

Efforts urged to tackle thriving illegal orchid trade in Tanzania and Zambia for *chikanda* production

BACKGROUND

Wild orchid harvest for the traditional delicacy *chikanda* has been recorded for many decades, primarily in Zambia, but also by tribes from neighbouring countries (Richards, 1939; Davenport and Ndangalasi, 2003). The dish originates from the Bemba tribe in north-eastern Zambia, but over recent decades has grown in popularity throughout the country, mainly due to increased urbanization. Initially, consumption took place on a small, household-scale, but more and more commercial harvest now occurs as a result of the dramatic rise in demand. Currently, ready-made *chikanda* can even be found on the menu in restaurants in Zambia's capital city Lusaka (Bingham, 2009). Most of Zambia's own orchid resources have become fairly depleted as a result, and the majority of orchid tubers used for *chikanda* now comes from abroad, principally from the Southern Highlands of Tanzania, but other reported sources include Angola, the Democratic Republic of Congo (DRC), and Malawi. These are mainly countries in which local consumption was taking place at a very small scale, but in which the Zambian demand has led to commercialized trade. Tunduma, a small Tanzanian town at the border with Zambia, seems to be the major hub for *chikanda* trade between the two countries. Tanzanian middlemen gather tubers from all over the country in their storage units and Zambian market vendors come to purchase stocks for further distribution within Zambia (Davenport and Ndangalasi, 2003).

Most of the species targeted for *chikanda* belong to the genera *Disa*, *Satyrium* and *Habenaria*, but as the orchid tubers are morphologically difficult to identify, it is not always clear which species are used for *chikanda* production (Davenport and Ndangalasi, 2003; Bingham, 2009). Market vendors and harvesters distinguish the tubers based on origin and presumed quality. Some tubers are considered to be *msekelele* or "fake", indicating a lower quality. However, vernacular names and methods of tuber distinction do not necessarily correspond to scientific classifications (Cunningham, 2001).

Although these genera are relatively widespread in Africa, they include several species at risk of overharvesting and possibly even extinction. Tanzania's Southern Highlands, and the adjacent highland areas in Zambia and Malawi, together form an area of great botanical interest and harbour several species with a very limited distribution (Cribb and Leedal, 1982). Therefore, in 2004, Kitulo National Park was established in Tanzania with orchid protection as its main objective (Davenport and Bytebier, 2004).

LEGISLATION

All orchids have been listed in the Appendices of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) since 1975; orchids used for *chikanda* production are all listed in Appendix II (UNEP-WCMC, 2014). Although a CITES-listing should ensure strict regulation of cross-border trade, research indicates that millions of wild-harvested orchid tubers cross Zambia's borders each year without permits (Davenport and Ndangalasi, 2003). No orchids are reported in the CITES Trade Database as having been imported by Zambia



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Above: A woman carrying freshly collected tubers from Sumbawanga region, Tanzania. Some of the tubers harvested there are consumed locally, others will be transported to Tunduma, a small town at the border with Zambia, from where they will be distributed, largely within Zambia.

Below: Sack of tubers at Soweto Market, Lusaka. Tubers are gathered here from different countries and will mainly be sold locally. Each sack can contain between 7000 and 18 000 tubers.



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ORCHID PHOTOGRAPHS: BARBARA GRAVENDEEL



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Tubers used for *chikanda* production are possibly derived from *Habenaria ocellata* (left) and *Disa erubescens* (centre), among other orchid species. Warehouse at Soweto Market, Lusaka (right). Warehouses seem to be shared among the traders and are located in the vicinity of the *chikanda* stalls.

for the last 10 years, thus indicating a significant discrepancy between actual and reported trade (UNEP-WCMC, 2003–2013). Under Tanzania's *National Parks Act* (MNRT, 2002), authorities can enforce local regulations, one of which states that vegetation in parks should not be disturbed.

AIMS

The project discussed here aimed to map *chikanda* harvest and trade and to use innovative molecular identification methods to identify the species used for *chikanda* production by sequencing DNA isolated from ready-made *chikanda*. Accurate identification, combined with quantitative data should enable the authors to determine which species are most susceptible to overharvesting. In addition, the authors aimed to investigate sustainable solutions to wildcrafting of *chikanda*, ideally without negatively affecting local livelihoods.

METHODS

Surveys were conducted between February 2013 and July 2014 in the trade hubs of Soweto market in Lusaka, and the border towns of Tunduma (Tanzania) and Nakonde (Zambia), as well as in villages in Rukwa, Iringa and Njombe Regions (Tanzania) that were reported in the trade hubs as being the main sources of tubers. Market vendors, middlemen and harvesters were interviewed, as well as Customs officers on the Tanzanian-Zambian border. The authors visited the headquarters of Kitulo National Park, which continues to be targeted by harvesters, to discuss the possibility of cultivating *chikanda* and the role that the park authorities could play in this process. Several slices of ready-made *chikanda* were purchased at Tunduma market for species analysis by means of Next Generation Sequencing of ITS2 using Ion Torrent PGM™. Obtained sequences were profiled against NCBI GenBank for identification using BLAST.

RESULTS

Market surveys: At Lusaka's Soweto market two large depots were found, each containing approximately 200 bags with 100–150 kg of *chikanda* tubers in each (an estimated total of 20–30 t). Market vendors indicate that Tanzania is the main source of *chikanda* and identified several regions of origin: Sumbawanga, Iringa and Mufindi. The following regions were mentioned as *chikanda* sources in Zambia: Luwingu, Kasama, Mporokoso and Serenje, all of which are located in the central or north-eastern part of the country. Tubers also originate from surrounding countries such as Angola, the Democratic Republic of Congo, Malawi and Mozambique. The tubers differ significantly in size, however. For example, those from Zambian regions and Mufindi (Tanzania) are quite small (± 0.5 –2 cm), whereas Iringa tubers are very large, with lengths of up to seven centimetres. Customers at Soweto market buy *chikanda* mainly for local consumption, but people come from as far as the Zambian Copperbelt province to buy tubers.

In Tunduma, Tanzania, similar sources for orchid tubers are mentioned. By far the most tubers come from Kikondo and Imalilo, two villages in the Njombe/Iringa region. A total of ca. 3000 *debe* or tins of *chikanda* are said to come from there each year. One *debe* can contain 1100–2900 tubers, depending on the size of the tubers. Three thousand tins of Iringa tubers would equate to a minimum of approximately 3.3 million tubers. Mufindi and Sumbawanga are two other regions in the country that are often reported as sources, and together account for an estimated annual 170 tins. The estimates add up to an alarming 3.5 million Tanzanian orchid tubers that are exported to Zambia each year. On top of this, Malawi and Mozambique contribute at least another 300 000 and 600 000 tubers annually, respectively.

Chikanda traders in Tunduma, Tanzania, mention that it is becoming more difficult to meet demand or even to maintain the supply that has been available during the last few years. Supplies from Mufindi were reported to have dwindled from 300 tins in previous years to only 120 in 2014. Supplies from Imalilo were also reported to be going down gradually, and in addition tuber size was decreasing.



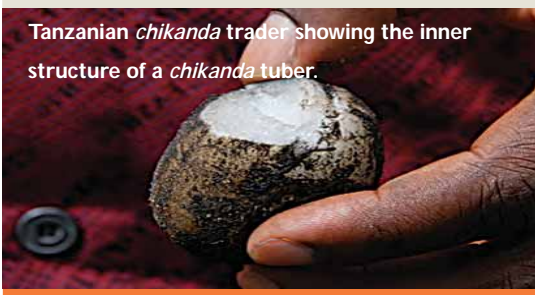
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CHIKANDA: WHAT IS IT?

Women preparing *chikanda* cake in a Zambian village close to Tunduma, Tanzania.

Chikanda mainly consists of ground orchid and peanut flour, preferably in a 1:1 ratio, or 1:2 if there is a lack of orchids. To prepare the dish, *chikanda* tubers are washed, sliced, and the bitter upper buds removed. The slices are dried in the sun for ± 20 minutes after which time they are pounded and sieved to a fine powder. Salt, baking powder and sometimes chilli powder for flavour are stirred into a pot of boiling water, followed by the peanut flour. Once the water comes back to the boil, the *chikanda* powder is added to thicken the mixture. The surface of the cake is smoothed with a spoon and the pot covered with a plate. This is moved to a charcoal-fired stove and the plate covered with hot charcoal. After ± 20 minutes, the charcoal is removed and the covered pot turned upside down on the floor to rest for a few minutes. The *chikanda* is ready to eat, hot or cold, served with some chilli sauce for extra spice.

Tanzanian *chikanda* trader showing the inner structure of a *chikanda* tuber.



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Customs officers in Tunduma, at the border with Zambia, claimed to be unaware of the enormous amount of orchid tubers that is crossing the border each year. Discussion of CITES and international trade regulations also revealed an unfamiliarity with these topics, especially in regard to the orchid trade. Cross-border *chikanda* traders seem to circumvent the official border post between the two countries by loading the bags onto motorbikes, bikes and donkeys, which can easily pass through the border without being searched.

Kitulo National Park, Tanzania: Management and rangers working in Kitulo National Park, are familiar with the problems of *chikanda* harvest. Despite the establishment of the park in 2004, largely to provide protection to the orchids growing there (Davenport and Bytebier, 2004), *chikanda* tubers are still intensively collected from the area. On some occasions parts of the high-altitude grasslands are burned to enable easier access to harvest the tubers. Villagers in and around Kitulo National Park (from Imalilo and Kikonde) were hesitant to discuss *chikanda* harvest and trade, and blamed the harvest on people from outside the area. However, when the conservation issues and possibilities of cultivation were mentioned, they showed a keen interest in participating in field trials of *chikanda* cultivation, as long as they are supplied with seedlings. The Kitulo National Park authorities shared their interest in *chikanda* cultivation and were willing to facilitate a cultivation programme by growing orchids from seeds and distributing the seedlings to the villagers for cultivation. Some small-scale cultivation projects have begun, but these are mainly in Zambia. None of these cultivation activities seem to take place in the villages where the majority of *chikanda* tubers are reported to come from.

Identification: Next Generation Sequencing using Ion-Torrent PGM™ has proved successful in identifying species in prepared *chikanda* to genus level, and in some cases to species level. A total of six ready-made *chikanda* samples were analysed and revealed the presence of six *Disa* species, eleven *Satyrium* species and one *Habenaria* species. Peanut *Arachis hypogaea* appeared to be present in all six *chikanda* samples, and it is known to be an important ingredient. Besides the expected ingredients, several adulterants or contaminants could be identified. These unexpected species included Mango *Mangifera indica*, Sweet Potato *Ipomoea batatas*, Pumpkin *Cucurbita maxima* and several grasses *Triticum aestivum*, *Elymus* spp. and *Eleusine coracana*. The species compositions differed greatly between the *chikanda* samples. One sample contained three species (*Disa ochrostachya*, *D. erubescens* and *Arachis hypogaea*), whereas another included at least thirteen orchid species and an additional fourteen intentional or unintentional ingredients.

DISCUSSION AND CONCLUSIONS

Chikanda is increasing in popularity: Ready-made *chikanda* can be found on the menu in numerous hotels and restaurants in Zambia, but has also recently appeared in supermarket chains in Lusaka. Moreover, across the border in Tanzania more and more people have started eating *chikanda*. This broader consumption highlights the need for immediate measures to be taken to ensure sustainable harvesting practices.

Increasing scarcity of chikanda tubers: Harvesters need to go further afield to collect *chikanda* than in previous years and spend more time in doing so. Market vendors report that the tubers they receive now are smaller than previously and, where Zambian supplies were once sufficient to meet demand, tubers now need to be imported from other countries. These are all signs of overharvesting and unsustainable use of the local orchid resources. The absence of most *chikanda* orchid species from the *IUCN Red List* (IUCN, 2014) reflects a gap in knowledge, and more research and monitoring of trade are urgently needed to stop overharvesting.

Joint conservation efforts: Both at the local village level and that of the Kitulo National Park authorities, the overharvest of orchid tubers for *chikanda* production has now been recognized. There is an overall willingness to co-operate on a project to initiate *chikanda* cultivation aimed at sustainability and diversification of cash income. Follow-up work between the authors and Kitulo National Park aims at combining scientific expertise and park ranger resources to create a pilot project on *chikanda* cultivation in collaboration with villages that are currently harvesting hotspots. Since some of the local endemics might be at risk of being overharvested and tubers are targeted indiscriminately, sustainable wild harvesting does not seem a viable solution. Cultivation would create the challenge of distinguishing between cultivated and wild-harvested orchids. However, the effectiveness of proposed conservation measures should also be further evaluated.

Identification and enforcement: Molecular identification is successful in identifying species used for *chikanda* production. However, to have an even more accurate idea of the species used for *chikanda*, the sequence reference database needs to be expanded to include more of the orchid species occurring in southern Africa. Local Customs officers seem not to be aware of the CITES regulations relating to plants, and in order to ensure proper enforcement at the border they might need additional information about these regulations and perhaps more specifically on orchids and the *chikanda* trade. Moreover, interviews with CITES Management and Scientific authorities should be carried out to learn their opinion on the possibility of orchid cultivation and a regulated trade.



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- ◀ **Msekelele, or "fake" chikanda tubers, considered to be of inferior quality to other chikanda tubers, Tunduma market, Tanzania.**