<i>Hebenaria oclusa</i> Summerh.	
Orchidaceae	<i>Satyrium neglectum</i> Schltr.	Linu, Amanu /Sekelele ¹
Orchidaceae	<i>Satyrium princiae</i> Rendle	

¹ - Kinga

² - Matengo

Annex 3. Orchid distribution in the study sites in Makete and Mbinga

Districts	Makete			Mbinga	
Orchid species	Kitulo	Makangalawe	Ilindiwe	Mpepo	Liwili Kitesa
<i>Brachycorythis pleistophylla</i> Reichb.f.	X				
<i>Disa erubescens</i> Rendle		X	x		
<i>Disa ochrostachya</i> Reichb.f.		X			
<i>Disa robusta</i> N.E.Br	X		x	X	X
<i>Eulophia schweinfurthii</i> Kraenzl					
<i>Habenaria xanthochlora</i> Reichb.f.					
<i>Satyrium atherstonei</i> Reichb.f.	X				
<i>Satyrium buchananii</i> Schltr.	X				
<i>Disa zombica</i>					X
<i>Eulophia odontoglossa</i> Reichb.f.					
<i>Habenaria macrura</i> Kraenzl		x			
<i>Habenaria praestans</i> Rendle		x	x		
<i>Habenaria occlusa</i> Summerh.	X				
<i>Roeporocharis wentzeliana</i> Kraenzl	X	x		X	X
<i>Satyrium acutirostrum</i> Summerh.	X				
<i>Satyrium crassicaule</i> Rendle	X	x			X
<i>Satyrium neglectum</i> Schltr	X	x	x	X	X
<i>Satyrium princiae</i> Rendle			x		

Annex 4: PROJECT TEAM

William Chrispo Hamisy – (In situ Conservation Scientist) Project Team Leader.

Tropical Pesticides Research Institute (TPRI), National Plant Genetic Resources Centre (NPGRC), P.O. Box 3024, Arusha, Tanzania.

Lourance Njopilai David Mapunda (Biodiversity Conservation Scientist) – Team

Member. Tropical Pesticides Research Institute (TPRI), National Plant Genetic Resources Centre (NPGRC), P.O. Box 3024, Arusha, Tanzania.

Anna Hans Makundi (Ex situ Conservation Scientist) Tropical Pesticides Research Institute (TPRI), National Plant Genetic Resources Centre (NPGRC), P.O. Box 3024, Arusha, Tanzania.

John Elia (Botanist) - Tropical Pesticides Research Institute (TPRI), National Herbarium of Tanzania (NHT), P.O. Box 3024, Arusha, Tanzania.

Raymond Killenga (Forester) – Tanga Region Catchment Project Office.

Uhuru Mwembe (Forester) – Makete District Natural Resources Officer.

Mwafute, E. (Forester) – Mbinga District Forestr Officer.

Joseph Lombola. (Information Officer) Mbinga District Education Office.

Annex 5: List of figures



Plate. 1. A group photo of the key informants with a scientist (Mr. Daniel Sitoni, in cape) in Mpepo Village in Mbinga



Plate. 2. Mr. William Hamisy collecting field data in collaboration with the local guides in Makete District.

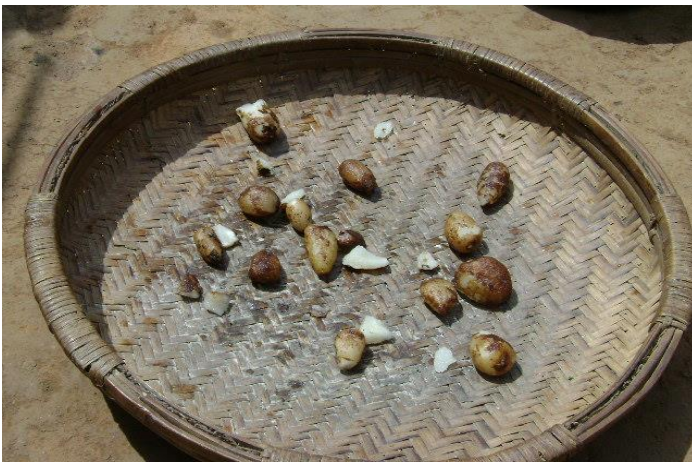


Plate. 3. Orchid tubers in a winnower, ready for the Preparation of Kikande



Plate 4. Chikanda preparation (Making of local baking powder, pounding of the orchid tubers using local motor and pestle, cooking of the orchid flour).



Plate 5. A sign board on the entry gate to the newly gazetted Kitulo National Park in Makete District.



Plate. 6. Three different types of the edible wild orchids in kitulo Plateau (Kidala, Kidala 2, Kigosi 1)



Plate 7. Orchid growing sites in Makete and Mbinga Districts.



Plate 8. Mr. Sitoni pressing the orchid herbarium specimens while Mr. Hamisy investigating the wild edible orchids in Makete District.



Plate 9. Threat posed to the wild edible orchids by burrowing animals who eat the orchids

Annex 6: Financial Report for the orchid project for the year 2006/ 2007

The project received financial assistance from the Rufford Small Grant for Nature Conservation (RSG) a sum of £ 5000.00. In addition, the project received a sum of 6000 \$ from the National Plant Genetic Resources Centre making a total of 11,000 £.

Table of expenditure summary

Activity	Amount £
1. Orchid survey in Makete and Mbinga <ul style="list-style-type: none"> • DSA for three researchers for 40 days @ 50 £ • Transport to Makete and Mbinga during survey covered 7600 km @ 0.25 £ • Transport during training and material collections • Allowances for local counterparts DFO Mbinga 20 days @ 10 £, DNRO Makete 20 days @ 10 £ • Plant identification charges • Statineries • Meal allowances for farmers • Transport for farmers 	3,000.00 1,900.00 1,900.00 400.00 200.00 100.00 100.00 200.00
2. Propagation trials <ul style="list-style-type: none"> • Materials 	3,200.00
Total	11,000.00