

ORCHID CONSERVATION PROJECT (REF: 58.09.08)

Development of Conservation Strategies for the Wild Edible Orchids in Tanzania



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List of acronyms

DNRO – District Natural Resources Officer
KNP – Kitulo National Park
NHT – National Herbarium of Tanzania
NPGRC – National Plant Genetic Resources Centre
TANAPA – Tanzania National Park Authority
WCS – Wild life Conservation Society

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Executive summary

The edible wild terrestrial orchids (The genus *Habenaria*, *Disa* and *Satyrium*) are among the most important species of the Orchidaceae family in Tanzania and the southern African region. The species are known to provide food (Kikande) to the rural communities in the region, as a result, contributing to food security and income generation among the rural communities. However, these resources are facing high threat of extinction due to habitat degradation and overutilization. High pressure on the resources and changes in land use pattern of their habitats has subjected some of the species to a danger of disappearance.

Taking this into consideration, the project was developed to develop conservation strategies for the wild edible orchids in Tanzania. The main aim of the project is to promote conservation of the wild edible orchid in Tanzania through integration of *in situ*, *ex situ* conservation measures and promote local communities participation in the conservation. A grant was requested from the RSG to facilitate the developed activities: Orchid survey and mapping in Makete and Mbinga, Establishment of permanent sample plots for orchid monitoring in the Kitulo National Park, General Plant Biodiversity survey in Liwili Kitesa forest in Mbinga, Development of *ex situ* conservation methods, and development of orchid propagation techniques for on farm planting, awareness creation among the Tanzanian Communities.

This report gives out the highlight of the proposed activities and achievements for the year 2009 – 2010.

1.0. INTRODUCTION

1.1. Background information

The edible, wild terrestrial orchids (The genus *Habenaria*, *Disa* and *Satyrium*) are among the mostly important species. The genus *Satyrium* with ninety species is near endemic to the temperate and montane area of Africa, with some species reported in Asia. On the other hand, the genus *Habenaria* has sixty four species which are pan tropical, found throughout the tropics in the world. *Disa* is another very large African genus with about 131 species in the southern African region. These includes the wide spread species as well as some endemics known from few locations.

The orchid family (Orchidaceae) is among the popular plant family in the world. The plants are recognized for attractive color and shape of their flowers as a result they are cultivated as home garden or greenhouse flowers forming one of the multibillion dollar horticultural industries in Europe and America. In Tanzania and some other southern African countries, the orchids are used as sources of food for the rural communities. The tubers are collected from the wild and processed into meatless sausage (Kikande) which is consumed locally and some sold in local markets and regional markets (Temu and Chihongo 1998, Ruffo 2000, Hamisy and Millinga 2002). On the other hand, some of the orchid plants are reported to have medicinal properties hence are potential sources of traditional medicine.

Regardless of their potentials, wild orchids including the edible species are facing a great danger of extinction. High exploitation pressure and high pressure for agricultural land in the southern Tanzania highlands have placed the edible wild orchids into a threat to extinction (WCS 2003). Harvesting of the orchid is associated with removal of the vegetative parts and forest burning as a result, threatened not only the orchid but also other plant found in the area. Apart from high threat facing the wild orchid in Tanzania, very little attention has been given to them. Very little is known about their geographic range and conservation status. As a result, this project aimed at generating information that will facilitate development of effective conservation measures for the orchid and their surrounding environment.

1.2. Main Objective

To contribute to the conservation of wild edible orchids in Tanzania, through integration of in situ, ex situ conservation measures and promote local communities participation in the conservation.

Specific objectives

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

2.0. THE STUDY AREA

The study is divided into three components: In situ conservation, ex situ conservation and local communities' participation in orchid conservation. The *in situ* conservation and farmers participation was carried out in Makete and Mbinga districts, southern highlands in Tanzania. This area lies within the Zambezian phytogeographic region with some of them (Poroto, Kipengere ranges and Matengo plateau) falling on the Afromountain region. While the *ex situ* conservation was carried out at the National Plant Genetic Resources Centre, in Arusha, Tanzania.

2.1. Makete District

Makete district is one of the five districts in Iringa region. It covers 5000 sq km, located between 8° 45' - 9° 45' E and between 33° 45' – 34° 50' S. The study was conducted in Kitulo National Park, Numbe valley, Ibagga and Makangalawe villages. The area lies in the highland zone between 2400 – 2800 masl and is characterized by high rainfall season occurring between November – May, while the dry season occurs between June – October.

Table 1. Location of the study sites in Makete and Mbinga districts.

District	Study site/ Village	Latitude (S)	Longitude (E)	Altitude (masl)
Makete	Kitulo NP	09° 06' 195"	33° 52' 305"	2735
	Numbe valley	09° 04' 1470"	33° 58' 8000"	2487
	Makangalawe	09° 20' 810"	34° 20' 528"	2400
	Ibagga	09° 14' 2890"	34° 14' 4000"	2472
Mbinga	Liwili kitesa	09° 15' 042"	34° 20' 360"	1590
	Lyaiki hill/ Mpepo	11° 20' 092"	35° 30' 310"	1500

2.2. Mbinga District

Mbinga is one of the four districts in Ruvuma region, it lies between 10° 15'S - 11° 34' S and 34° 24' - 35° 28' E Longitudes. The district covers a total of 8,321 Sq km, between 600 – 1900 masl topography. The district has four main agro ecological zones namely mountainous highlands, Rolling hills, Hagati plateau and coastal strips (Schmeid 1989, Temu and Chihongo 1998). The natural vegetation of Mbinga is characterized by the Zambezian miombo woodlands, Zambezian swamps and riparian forests, Afromontane rain forests and the Afro montane un defined forests. In Mbinga, the orchid studies were carried out in Liwili Kitesa forest as well as in Lyaiki hills in Mpepo.

3.0. ACTIVITIES CARRIED OUT DURING 2009 – 2010

3.1. Development of the effective in situ conservation and management interventions for the wild edible orchids in Makete and Mbinga districts.

3.1.1. *Orchid survey and permanent sample plots establishment*

Field surveys were carried out during May and July 2009 in Makete and Mbinga districts in Tanzania. The aim of the survey was to identify the available edible wild orchid, map their actual distribution and determine their conservation status. Finally establish the permanent sample plots for orchid conservation monitoring.

In Makete, the surveys were carried out in four sites namely Kitulo National Park, Numbe valley, Makangalawe and Ibaga villages (Table 1). The selection of the named study sites was based on the semi structured interviews conducted between the researchers and the district Natural Resources Authorities as well as based on the previous studies (Hamisy 2005, 2007). In Kitulo National Park due to great habitat variability, the site was stratified into different strata, based on the topography (Annex 1). In each of the stratum, sampling points were randomly selected and modified Whittaker plots were used in the data collection (Comiskey *et al.* 1999; Stohlgren *et al.* 1995) in which 20 x 50 m (0.1 ha) plots were established in each stratum, within which ten sub plots (1 x 2 m) were established just inside the periphery of the main plot. GPS was used to map the location of each sample plots (Annex 1). In Kitulo National Park, the first stratum was located in an area described as Ijengeja (Local community); This area is characterized by the lowest altitude. The area is sloppy extending from the road, down wards to the swampy area. The second strata was located at an areas described as COMWEX. The area is located on the flat area. The third stratum was located at Kitulo Dairy Farm, located at the highest point in the area (Annex 1). In each sub plot, the available orchid species were collected and taken to the NHT for further identification. In each site local people were employed to identify and provide information on its utilization.



Fig.1. Survey team pressing plant specimens in the field for plant identification

3.1.2. General biodiversity survey in Liwili Kitesa

In Mbinga, the general plant biodiversity survey was conducted in Liwili kitesa forest to study the conservation potential of the forest. Modified Whittaker plots were used. In this study, herbs were collected in side the 1 x 2 m plots, shrubs in side 2 x 5 m plots and trees in the main plot (20 x 50 m). All the plant species were identified and enumerated.

3.2. To develop appropriate ex situ conservation strategies for the edible orchids in Tanzania.

3.2.1. Development of Low moisture content seed storage

The seeds of the 11 orchid species were collected from Makete and Mbinga (table 5) and brought to the NPGRC for seed storage experiments. The seeds were processed and dried to 5 % MC and stored in the freezers at – 18 °C. Data collection on the survival through germination tests has been going on.

3.3. To promote local communities participation in orchid conservation and use.

3.2.1. Propagation techniques and the restoration program

Tubers and seeds of the selected 11 orchid species (table 5) were collected from Makete and Mbinga and planted in the screen house at the NPGRC in a RCD experiment. Data were collected on germination and survival of the orchid species.

3.2.2. Awareness creation

To raise awareness among the communities including the policy maker on the value of Liwili kitesa forest, a leaflet was developed “***Potential of the Liwili kitesa Forest on biodiversity conservation and environmental protection***”.

Meeting with TANAPA (Kitulo National Park) was carried out to discuss the conservation potential of the park and the need for establishment of the permanent sample plots for the monitoring of impact of the changes in the park management on the wild orchids.

Meeting with district Natural resources authorities in Makete and Mbinga to discuss the importance of orchid conservation. Meeting with village leaders in Ibagu, Makangalawe, Mapera and Mpepo. Discussions were held on the importance of orchid conservation. Establishment of 20 people committee to participate in the conservation training and conservation activities. Presentation of the need for orchid conservation was done. Priority area for future action was developed.

4.0. ACHIEVEMENTS AND DISCUSSION

4.1. *Orchid survey and sample plot establishment*

4.1.1. *Permanent sample plots*

9 permanent sample plots were established in the Kitulo National Park (Annex 1). These plots are located in different strata characterized by different topography and moisture regime. The plots were mapped using GPS and baseline data collected done. The plots will be used for future monitoring of the impact of management changes on the orchid species diversity in the National Park.

4.1.2. *Orchid survey*

A total of 26 orchid species from 5 genera consisting of both edible and non edible plant species were recorded both in Makete and Mbinga district. The study encountered large number of orchid species compared to the previous study (**Hamisy 2007**). *Brachycorythis pleistophylla*, *Satyrium antherstonei*, *Habenaria xanthochlora* and *Eulophia adontoglossa* previously recorded in the area were missing in the current survey, while *Disa fragrans*, *Satyrium robustum*, *Habenaria filicortis*, *H. ionantha*, *S. longicauda* and *D. ukingensis* missing in the previous survey were recorded this time. The named differences could be attributed to variation in the seasons that the studies were carried out due to ecological requirements of different species. Of the recorded species only 46 % constitutes the edible orchids while others are none edible (Table 4). The genera *Disa* was the leading in the number of edible orchids (7 sp) followed by *Satyrium* (6 sp), others includes *Habenaria* and *Roeperocharis*. High diversity of the orchids both edible and none edible species were encountered in Makete district compared to Mbinga (Annex 2).

Table 2. Frequency distribution of the orchids in Makete and Mbinga (%)

Local Name	Scientific name	KNP	Makangalawe	Ibaga	Lyawiki
Msekerere 4& 5	<i>Satyrium neglectum</i>	17	20	3	0
Vigosi	<i>Disa fragrans</i>	19	0	0	0
Masekerere	<i>Habenaria occlusa</i>	4	0	0	0
Vidudu/ Satyrium	<i>Satyrium robustum</i>	4	0	3	0
Masekerere/ Madudu 2	<i>Disa erubescens</i>	7	13	0	0
Madudu	<i>Satyrium princeae</i>	16	0	0	0
Madudu 1	<i>Habenaria fillicortis</i>	1	10	0	0
Sekerere/ Madudu 2/ Habenaria	<i>Satyrium aberrans</i>	2	0	0	0
Madudu/ ndogo	<i>Habenaria ionantha</i>	1	0	0	0
Masekerere jani moja	<i>Satyrium longicauda</i>	2	0	0	0
Masekerere ndogo 2/ Zambia	<i>Disa robusta</i>	7	0	0	0
Masekerere 6	<i>Roeperocharis bennettiana</i>	17	0	0	0
Vidala	<i>Satyrium volkensisii</i>	3	0	0	0
Masekerere	<i>Satyrium clasicale</i>	8	0	0	0
Vidala	<i>Disa ukingsensis</i>	3	0	0	0
Vidudu	<i>Satyrium buechananii</i>	1	0	0	0
Masekerere 5	<i>Habenaria chlorotica</i>	13	0	3	0
Masekerere 1	<i>Habenaria macrura</i>	1	0	0	0
Masekerere 2	<i>Habenaria praestrans</i>	0	0	3	0
Masekerere jike 3	<i>Satyrium princeae</i>	0	0	7	0
Mangonze (Vidole)	<i>Disa sp.</i>	0	0	0	3
Ntetemera	<i>Disa hamatopetala</i>	0	0	0	3
Mheng'enyula	<i>Disa zombica</i>	0	0	0	7

Annex 2 shows the distribution of orchid species in the study sites. *Habenaria neglectum* was the widely distributed species found throughout the study sites, followed by *Satyrium volkensisii*. On the other hand, 14 species were restricted to certain sites only. Frequency data (Table 3) shows that *Satyrium neglectum* to have high frequency (20 %) in Makangalawe and 17 % in Kitulo National Park. On the other hand, *H. occlusa* (4 % in KNP), *S. aberrans* (2 % in KNP), *H. ionantha* (1 % in KNP), *H. buechananii* (1 %) and *H. macrura* (1 %) were the rarest orchid species.

Table 3. Orchid species diversity/ Abundance (Plants/ ha)

Botanical name	Makete						Mbinga		
	Kitulo National Park				Numbe valley	Makanga lawe	Ibaga	Liwili Kitesa	Mpepo
	Njiapanda	Ijengeja	KDF	KNP					
<i>Satyrium neglectum</i>	10000	0	65000	25000	0	16667	1667	0	0
<i>Disa fragrans</i>	36667	0	60000	32222	0	0	0	0	0
<i>Habenaria oclusa</i>	1667	6667	0	2778	0	0	0	0	0
<i>Satyrium robustum</i>	5000	3333	0	2778	0	0	5000	0	0
<i>Disa erubescens</i>	26667	0	0	8889	0	35000	0	0	0
<i>Satyrium princeae</i>	3333	0	0	1111	0	0	0	0	0
<i>Habenaria fillicortis</i>	1667	6667	3333	3889	0	5000	0	0	0
<i>Satyrium aberrans</i>	5000	1667	0	2222	0	0	0	0	0
<i>Habenaria ionantha</i>	1667	0	0	556	0	0	0	0	0
<i>Satyrium longicauda</i>	21667	0	0	7222	0	0	0	0	0
<i>Disa robusta</i>	0	58333	0	19444	0	0	0	0	0
<i>Roeperocharis bennettiana</i>	0	5000	51667	18889	0	0	0	0	0
<i>Satyrium volkensii</i>	0	6667	0	2222	0	0	0	0	0
<i>Satyrium clasicanle</i>	0	8333	35000	14444	0	0	0	0	0
<i>Disa ukingensis</i>	0	8333	0	2778	0	0	0	0	0
<i>Satyrium buchananii</i>	0	15000	0	5000	0	0	0	0	0
<i>Habenaria chlorotica</i>	0	5000	60000	21667	0	0	1667	0	0
<i>Habenaria macrura</i>	0	0	3333	1111	0	0	0	0	0
<i>Habenaria praestrans</i>	0	0	0	0	0	0	3333	0	0
<i>Satyrium princeae</i>	0	0	0	0	0	0	10000	0	0
<i>Disa sp.</i>	0	0	0	0	0	0	0	0	1667
<i>Disa hamatopetala</i>	0	0	0	0	0	0	0	0	1667
<i>Disa zombica</i>	0	0	0	0	0	0	0	0	3333

The density data (Table 3), shows *D. erubescens* as the mostly abundant species (35,000 plants/ha) in Makangalawe, followed by *D. fragrans* (32,222 plants/ha) in KNP, on the other hand, *H. ionantha*, *H. macrura*, *S. princeae*, *D. hamenopetala*, *D. ukingensis*, *S. aberrans*, *S. robusta* and *S. oclusa* had the least number of plants. The Kitulo National park had the largest number of orchid species both edible and non edible, hence has a potential role to play in the orchid conservation in Tanzania. On the other hand, no orchid species were encountered in the study plots in Numbe valley and Liwili Kitesa forest reserves except for the six species found out side the plots. This shows high threat, the orchid are facing in the area. The most unique future is that, the three species found in Liwili Kitesa were endemic to Mbinga hence the need for conserving the species in the area.

Table 4. Proportions of the wild edible orchids in Makete and Mbinga

Orchid type	Genera	Kitulo	Makangalawe	Numbe valley	Ibaga	Liwili kitesa	Mpepo
EDIBLE	Species	4	4	4	2	3	3
	Genera	10	2	2	1	1	1
NON EDIBLE	Species	10	5	1	4	1	1
	Genera	2	3	1	2	1	1

The study revealed high exploitation pressure for the edible orchids both in Makete and Mbinga, while some illegal collections were also noted in Kitulo National Park, regardless of KNP being protected by law. This shows the importance of incorporating the rural communities surrounding the area in the conservation activities. Apart from the Liwili Kitesa Forest, in other un protected areas, the edible orchids were almost extinct; this calls for promoting of the on farm planting to allow the local people to get the resources out side the protected areas.

4.2. General biodiversity survey in Liwili Kitesa

Liwili kitesa forest composed of high species diversity. The study recorded large number of species in Liwili Kitesa Forest ranging from Herb, shrubs and trees. The species have high social economic potentials, such as medicinal, wild relatives of the cultivated crops species hence potential gene pool for future crop improvements. This with other values such as catchment potential signifies the forest to warrant high conservation status.

4.3. Development of Low moisture content seed storage

Preliminary results indicated that both 11 orchid species tolerate drying to low moisture contents and low temperature storage, hence can facilitate *ex situ* conservation in the gene bank.

4.4. Propagation techniques and the restoration program

Table 5. Orchid characterization data

S/ N	Species name		Tuber width (cm)		Tuber length (cm)		Status
	Local Name	Scientific name	Average	Range	Average	Range	
1	Kikande cha kike KDF No. 7	<i>Satyrium volkensii</i>	3.13	1.6 - 4.0	6.4	4.0 - 8.0	Edible
2	Swaluwanu No. 3	<i>Satyrium sp.</i>	0.75	0.1 - 1.0	2.1	1.0 - 3.0	Edible
3	No. 5	<i>Habenaria chlorotica</i>	1.37	1.1 - 1.5	1.84	1.0 - 2.2	Not edible
4	Kidume KDF 1	<i>Disa fragrans</i>	1.7	1.3 - 2	5.32	4.2 - 6.5	Edible
5	No. 6	<i>Roeperocharis bennetiana</i>	1	1.0 - 1.0	1.9	1.0 - 4.0	Not edible
6	Vijike vyekundu KDF 2	<i>Disa ukingensis</i>	1.37	1.1 - 2.1	2.82	2.0 - 4.0	Edible
7	Kinjeji 2	<i>Satyrium classicaule</i>	1.1	1.0 - 1.2	2.01	1.8 - 2.4	Edible
8	Sunzalapai	<i>Satyrium buchananii</i>	1.45	1.1 - 3.6	4.1	3.0 - 7.0	Edible
9	Mheng'enyule	<i>Disa zombica</i>	1.87	1.0 - 2.1	4	2.0 - 6.0	Edible
10	Ntetemera	<i>Disa hamatopetala</i>	1.81	1.0 - 2.1	3.5	3.0 - 4.0	Edible
11	Masekerere 6	<i>Roeperocharis bennetiana</i>	1.23	1.0 - 2.0	2	1.0 - 3.0	Not edible

Tuber characterization data shows that, *Satyrium volkensii* (the edible orchids) to be the leading in tuber length and width followed by *Disa fragrans* and *Satyrium buchananii* both edible. These are among the highly preferred edible species. Although this might seem that farmer's preference is based on tuber size, still there are some species with small tubers but highly preferred (*D. ukingensis*). Many other factors contribute to farmer's choice of the edible orchids such as tuber elasticity and sweetness have been reported. Of the characterized orchids, *Satyrium volkensii* had the largest tuber size compared to others followed by *Disa fragrans*. These results can be used in decision making for species domestication.

Results of the propagation techniques show the orchids to respond well to propagation using tubers. Germination by seeds showed some problems, Stewart and Campbell (1996) reported that, orchid growth is facilitated by symbiotic association with fungal species, hence the need for incorporating mycorrhizal fungal to study their potential on orchid propagation by seeds.



Fig. 2. Orchid propagation trial at the NPGRC in Arusha, Tanzania

4.6. Awareness creation

To raise awareness among the communities including the policy maker on the value of Liwili kitesa forest, a leaflet was developed “***Potential of the Liwili kitesa Forest on biodiversity conservation and environmental protection***”.

Meeting with TANAPA (Kitulo National Park) was carried out to discuss the conservation potential of the park and the need for establishment of the permanent sample plots for the monitoring of impact of the changes in the park management on the wild orchids.

Meeting with district Natural resources authorities in Makete and Mbinga to discuss the importance of orchid conservation. Meeting with village leaders in Ibagu, Makangalawe, Mapera and Mpepo. Discussions were held on the importance of orchid conservation. Establishment of 20 people committee to participate in the conservation training and conservation activities. Presentation of the need for orchid conservation was done. Priority area for future action was presented.

In Liwili kitesa, agreed to demarcate the forest boundaries and train villagers on the alternative source of income (Beekeeping).

5.0. CONCLUSION

The study recorded 26 orchid species in Makete and Mbinga, the number is higher than the previous record. High diversity was recorded in Makete and especially in Kitulo National Park suggesting the importance of the area in the conservation of the orchids in Tanzania.

Low numbers of the orchids were recorded in Liwili Kites Forest in Mbinga. However, the species encountered here were endemic to this area hence conservation of the area would save these endemic plants.

High impact on the orchids were noted in Liwili Kitesa forest as well as other sites outside the conserved areas both in Makete and Mbinga, with some illegal collection recorded in the KNP, suggesting the need for involving the communities in the conservation.

6.0. RECOMMENDATIONS

- To continue collecting baseline data on the permanent sample plots in Kitulo NP for recommendation on the future management plans.
- Orchid species responds very well to vegetative propagation than through the seeds, hence the need for further investigation on the importance of mycorrhiza on the orchid germination.
- On farm trial for orchid domestication to be carried out at Ibagu in Makete and Mpepo in Mbinga.
- Management of Liwili kitesa Forest
 - Boundary planting
 - Bee keeping training for the villagers
 - Restoration of the wild orchid in Liwili Kitesa forest.
- Ex situ conservation
 - Sample the orchid seeds and tubers to ex situ storage at the NPGRC.

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Annex 1: Sample location in makete and Mbinga

District	Area	Strata	Plot No.	Latitude S	Longitude E	Altitude masl
Makete	Kitulo NP	Comwex	1	09° 03' 6940"	33° 51' 2871"	2797
			2	09° 03' 6490"	33° 51' 2855"	2855
			3	09° 03' 4870"	33° 51' 0000"	2821
		Ijengeja	1	09° 02' 6540"	33° 52' 0000"	2748
			2	09° 02' 671"	33° 52' 9000"	2753
			3	09° 02' 7150"	33° 53' 0000"	2720
		KDF	1	09° 05' 8040"	33° 52' 2000"	2933
			2	09° 05' 8980"	33° 52' 3000"	2929
			3	09° 06' 0540"	33° 52' 2000"	2880
	Numbe valley	-	1	09° 04' 1470"	33° 58' 8000"	2452
			2	09° 04' 2290"	33° 58' 8000"	2487
	Makangalawe	-	1	09° 20' 8520"	34° 19' 9000"	2538
			2	09° 20' 8480"	33° 20' 0000"	2534
			3	09° 20' 8040"	34° 20' 1000"	2537
	Ibaga	-	1	09° 14' 4700"	34° 14' 4000"	2481
2			09° 14' 2890"	34° 14' 4000"	2472	
3			09° 14' 1860"	34° 14' 4000"	2492	
Mbinga	Liwili Kitesa	-	1	11° 12' 0640"	34° 53' 4000"	1752
			2	11° 11' 7040"	34° 53' 7040"	1828
			3	11° 10' 7300"	34° 53' 6000"	1780
	Lyawiki	-	1	11° 28' 2840"	35° 04' 8000"	1745
			2	11° 28' 1650"	35° 04' 7000"	1778
			3	11° 28' 2830"	35° 05' 0000"	1647

Annex 2. Checklist of orchid species found in Makete and Mbinga districts

S/ N	Local name	Botanical name	Makete				Mbinga	
			Kitu lo	Numbe valley	Makanga lawe	Iba ga	Liwili kitesa	Mpe po
1	Msekerere	<i>Habenaria neglectum</i>	x		x	x	X	X
2	Vigosi	<i>Disa fragrans</i>	x					
3	Masekerere	<i>Habenaria oclusa</i>	x					
4	Vidudu/ Satyrium	<i>Satyrium robustum</i>	x	x		x		
5	Masekerere/ Madudu 2	<i>Disa erubescens</i>	x		x			
6	Madudu	<i>Satyrium princeae Rendle</i>	x			x		
7	Madudu 1	<i>Habenaria fillicortis</i>	x		x			
8	Sekerere/ Madudu 2/ Habenaria	<i>Satyrium aberrans</i>	x					
9	Madudu	<i>Habenaria ionantha</i>	x					
10	Masekerere	<i>Satyrium longicauda</i>	x					
11	Masekerere ndogo 2/ Zambia	<i>Disa robusta</i>	x					
12	Masekerere 6	<i>Roeperocharis wentzeliana</i>	x	x	x			
13	Vidala	<i>Satyrium volkensisii</i>	x	x	x	x		
14	Vidala vyekundu	<i>Disa ukingensis</i>	x					
15	Vidudu/ Sunzalapai	<i>Satyrium buchananii</i>	x	x			x	
16	Masekerere	<i>Habenaria praestrans</i>				x		
17	Masekeni/ Kinjeji	<i>Satyrium crassicaule</i>	x		x		x	
18	Masekeni	<i>Satyrium acutirostrum</i>	x					
19	Masekerere 5	<i>Habenaria chlorotica</i>	x			x		
20	Masekerere 3	<i>Habenaria macrura</i>	x		x			
21	Mangonze	<i>Disa sp.</i>						x
22	Ntetemera	<i>Disa hamatopetala</i>					x	x
23	Mheng'enyula	<i>Disa zombica</i>					x	x
24		<i>Europhia schweinfurthii</i>			x			
25		<i>Disa achrostachya</i>			x			
26	Suluwanu	<i>Satyrium sp.</i>					x	

Annex 3: Financial report

S/ N	Activity	Responsible	ITEM	Unit	Measur ement	Unit Cost £	Amount £	
1	Orchid survey and sample plot establishment in Makete	Two researchers and one botanist	Daily subsistence allowance for 15 days	Days	15	150	2250	
		One driver	Daily subsistence allowance for 15 days	Days	15	35	525	
		Local laborers	Allowances	Days	10	2	20	
	Sub total						2795	
2	Orchid biodiversity survey in Mbinga	Two researchers and one botanist	Daily subsistence allowance for 15 days	Days	15	150	2250	
		One driver	Daily subsistence allowance for 15 days	Days	15	35	525	
		Local laborers	Allowances	Days	10	2	20	
		District Officers	Allowances	Days	10	20	200	
	Sub total						2995	
3	Orchid seeds collection in Makete and Mbinga	Two researchers and one botanist	Daily subsistence allowance for 14 days	Days	14	150	2100	
		One driver	Daily subsistence allowance for 14 days	Days	14	35	490	
		Local laborers	Allowances	Days	10	2	20	
		District Officers	Allowances	Days	10	20	200	
	Sub total						2810	
4	Transport	vehicle highering for the field survey, Orchid collection in Makete and Mbinga	Arusha Makete	Km	2800	0.5	1400	
			Arusha Mbinga	Km	3400	0.5	1700	
			Seed collection	Arusha Makete	Km	2000	0.5	1000
			Arusha Mbinga	Km	3000	0.5	1500	
	Sub Total						5600	
5	Publications and report writing	Stationeries	Printer cartridge	Number	3	62.5	187.5	
			A 4 paper	Reams	5	3	15	
			Pen pencil	Variable	1	200	200	
	Sub total						402.5	
6	Laboratory reagents	Reagents	Agar	Gm 500	2	20	40	
			Liquid nitrogen	Litres	60	15	900	
	Sub total						940	
	Grant total						15542.5	
	Total Grant						12,000.00	
	Local contribution						3,542.50	