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ORIGINAL RESEARCH PAPER

Using traditional ecological knowledge in discovery of rare plants: a case study from Turkey

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Abstract

Sustainable (and adaptive) management of natural resources is usually based on long term local experiences with nature. Local traditional communities often possess rich ecological knowledge connected to nature and traditional resource use and management. This knowledge can provide unexpected new information for researchers, and show new opportunities and ways for professionals in conserving rare and threatened species.

We found significant new populations of the rare *Ophrys lesbis* in a private area next to the settlement of Çamlık, Muğla, and *Orchis punctulata* in the graveyard of Kadılar, Antalya with the help of local rural people. We firstly report the replanting of some orchid species (*Orchis papilionacea*, *O. italica*, and *Barlia robertiana*) in kitchen gardens of Çamlık and Bayır, in Muğla Province.

The presence of significant orchid populations (e.g., the biggest ever found for *Ophrys lesbis*) in an area, where local owners have been actively harvesting salep from year to year for decades suggests that the moderate salep harvesting can be sustainable for long run. Based on our observations, Turkish salep harvesters can help botanists and conservationists find new locations of rare threatened orchid populations, and therefore indirectly help in conserve these populations.

Keywords

flora of Asia Minor; *Ophrys lesbis*; Orchidaceae; orchids; *Orchis punctulata*; red list species; salep; TEK

Introduction

While traditional ecological knowledge of wild plants and their use for different purposes seem decreasing in the twenty-first century throughout Europe [1–5], local communities in several regions of Turkey still often use wild plants for nutritional and medical purposes [6–12]. In Turkey, tubers of the terrestrial orchids have been collected for centuries, and used for making a hot winter beverage (*salep*) and ice-cream (*salepi dondurma*), and are still used for those purposes [13,14]. Salep collection is considered one of the most important threats to orchids in the Balkans [15], in the Southwestern Asia [16,17], and especially in Turkey [13,18–24]. Germany is one of the major importers of salep in Europe: the number of excavated, exported orchid individuals just for salep in Germany is approximately 3 or 4 million individuals per year [19]. Since then, the demand for salep has unfortunately grown; therefore the price of salep (and probably the magnitude of export) has also increased [16]. On the other hand, Ertuğ [25] defended the sustainable salep collecting by local residents and for the rights of local communities to continue traditional cultural activities, like salep harvesting.

Local communities often possess rich local ecological knowledge connected to traditional resource use and resource management [26]. Sustainable (and adaptive) management of natural resources [27] is usually based on long term local experiences with nature. Application of traditional ecological knowledge for conservation activities has started recently, in the past few decades [28,29]. Experiences show that traditional ecological knowledge can help find new localities of rare threatened species, document changes in their population sizes and distributions analyze the effects of various management practices and disturbances on their populations, etc. [30,31].

This paper documents a special case where local Turkish people's traditional ecological knowledge related to orchids helped find significant (actually the largest ever) population of a rare orchid species and important populations of some other species. As we know, the local ecological knowledge of salep harvesters has not yet been studied, neither used for conservation.

Material and methods

Between March 27 and April 10, 2015, we surveyed the orchid flora of graveyards in Turkey (cf. [24]). During our work, we met local residents who revealed that they have significant knowledge related to orchids (three study locations are shown in Fig. 1). Our key informant persons were Mrs. Güllü S. (age: 85 years, Muğla), Mr. and Mrs. F. (age: 74 and 72, Muğla), and Mr. Hasan K, (age: 76, Antalya). A free informed consent was asked for when taking pictures of local informants.

The geocoordinates of and the altitude of the study locations were determined by a Garmin E-Trex Legend GPS handheld device recorded in WGS84 format. Area of parcels studied was measured using Google Earth Pro software.
This paper follows the nomenclature of Kreutz [32].

Fig. 1 Map of the study area. Provinces Muğla and Antalya are highlighted with green and blue, respectively.

Results

On March 29, 2015, in a restaurant in the village of Çamlik (Muğla Province), we found in vases as table decoration (Fig. 2b) hundreds of individuals from seven orchid species: *Barlia robertiana* (Loiseleur) Greuter [syn. *Himantoglossum robertianum* (Loiseleur) P. Delforge], *Orchis italica* Poiret, *Ophrys reinholdii* H. Fleischmann, *O. tenthredinifera* Willdenow, *O. lesbis* Gölz & H. R. Reinhard, *O. sicula* Tineo, *O. heterochila* (Renz & Taubenheim) P. Delforge]. The bouquets were collected by the members of the restaurant owner family. The owner family farms (growing olive trees, keeping

livestock), and also makes carpets and runs the restaurant. Householder Recep S. buys the salep collected by village residents (Fig. 2c,d). His mother, Güllü S. (Fig. 2e,f) learned about salep harvesting from her father while she was a child. She told us that annual salep harvesting season lasts ca. 30 days between March and April. In a month, a hardworking person is able to collect maximum 30–40 kg of dried salep. She said salep can be found in nearby forests and pastures. She perceives that the number of orchid individuals is the same now as 70–80 years ago in her childhood. During the collection process, she does not excavate all individuals of a population, just a few plants, and she leaves the rest of the population undisturbed. She named the following plant species in the restaurant's bouquets: *Orchis italica* (Tavşan topu – "hare ball"), *Barlia robertiana* – Botanak. She did not differentiate among the different species of *Serapias* taxa (Katır tırnağı – "mule hoof") and the *Ophrys* taxa (Kedi tırnağı – "cat claw") while the different *Ophrys* taxa were in different vases on the tables. She told us that in Muğla Province, the *Ophrys reinholdii* can be found in forests – this fact is a good indication of her field knowledge of the habitat preferences of orchid taxa found there.

The individuals found in the vases were harvested on the pastures in their olive tree plantations. The next day they led us there. The habitat (37.0709° N, 027.5388° E) we saw was a sparsely structured olive groove, with grasslands under the trees (Fig. 2g). We found 10 orchid species on this parcel in total, including the rare *Ophrys lesbis* (Fig. 2h,i), with 40 individuals. They told us that beside growing olives, they let two or three sheep graze the area for a few months annually, although no sheep were visible when we visited the pastures. The intensity of grazing was enough to keep the territory mostly shrub-free and we found no signs of overgrazing, which is typical in Turkey. We assessed in detail the orchids found there and in nine neighboring parcels. One parcel was plowed, one was overgrazed by cows, and all the others provided habitat for orchids: 2–6 species with 7–155 individuals. The total area of surveyed eight plots harboring orchids was 4.04 hectares, which represents a dense orchid population (174 flowering individuals/hectare). We found 313 individuals of the *Ophrys lesbis* altogether (Tab. 1).

We documented the planting of orchids in the kitchen garden of Çamlık (Muğla) [*Orchis italica* (Fig. 2e) and *Orchis papilionacea* (Fig. 2f)], and Bayır (Muğla) [*Barlia robertiana* (Fig. 3a,b)].

Furthermore, on April 6, 2015, Hasan K. showed us individuals of the *Orchis punctulata* Steven ex Lindley as salep (Fig. 3c–e) in the graveyard of his home village (Kadılar, 36.71360° N, 31.63334° E, 36 m a.s.l., Antalya). In the viable population of *O. punctulata*, we counted altogether 82 flowering individuals. Additionally, in the same graveyard, we recorded more than 500 individuals of six further taxa [*Ophrys mammosa* Desfontaines (one flowering specimen), *O. tenthredinifera* Willdenow (two mature individuals), *Ophrys* sp. (ca. 20 sterile individuals), *Serapias politisii* Renz (15 flowering specimens), and *Spiranthes spiralis* (L.) Chevallier (ca. 500 leaf-rosettes)] were recorded. In the whole graveyard, traces of salep harvesting were not detectable.

Discussion

We found a valuable orchid locality next to the settlement of Çamlık (Muğla), with the kind help of a local family. There, we counted 701 individuals of 15 orchid species on eight olive tree parcels. The occurrence of rare *Ophrys lesbis* provides the most valuable data. This taxon was described from the island of Lesvos [33]; nowadays a few localities are known there, only with a few individuals. Later, a few populations were found in Muğla Province (populations with maximum around 100 individuals) [32]. *Ophrys lesbis* was reported recently from altogether five flora mapping grids, and additionally it has one more historical data in Turkey [34]. The species is listed (under high risk) among the most threatened European orchids by the IUCN/SSC Orchid Specialist Group [35]. Main threatening factors are overgrazing and tourism development. Only some populations are known, the known habitats are small-scaled with very limited general distribution. We found probably the largest known population

Fig. 2 **a** Traces of salep collecting [*Ophrys umbilicata*; near Seferihisar (İzmir)]. **b** Bouquets of orchids (including the rare *Ophrys lesbis*) and other wildflowers as table decoration in Çamlık village near Bodrum (Muğla). **c** Drying of orchid tubers collected for salep in Çamlık (Muğla). **d** Dried and powdered salep in Çamlık (Muğla). **e,f** 85-year-old Güllü S. showing flowering *Orchis italica* and *Anacamptis papilionacea* (respectively), planted in her family's garden. **g** New and significant locality of *Ophrys lesbis* and 14 other orchid species, found with the help of a local family. **h,i** Habit and inflorescence of *Ophrys lesbis*, respectively. Photographs: **a,c–f** A. Molnár V.; **b,g–i** V. Löki.

Tab. 1 Geographic position, area, and orchid flora of parcels (mostly grassy traditional olive groves) found by the help of a local family near Çamlık (Muğla, Turkey).

No.	1	2	3	4	5	6	9	10	Total
Altitude (m a.s.l.)	181–198	181–198	181–200	179–180	171–195	175–190	166–173	173–183	166–198
Area (hectares)	0.81	0.40	0.70	0.09	0.34	0.38	0.75	0.57	4.04
No. of orchid species	10	4	6	2	3	6	3	5	15
Total number of orchid individuals	139	99	133	59	92	155	7	17	701
Barlia robertiana (Loiseleur) Greuter	2	-	3	-	-	-	-	-	5
Ophrys bombyliflora Link	5	-	-	-	-	-	-	-	5
Ophrys ferrum-equinum Desfontaines	4	-	-	-	-	-	1	-	5
Ophrys heterochila (Renz & Taubenheim) P. Delforge	15	-	-	-	5	3	-	11	34
Ophrys lesbis Gölz & H. R. Reinhard	40	75	84	3	39	66	5	1	313
Ophrys lucis (Kalteisen & H. R. Reinhard) H. F. Paulus & Gack	-	-	2	-	-	-	-	-	2
Ophrys sicula Tineo	36	4	36	56	48	58	-	-	238
Ophrys tenthredinifera Willdenow	-	-	-	-	-	8	-	-	8
Orchis anatolica Boissier	10	-	-	-	-	-	-	-	10
Orchis italica Poiret	4	-	-	-	-	-	-	-	4
Orchis papilionacea L. subsp. *heroica* (E. D. Clarke) H. Baumann	-	-	-	-	-	-	-	2	2
Orchis sancta L.	-	-	-	-	-	10	-	-	10
Serapias bergonii E. G. Camus	-	5	3	-	-	-	1	1	10
Serapias politisii (Renz)	20	15	5	-	-	10	-	2	52
Spiranthes spiralis (L.) Chevallier	3	-	-	-	-	-	-	-	3

Fig. 3 **a,b** Local informants showing cultivated specimens of *Barlia robertiana* (shown with white arrows) in their garden (Bayır, Muğla). **c** 76-year-old key informant person showing *Orchis punctulata* (shown with white arrow) in graveyard of Kadılar (Antalya). **d,e** Habitat and inflorescence of *Orchis punctulata* in the graveyard of Kadılar (Antalya). Photographs: **c,e** A. Molnár V.; **d** V. Löki; **a,b** K. Süveges.

with 313 individuals, where based on the total area of the 10 plots, the population density is approximately 78 individuals/ha; however, the full population size is definitely still bigger, considering both the picked up, the vegetative (non-flowering), and the (certainly present) dormant individuals of the territory. Without the help of local informants, it would have been difficult to find this important locality.

Locals distinguished and named several orchid folk taxa. In most cases, they applied sublexical categorization: morphologically similar species were recognized but not named separately [36].

Conscious management of sensitive resources by local communities is well documented in many regions of the world (see, e.g., *Larus glaucescens* egg collection in Alaska [37], bulb collection of *Camassius* species in British Columbia [26], and collection of *Gentiana lutea* L. in the Carpathians; Z. Molnár and D. Babai, unpublished). The presence of significant orchid populations in a habitat, where the owner family has been actively harvesting salep from year to year for decades suggests that the careful salep harvesting can be sustainable for long run. Interviews with the key informants also suggest that they do not recognize a decrease in orchid populations as they do not harvest all individuals from a site. A photograph from April 5, 1997, of M. Wagner in a book by Kreutz [32: p. 33] proves that the family has harvested salep for at least 20 years. We argue that overuse of resources by consumers in developed countries cannot be an excuse to ban traditional practices in local communities in developing or transitional economies.

We observed in Çamlık and Bayır (Muğla), that some orchid species (*Orchis papilionacea*, *O. italica*, and *Barlia robertiana*) are planted in the kitchen gardens; as far as we know, this practice in the case of orchids has been previously unreported. Steinberg [38] considers that Neotropical kitchen gardens could be sometimes the only habitat patch remnants of the previous dense vegetation, and argues that although kitchen gardens are anthropogenically created agroecosystems, they also provide important habitats for biodiversity. We believe probably this can be also true in other regions of the world, especially in some regions of countries like Turkey, where though the biodiversity is still significant, the sociocultural and economical circumstances are changing. As orchids are often collected in the Southwestern Asia, and enjoy local people's prior attention due to their many possible uses, this observed habit may indicate the potential in thematic researches of orchids in kitchen gardens; and besides the obtaining of previously unknown ethnobotanical knowledge, it anticipates the acquisition of valuable floristic data too. We believe that they do not harvest these few individuals for salep purposes; our finding is rather evidence that local people are not just collecting and using the elements of nature, but they find them also aesthetic, and presence of these otherwise usable delights them in their close environment.

We found a significant population of *Orchis punctulata* also with the help of a local informant in the graveyard in Kadılar, Antalya. The species was reported recently from 34 flora mapping grids, and it has additionally 44 historical data in Turkey [34]. Kreutz [32] highlights the endangerment of the species; *Orchis punctulata* is also listed (under medium risk) among the most threatened European orchids by IUCN/SSC Orchid Specialist Group [35]. Main threatening factors for the species are: gathering of tubers for salep and that only some, often small and scattered populations are known.

Local people can often help botanists and conservationists find new localities of rare species. The easiest ways to interview local informants is to use living individuals or in case of protected species, color pictures of rare taxa. Pictures should show plants in a way local people perceive it (cf. [39]): i.e., not the botanically characteristic traits focused but the whole plant with some hints on the size of the plant and maybe the habitat. In those rare cases when the rare plant taxon has a specific local folk name, people can be asked more easily by its name [4].

The following plant species are good candidates for "locality hunting" according to our experiences in Central Europe: *Daphne cneorum* L. (a culturally important species; festivals are organized on the place when it flowers; Kalotaszeg region, Romania), *Cypripedium calceolus* L. (a highly salient species, locals even replant individuals into their gardens; Gyimes and Kalotaszeg, Romania), *Nigritella rubra* (Wettst.) K. Richt. (a distinct taxon of the orchid family, and has a separate name in one of the villages in Gyimes, Romania), *Gentiana lutea* (an important but very rare medicinal plant with

a single locality in Gyimes, Romania), *Leontopodium alpinum* Cass. (important for decoration and for tourists; Gyimes, Romania), *Eriophorum* spp. (used for decoration; Kalotaszeg, Romania), *Sternbergia colchiciflora* Waldst. & Kit. (a salient taxon, looks like a strange short tulip and flowers in fall; Great Hungarian Plain, Hungary). Locals can especially effectively help this exercise in understudied areas where time for searching for new localities is limited.

Traditional local land-use practices (in our case extensive grazing of grassy olive groves) are often beneficial to rare species. Traditional ecological knowledge could help understand which practices are appropriate for which species. Local people are increasingly aware of the goals of nature conservation which may lead to new types of cooperation and knowledge coproduction between locals and botanists/conservationists (see, e.g., the case of the "conservation herder" [40]).

Based on our observations, traditional Turkish salep harvesters are able to help find new locations of rare, threatened orchid populations. They are also competent in differentiating orchids at least at the genus level and can confidently show the populations in the field, therefore indirectly contributing to conservation of these populations.

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