



*Dactylorhiza umbrosa*

## **Illegal wild collection and international trade of CITES-listed terrestrial orchid tubers in Iran**

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PHOTOGRAPHS: ABDOLBASET GHORBANI

Orchid tubers known as salep are collected widely from the wild in Asia Minor, Iran and the north-eastern Mediterranean region where they are traded for use of the ground tuber in the production of ice cream and a drink, also known as salep. The harvest of salep orchid tubers in Iran has been boosted in recent years by international demand, mainly from Turkey, the main consumer in the region for salep drink, but also from Pakistan and India for a range of purposes. It is estimated that in 2013, 7–11 million individual orchids were harvested in Iran, mainly from the Golestan and Azarbaijan provinces. More than 19 species and sub-species are targeted indiscriminately, all of which are listed in the CITES Appendices and most are threatened with local extinction. Given the destructive nature of collection practices, the current harvest in Iran is unlikely to be sustainable. This study focuses on the current status of orchid tuber collection and trade in Iran, where collection and harvest of tubers, and export without permits, is illegal, and highlights the need for active measures to protect orchids from being overharvested, including examining the feasibility of establishing sustainable harvesting practices.

## INTRODUCTION

Tuberous terrestrial orchids have long been used as a source of medicine for the treatment of a range of health problems, as well as in dietary supplements and as an aphrodisiac in different parts of the world (Arditti, 1992; Bulpitt, 2005; Hossain, 2011; Subedi *et al.*, 2013). Dioscorides (1st century A.D.) cited two terrestrial orchids in his book *De Materia Medica*, and Avicenna (Persian physician, 908–1037) referred to the aphrodisiacal and other healing properties of orchids (Berliocchi, 2004). In Africa, different species of *Eulophia* are used to treat diabetes or to prevent epilepsy (Bulpitt, 2005). In Asia Minor, dried tubers of terrestrial orchids are known as salep, a word which comes from the Arabic word *Sahlab* (Persian: *Salab*; Hindi: *Salab misri/salab mishri/salam panja*), and refers to the dried tubers of terrestrial orchids, ground tuber flour and a hot, milky beverage made from the flour. Salep drink was once commonly consumed throughout the Ottoman Empire and as far as Germany and England (Bulpitt, 2005). In the late 17th century, the drink was in vogue in England under the name of *salop* or *saloop* (Davidson, 2006). Although nowadays it has lost much of its importance in Western Europe, it is still popular in Asia Minor, Greece and Cyprus (Bulpitt, 2005; Starin, 2012). Salep powder is also used in ice cream production as a stabilizer and to increase the melting temperature (Bahramparvar and Mazaheri Tehrani, 2011). In Turkey, traditional salep ice cream is called *kahramanmaraş* or *maraş dondurma* and differs in taste and texture from industrial ice cream owing to the natural flavour of the salep powder and its sticky consistency (Güven *et al.*, 2003). Salep drink is not commonly consumed in Iran and because of the high

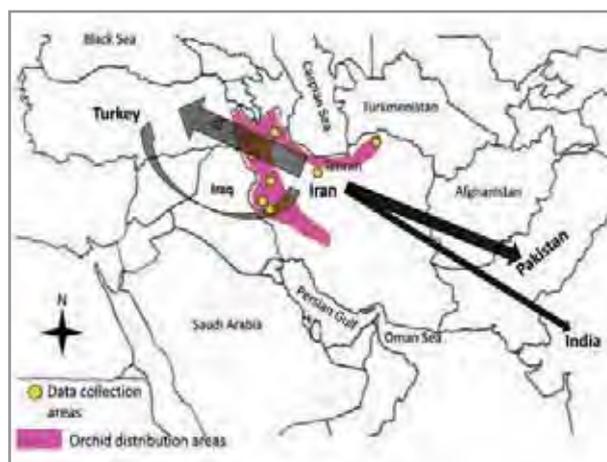


Fig. 1. Principal salep orchid tuber distribution and collection areas in Iran, and the main tuber trade destinations (arrows).

price of natural salep, the powder is not used in industrial ice cream production. Salep is also used to make a sexual tonic and aphrodisiac in Indian Ayurveda medicine and in Unani medicine in India and Pakistan.

Turkey is the main consumer of salep in the region. Some 90% of all tuberous orchids (120 taxa) are collected in Turkey for the production of salep, with an estimated 30 t of salep produced annually, which equates to the destructive harvest of 40–50 million orchids (Sezik, 2006).

Due to its illegal status, published reports or updates of orchid collection and trade status from most salep-producing countries are very limited. However, it is known that in Iran the harvest of orchid tubers for salep has been boosted in recent years by international demand and the country has become one of the main suppliers for this trade.

Many of the orchid species used for production of salep are protected in their range countries, and most are threatened with local extinction (Swarts and Dixon, 2009). Collection and harvest of orchid tubers without permits in Iran is illegal.

## METHODS

This study focused on the current status of orchid tuber collection and trade in Iran. It also investigated the legislation and regulations regarding orchid conservation and trade in the country, and associated enforcement. During March–July 2013 and May 2014, semi-structured and open-ended interviews were conducted with local orchid collectors to record information regarding collection practices, collection sites and seasons, processing practices, the history and volume of the harvest, and the current uses of the tubers. Whenever possible, harvest practice was directly observed in the field. Herbarium samples of harvested species were identified using the *Flora Iranica* Vol. 126 (Renz, 1978) and *Flora of Iran* Vol. 57 (Shahsavari, 2008). Surveys were conducted in the provinces of Golestan (Kalaleh and Maraveh Tappe districts) and Western Azarbaijan (Mahabad and Piranshahr districts).



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**Fig. 2. Digging up orchid tubers.** Yeke-Chenar village, near Maraveh Tappe, Golestan province.

A market survey was conducted by interviewing traders in herbal shops or stalls in markets in Golestan province, at bazaars in Urmieh, Mahabad and Sardasht (Western Azarbaijan province), the cities of Kermanshah and Kerend (Kermanshah province), Ardabil (Ardabil province) and Tehran Grand Bazaar (Fig. 1). Information regarding prices along the trade chain, quality preferences, the total volume of annual trade and the destinations of tubers was recorded from *salep* traders and the owners of *Attari*, or herbal shops.



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**Fig. 3. *Orchis simia*.** Once the fresh *salep* tubers have been removed, the plants and old tubers are discarded.

To estimate the number of tubers equivalent to one kilogramme of fresh tubers, five samples of 500 g of fresh tubers were purchased from Maraveh Tappe, the number of tubers in each sample was counted and the average was extrapolated to one kilogramme. To estimate the number of tubers in one kilogramme of dried tubers, samples of 50 g and 100 g of dried tubers were purchased from Mahabad, Urmieh, Kermanshah and Sanandaj, the number of tubers in each sample was counted and the averages were extrapolated to one kilogramme. These numbers were then used to estimate the total number of orchids harvested in a season, as calculated from the total weight of traded tubers obtained from the market survey. Tuber sampling was carried out mid-season. Most of the purchased dried tuber samples were from the previous year's harvest; traders hold on to their stocks until the end of the season when prices are at their highest.

## DISTRIBUTION, STATUS AND ECOLOGY

The Orchidaceae family in Iran is represented by 46 species and subspecies, of which 30 (sub)species (65%) produce tubers that can theoretically be used for the production of *salep* flour. Members of the family are distributed over different habitats—from Hyrcanian forests and dry oak forests to alpine wet grasslands, mainly along the Alborz Mountains in the north, and the Zagros Mountains in the west (Renz, 1978; Shahsavari, 2008). Despite collection being illegal, many of these plants are intensively exploited for their tubers. The conservation status of Orchidaceae species in Iran is poorly known; the majority of species have not been evaluated according to the categories and criteria of IUCN's global *Red List of Threatened Species*, and neither have national assessments been carried out. The ecology of the plants and the potential for sustainable use is also poorly known, and limited information is available on reproduction/regeneration rates of the different species commercially harvested in Iran and the surrounding region. Terrestrial orchids have complicated reproductive and regeneration systems, and pollination is largely dependent on specific pollinator species. In some genera, such as *Ophrys*, this is particularly complex, whereby seed production is highly dependent on pollinators while seed germination depends on mycorrhizal fungi. Any disturbance to the natural environment can break this chain of plant-pollinator-fungi and cause a reduction in reproduction/regeneration of orchid populations.

## LEGISLATION AND PROTECTION

Many of the orchid species being harvested for the production of *salep* flour are protected in their range countries, and most are threatened with local extinction (Swartz and Dixon, 2009). However, in Iran protection is not effective owing to the lack of public awareness of their protected status and because most of the collection occurs in open access areas where controls are limited. Iran has been a signatory to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) since 1976. All orchid species are listed in CITES Appendix I or II, and international trade in specimens or products requires both export and import permits. As far as is known, in Iran these are only granted for hybrid species and those that are claimed to be of cultivated origin. Protection of orchids growing in protected areas is the responsibility of the Department of Environment (DoE) and collection of orchid tubers from these areas requires

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**Fig. 4. Fresh (top) and dried palmate *salep* tuber of *Dactylorhiza* sp., Mahabad market, West Azarbaijan province.**

*Salep* flour from palmate tubers is considered to be of lower quality than that derived from oval tubers (below).

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**Traditional tool for digging up the tubers.**

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**Fig. 5. Fresh (top) and dried oval *salep* tubers, Maraveh Tappe Market, Golestan province.**

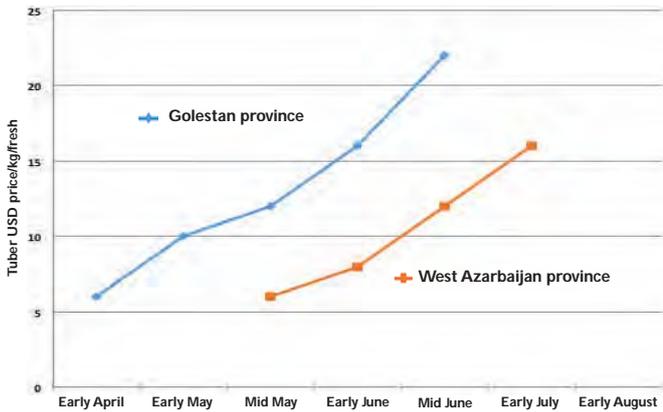
permission from the DoE; no commercial collection is allowed. Those growing in other areas, including open access areas, fall under the jurisdiction of the Forests, Range and Watershed Management Organization (FRWO). The export of plant material should also be accompanied by a permit issued by FRWO as well as phytosanitary certificates. Furthermore, a recent regulation issued by FRWO to provincial offices on 12 June 2013 (number 92/1/15123) reiterated that in order to protect the genetic resources of the country from depletion, all orchid collection is illegal and should be prevented, and that FRWO offices should not permit the collection, transport or export of orchid tubers (FRWO, 2013). Unfortunately, enforcement of these regulations is not effective enough to prevent destructive orchid collection, primarily because of limited tools and resources to monitor and control this trade. Currently traders and middlemen in bazaars are trading large amounts of dried tubers (up to four tonnes annually) without any interference from the authorities (J. Iezadi pers. comm. to A. Ghorbani, May 2014).

## RESULTS

Based on the findings of this study, 19 species and subspecies of *salep* orchids (41% of the total number of orchid species in Iran) are harvested for their tubers (Table 1). All are harvested indiscriminately and the tubers in the market are a mixture of different species. Each orchid plant generally has two tubers: one old wrinkled tuber and one fleshy over-wintering tuber, which will nourish the formation of the next flowering shoot. During harvesting, plants are dug out, the fresh tubers are collected and the plants and old tubers are discarded (Figs. 2/3). It has been observed that in Western Azarbaijan province, old orchid tubers are replanted after the fresh tubers have been harvested; success rates of such practices are unknown.

Harvested tubers are washed, boiled in water or milk for *ca.* 10–15 minutes and sun dried and traded in a dried form. Morphologically, two kinds of *salep* are recognized in the market: palmate (*Panjeh-ey*) *salep* from branched or palmate tubers of *Dactylorhiza* species (Fig. 4), and the round or oval (*Qolveh-ey*) *salep* from other orchid species (Fig. 5). Palmate *salep* is considered to be of inferior quality and fetches lower prices in the market than the round/oval *salep*.

The number of tubers in one kilogramme of fresh or dry *salep* depends highly on the composition of collected species and the life stage of the plants when harvested. The former varies geographically as distributions of species may differ. For example *Dactylorhiza* and *Himantoglossum* species produce bigger tubers which can weigh between four and six grammes, respectively, when dried. Also, tubers collected after flowering and during the fruiting period are the heaviest, lose less weight after drying and are of better quality. In Golestan province, one kilogramme of fresh tubers consists of  $304 \pm 73$  tubers, which is indicative of the number of orchid plants that must be harvested to produce one kilogramme of fresh *salep* tubers (each tuber representing one orchid plant). Depending on the age of plants at harvest time and composition of species, between four to eight kilogrammes of fresh *salep* tubers normally yield one kilogramme of dried *salep*. On average, one kilogramme of dried *salep* from *Dactylorhiza* species (palmate *salep*) can be produced by uprooting  $605 \pm 219$  plants, while one kilogramme of dried ovoid *salep* (from other species) requires harvesting  $1117 \pm 236$  orchid plants (samples taken from western provinces).



**Fig. 6.** Price changes during harvest season for fresh salep tubers in northern and north-western parts of Iran.

In Golestan province, the orchid tuber harvest in April–June 2013 was estimated at 24.5 t of fresh tubers traded by seven middlemen. This volume required the destructive harvesting of  $7.4 \pm 1.7$  million individual orchids. In Tehran bazaar, six medicinal plant wholesalers traded 1920 kg of dried tubers during May–July 2013. The estimated number of orchids harvested for that volume is  $1.16 \pm 0.4$  million individuals. These specimens were from other provinces, such as Mazandaran and some western provinces; it was not possible to obtain exact figures for each province or region.

Prices for fresh tubers vary from about USD5–6/kg at the beginning of the season—when they are unripe, of poorer quality, and with a higher water content—to more than USD22/kg towards the end of the season (Fig. 6). Prices also depend on the size of the tubers

and the quantity available for sale. Fresh tubers are purchased by local representatives or local middlemen in the villages, directly from the collectors, who sell them to a second middleman. The tubers are dried by the second middleman and sold to wholesalers in cities like Tehran, Urmieh and Tabriz, or directly to merchants from Turkey, Pakistan and India (Fig. 1), which are the end markets. According to the traders in Tehran bazaar, since the export of *salep* is illegal, the foreign merchants either buy small volumes of *salep* tubers (ca. 15–20 kg), to be exported in hand luggage, or mixed with almonds to avoid detection. Considering the average price of USD13/kg for fresh tubers, *salep* trade in Golestan province was worth nearly USD320 000 in the 2013 season. In Tehran bazaar, dried *salep* is purchased for USD110–130/kg and sold for USD160/kg, with an estimated total sales value of nearly USD310 000 in 2013.

These estimates of the number of harvested plants are not comprehensive and may not represent the number of plants harvested nationally. However, this level of harvest will affect the population of orchids sooner or later. In the western provinces of Iran, which have a longer history of orchid collection, people have reported a decline in orchid populations, and as a result try to replant the old tubers after removing the new tubers. The effects of replanting old tubers on regeneration and population restoration has not yet been studied. In the northern provinces, however, where traders from outside the area introduced collection practices only six years ago, villagers still consider orchids as a gift of nature, provided to them as a resource to supplement their income. They appear not to be aware that the orchid tuber harvest may cause a decline in orchid populations.

A SELECTION OF ORCHID SPECIES HARVESTED IN IRAN FOR THEIR TUBERS TO PRODUCE SALEP



*Orchis adenocheila*



*Himantoglossum comperianum*



*Orchis mascula*

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Species	Provinces where collection occurs
<i>Anacamptis collina</i>	Golestan
<i>Anacamptis coriophora</i>	Western Azarbaijan, Kurdistan
<i>Anacamptis morio</i> subsp. <i>picta</i>	Ardabil, Eastern Azarbaijan
<i>Anacamptis palustris</i>	Western Azarbaijan, Kurdistan
<i>Anacamptis pyramidalis</i>	Golestan, Gilan, Mazandaran
<i>Dactylorhiza incarnata</i>	Western Azarbaijan, Kurdistan
<i>Dactylorhiza romana</i> subsp. <i>georgica</i>	Golestan, Eastern Azarbaijan
<i>Dactylorhiza umbrosa</i>	Western Azarbaijan, Kurdistan, Kermanshah
<i>Himantoglossum affine</i>	Kermanshah
<i>Himantoglossum comperianum</i>	Western Azarbaijan, Kurdistan, Kermanshah
<i>Ophrys scolopax</i>	Golestan
<i>Ophrys sphegodes</i>	Golestan
<i>Ophrys sphegodes</i> subsp. <i>mammosa</i>	Golestan
<i>Orchis adenocheila</i>	Golestan, Gilan, Western Azarbaijan
<i>Orchis mascula</i>	Golestan, Mazandaran, Gilan, Ardabil, Eastern Azarbaijan
<i>Orchis simia</i>	Golestan, Mazandaran, Gilan, Ardabil, Eastern Azarbaijan, Western Azarbaijan
<i>Orchis punctulata</i>	Golestan
<i>Platanthera chlorantha</i>	Gilan, Eastern Azarbaijan
<i>Stenisiella satyrioides</i>	Golestan

**Table 1. Orchid species harvested for production of salep flour in Iran, and the main collection areas.**

## DISCUSSION

As *salep* is not commonly consumed in Iran, the current orchid collection boom in that country is driven by international demand, particularly from Turkey, Pakistan and India, and the resultant high prices. Collection areas overlap with areas of high orchid species diversity and the harvest is a threat to orchid diversity in these locations. The eastern part of Golestan province, for example, is one of the hotspots of orchid species diversity in Iran, yet wild orchid collection is booming there. Current orchid harvesting practices destroy individual plants and may consequently be damaging populations. The high prices of tubers have led to competition among collectors, and many commence harvesting before the plants bloom and develop seeds. Considering that the harvested parts are tubers that are needed to nourish the following year's flowering stem, that the plant is destroyed after harvest, and that the harvest mostly happens before seed production, current orchid collection practices are likely to be unsustainable. However, orchid tuber collection is important for the local people involved—most of them farmers—as it is a source of additional income at a time of the year when there is a shortage of cash.

Since the trade in *salep* must be accompanied by CITES permits and considering that FRWO is not issuing any collection and export permits, the international trade in harvested tubers is clearly illegal. Mixing tubers with nuts such as almonds, or mislabelling the tubers and exporting them with permits that have been issued for nuts or other goods, makes it difficult for such shipments to be verified by Customs through morphological tests; it is especially difficult when *salep* is exported/imported in the form of flour. Effective identification and verification methods can help in controlling this illegal trade.

## RECOMMENDATIONS

To address some of the problems identified in relation to the protection of orchid resources in Iran, the authors recommend several actions: in the short-term and at the national level, collection bans should be implemented in heavily exploited areas and enforcement of regulations strengthened. Forest rangers and environmental guides need training in orchid identification and the public made aware of the need for orchid conservation. To control the international illegal trade of orchid tubers, a DNA barcoding-based identification method can be used to verify the identity of traded goods and also those species that are most commonly in trade, especially when *salep* is traded in the form of flour. This, in turn, can help in the effective protection of these species by focusing conservation action on highly exploited species and specific geographical areas. DNA barcoding can also help to identify adulterants in *salep* powder that may present a health risk for consumers. Furthermore, identifying *salep* in mislabelled export/import items can assist Customs and other organizations in both the countries of origin and destination countries to control and seize illegal trade.

FRWO, as the responsible organization in Iran for conserving natural resources outside protected areas, should be provided with the necessary resources to enforce regulations on the harvest of orchids, and to strengthen the enforcement of regulations through provincial offices. Monitoring orchid populations by mapping and recording orchid population distributions and densities, and reporting new populations and significant finds to a central FRWO database should be carried out. Village councils and villagers in densely harvested areas should be informed about collection regulations and the

conservation status of orchids through educational and participatory workshops, with the aim of involving them in efforts to implement legal sustainable harvesting and production.

Over the longer term, the establishment of targeted Orchid Conservation Areas can mitigate the effects of illegal collection on orchid populations in hotspot collection areas, but also attract tourism and associated benefits. The training of local villagers in sustainable collection practices and cultivation can reduce pressure on wild populations and could sustain the financial benefits villagers derive from the *salep* trade. However, sustainable harvest practices are difficult, especially in the study area, owing to the complicated life cycle of the harvested orchid species, their reproduction and regeneration systems, which requires the presence of mycorrhizal fungi and specific pollinator species. More research is therefore vital if sustainable harvesting measures are to be developed. The practice of replanting old tubers, currently undertaken in Western Azarbaijan province, should be explored and, if found to be successful, could be used as a model in other areas for best practice for harvesting. However, for cultivation practices to become realistic, support must be provided to the scientific community, the government in Iran and local NGOs.

## ACKNOWLEDGEMENTS

Financial support from the Swedish Research Link programme of the Swedish Science Council is gratefully acknowledged. Carl Tryggers Foundation for Scientific Research provided a postdoctoral research stipend to Abdolbaset Ghorbani (AG) (through Hugo de Boer (HdB)). Further support for fieldwork was gratefully received from the Anne S. Chatham fellowship of the Garden Club of America (AG), Sven och Dagmar Saléns stiftelse (HdB, AG) and Lars Hiertas Minne (HdB). David L. Roberts, Durrell Institute of Conservation and Ecology, School of Anthropology and Conservation, University of Kent, UK, is acknowledged for his helpful comments on this paper; Bryony Morgan, TRAFFIC's Medicinal Plants Programme Officer and Executive Officer, FairWild Foundation Secretariat, and Anastasiya Timoshyna, TRAFFIC's Medicinal Plants Programme Leader, are also acknowledged for their comments on an early draft.



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