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Isolated Mediterranean foraging: wild greens in the matrifocal community of Olympos, Karpathos Island, Greece

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Abstract

Background Studies on the in-depth documentation of wild greens use in the Mediterranean Diet (MD) are vital to understanding patterns of cross-geographical change in wild food ingredients in the Mediterranean context, their appreciated taste, and possible evolution. Our present study aims to document the leafy, wild-sourced plant portion of the MD in the unique and isolated matrifocal community of Olympos, North Karpathos Isle, Greece.

Methods An ethnobotanical field study focussing on traditionally wild-sourced edible greens (*chórta*) was conducted during the spring of 2023 via 42 semi-structured interviews with local people.

Results Our study documented 69 wild green taxa, along with their culinary uses and linguistic labels. Half of the gathered wild greens have a bitter taste (i.e. members of Asteraceae and Brassicaceae), while 70% of the top-quoted greens are bitter. These greens were mostly consumed cooked. Nearly half of the quoted taxa had been previously recorded as used in the food system of central Crete. In contrast, one-fourth of the folk phytonyms recorded in Olympos do not match the ones found in Crete and the rest of Greece, which may be linked to the Doric culture that the community remained attached to because of its isolation. However, the plant-human interaction kernel is similar to that of surrounding areas. Moreover, the community of Olympos seems to rely less on aromatic wild greens (compared with Crete).

Conclusion Cross-cultural foraging comparison is crucial for better understanding the circulation, exchange, and evolution of local plant knowledge under the MD umbrella. Our study assesses, in particular, how noteworthy phytolinguistic differences indicating different ancient trajectories of cultural encounters/exchanges may not necessarily be reflected in differences in terms of plant reports. As often postulated in linguistic ethnobiology, ancient linguistic labels sometimes remain as “empty shells”. Given the fragile environment and the increasing over-tourism during the summer months the study site is experiencing, the presented data could contribute to a more substantial shift towards sustainable eco-tourism initiatives involving the foraging and cooking of wild greens.

Keywords *Chórta*, Ethnobotany, Mediterranean diets, Wild food plants, Edible greens, Karpathos

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Background

The Mediterranean Diet (MD), i.e. the traditional dietary system of Mediterranean countries, characterised primarily by the high consumption of vegetables, pulses, and olive oil and the moderate consumption of animal protein, which is thought to confer health benefits, includes a substantial portion of wild plant ingredients, which were, and still partially are, traditionally gathered in the late autumn, winter, and spring. MD-centred studies have primarily forgotten most of these ingredients [1]. The large majority of these wild food plants are wild leafy vegetables (or wild greens), of which not much is phytochemically or pharmacologically known; however, their spatial and temporal variations represent crucial factors for better understanding the possible evolution of the MD. The MD likely originated in its most basic form in the Fertile Crescent after the Neolithic period since most cultivated plant ingredients and associated wild weeds were primarily available in post-Neolithic settlements [2, 3].

In the quest for a better understanding of the wild green portion of the Central and Eastern areas of the Mediterranean Diet, the commencement of this work was represented by a set of questions:

Apart from Crete, a well-studied prototype for the MD and a widely studied region [1, 4], are the Dodecanese islands also hotspots for the traditional gathering of wild greens/leafy vegetables (*chórta*)?

Are foraging patterns (i.e. gathered species) in the isolated, matrifocal, ancient Greek Doric-speaking community of Olympos on North Karpathos Island different from those of neighbouring Crete?

Are there differences between the folk plant names of Olympos and those of Crete?

Historically, the MD likely derives from ancient Neolithic food systems [2, 3], and the “hidden portion” of the MD [1] has been the subject of some studies in coastal areas of Southern Europe [3, 5] and, to a much lesser extent, in the Middle East and Northern Africa (MENA) [6–9], which mainly aimed at documenting the botanical identity of wild-sourced edible greens. Still, cross-cultural studies on this topic are scarce [10–12], even though these studies could better articulate hypotheses regarding the exchange and circulation of local ecological knowledge (LEK) linked to wild vegetables.

The current field study was designed to cover a specific site in the Dodecanese, the tiny village of Olympos, on North Karpathos Island, Greece, where the community retains several linguistic features deriving from the ancient Greek Doric idiom and is known for being one of the last matrifocal communities in the world [13].

The peculiarity of the site offers an ideal arena for phytolinguistic analysis of the data, which often allows us to draw hypotheses on the influences, origins, and exchanges of the recorded human-nature interactions. Unfortunately, robust contemporary cross-linguistic comparisons on folk plant names are lacking in Europe, and the entire ethnobotanist community seems to rely on the quoted folk names as provided by study participants and a few national reference books and compilations on vernacular plant names that exist in a few specific languages. The specific research objectives of this study were therefore:

To record the local names and traditional culinary uses of local wild edible greens in Olympos;

To reflect upon the reasons for possible similarities and differences between plant use reports and folk plant naming in Olympos and Central Crete;

To compare the data collected (both plant folk names and uses) with those of the nearest pre-existing ethnobotanical study site of Central Crete [1] as well as Central and Eastern Mediterranean areas;

To highlight the influence of socio-economic changes in past decades on foraging practices and their likely future sustainable development.

Methods

Study site

Karpathos, the second largest of the Dodecanese islands, is in the southeastern Aegean Sea [14]. The northern portion of the island, particularly the village of Olympos (pronounced as “Olymbos” by the locals), is characterised by its mountainous terrain and rugged coastline [15]. The Mediterranean climate features hot, dry summers and mild, wet winters [16] that contribute to the area’s rich flora and vegetation and support the traditional farming practices of the local community. However, water scarcity limits agricultural productivity, leading locals to cultivate even the most remote fields [13].

The Cretan area represents the southernmost phytogeographical region of Greece, encompassing the islands of Crete, Karpathos, Kasos, and Saria [17]. The flora of the island of Crete comprises at least 1624 different species, which includes at least 139 single-island endemic species (10.2%) [18], thus encompassing 95.2% of the species richness of the total Cretan area [19]. Within the Cretan area, the flora of Karpathos, Kasos, and Saria includes at least 923 plant species [19], among which 82 taxa of Karpathos are not to be found on Crete, including ten confined to only the Karpathos-Kasos complex and nine endemics restricted to only the islands of Karpathos and Saria [19]. In total, 28 plant species are shared endemics of Crete and Karpathos [19].

Historically, Olympos operated as a self-sufficient community with a notable matrifocal structure, which, along with its geographical isolation, helped preserve its unique cultural and social structure [13]. With human occupation dating back to pre-historic times, the studied urbanised area of Olympos was established during the Byzantine era, between the seventh and ninth centuries, as a refuge from pirate attacks. Olympos was built when inhabitants of the village Vroukounta were regularly attacked by Arabs and pirates. They were forced to leave the coast and decided to settle in the interior, beyond impassable mountains. Olympos has remained relatively unchanged over the centuries due to its natural isolation [20]. From 1837 to 1912, Karpathos belonged to the Ottoman Empire, where the local culture and language remarkably withstood significant change. Subsequent governance by Italy, Germany, and Britain preceded its integration into Greece in 1947 [21].

Emigration, particularly to America, peaked from the late nineteenth century through the mid-twentieth century, significantly impacting the island's population. These migration waves, especially after 1950, resulted in a decline in the number of residents in the community of Olympos. However, the 1980s and onwards saw a reversal, with many emigrants returning and investing in the island [15]. Many Olympians live in Rhodes, Athens, and Piraeus in Greece, and Baltimore in the USA. These migrants and their descendants visit their hometowns regularly, preserve their homes, and attempt to transmit their heritage to their descendants. We observed a flow of traditional food items, including *chorea*, from the town to Olympians living in Rhodes and Athens.

Northern Karpathos, particularly the village of Olympos, is often cited in discussions of matrifocal societies. In Olympos, traditional roles have usually showcased strong female figures, particularly in the domestic and social spheres, and women have been vital in preserving folk traditions and crafts. The women of Olympos are particularly notable for their traditional costumes and prominent roles in local businesses and community life. This practice has historical roots in the village's societal structure [13, 22]. Olympos is celebrated for vividly preserving these traditions, and its way of life and festivities are recognised by UNESCO [15].

Olympos remained very isolated and endogamic until a few decades ago when an unsuitable 45-km road started to connect it to Pigadia and the rest of the island—the road was asphalted only in 2010; before the construction of the road, the only connection with the outside world was via the sea and the neighbouring Diafani harbour.

Like much of Greece, Olympos is Greek Orthodox regarding its religious affiliation. The Greek Orthodox Church plays a significant role in its inhabitants' cultural

and spiritual life [13]. This is reflected in the village's traditions, festivals, and daily lifeways, with numerous religious celebrations and customs intertwined with the community's identity [23].

In Olympos, the local permanent inhabitants now number at most 150 elderly individuals. They speak a variety of Greek that is also widely spoken in the Dodecanese isles (including Crete), but the community retains several linguistic features (especially in the vocabulary) deriving from ancient Doric Greek. The local landscape and gastronomy of the community largely overlap those of the communities on other Greek Isles, with a particular accent in Olympos on *locally* sourced ingredients: home-made noodles (legacy of Italian influences), fava beans, lentils, goat and sheep cheese, artichokes, tomatoes, peppers, wild greens, and herbal teas.

However, the community of Olympos, compared with Cretan communities, has remained tremendously isolated for centuries; however, this situation has changed over the past a few decades. Due to recent socio-economic changes, Olympos has become a tourist attraction for the summer only while being abandoned in other seasons; depopulation and restricted access to fresh water have led to limited traditional agro-pastoralist activities. The neighbouring Cretan communities, used in this study as the principal comparative site, are still much more vibrant and engage in a range of farming activities (Table 1).

Field study and data analysis

The ethnobotanical field study was conducted in Olympos in April 2023 (Fig. 1). The survey's primary purpose was to record local knowledge on wild-sourced edible greens (*chórta*) currently gathered and consumed by locals (Fig. 2).

Forty-two study participants (20 men and 22 women) were recruited through a snowball technique to participate in semi-structured interviews, favouring middle-aged and elderly inhabitants (range: 40–84 years), especially rural farmers, shepherds, and elderly women, who were considered potential local knowledge holders of the foraging traditions in the area. Before each interview, verbal consent was obtained from each participant, and the Code of Ethics adopted by the International Society of Ethnobiology [24] was followed. All the interviews and following analysis were conducted anonymously. The interviewees were first asked to free list the wild vegetables they collected, and then additional questions were asked regarding their preparation and taste. If the weather, location, and health of the interviewees permitted, plant gathering walks were undertaken, otherwise photographs of the plants were used to support their identification. Semi-structured interviews on each

Table 1 Brief comparison between the study site of Olympos and that of Central Crete

Location	Olympos	Central Crete
Language	Greek with Doric influences	Greek
Anthropological characteristics	Matrifocal	Patrifocal
Vegetation and Landscape	Mediterranean arid ecology	
Main economic activities	Very few agro-pastoral activities and prevailing summer tourism	Robust agro-pastoral activities and year-around tourism
Gastronomy	Greek Mediterranean diet	
History and migration	Long history of outgoing migration	Mixed history of outgoing and incoming migration

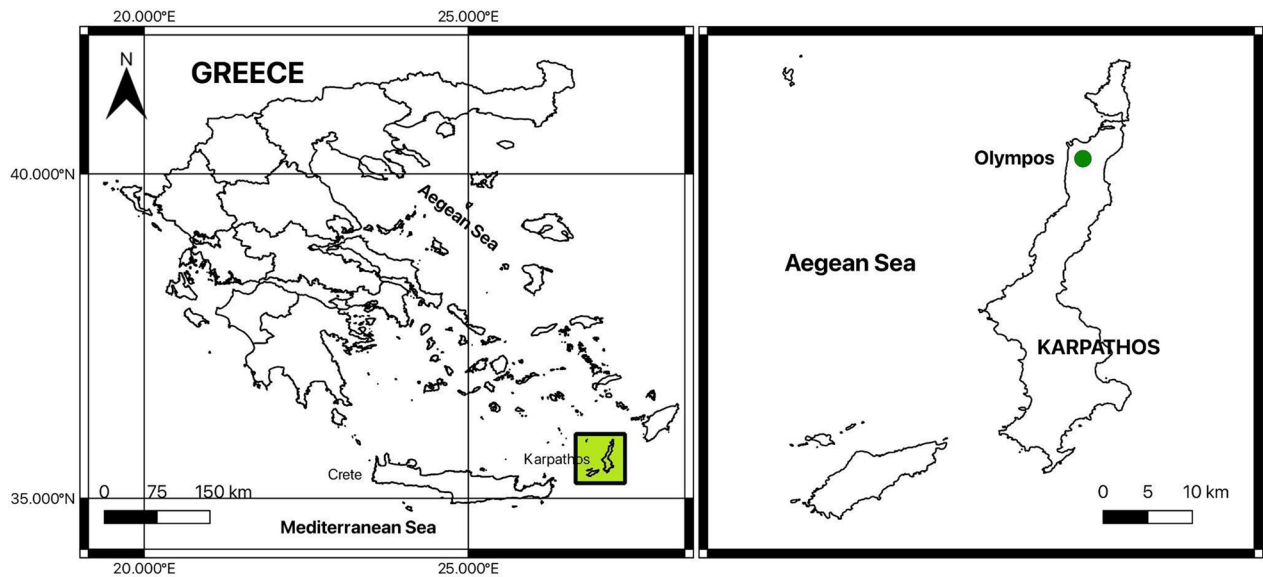


Fig. 1 The study site of Olympos, located on Karpathos Island, Greece



Fig. 2 The landscape of the study area: Olympos village (on the left) and the farming settlement of Avlona (on the right)

free-listed item were conducted in English since most inhabitants speak this language because of their history of migration to the USA. In a few cases where the interviewees did not comprehend English well, we involved local inhabitants as mediators.

The local name(s) and the detailed food uses were documented for each free-listed wild green plant. We deliberately excluded from the survey wild fruits and mushrooms; however, wild plant snacks (i.e. wild plant parts ingested mainly for leisure outside food contexts/domestic arenas) were included, as well as those cultivated species whose local food use was unusual. When possible, specimens of the quoted wild greens were collected from the study area and were taxonomically identified using standard reference works on the Aegean Flora [18, 25]. Voucher specimens bearing the codes ETBOTOLY01-72 were deposited at the Herbarium of the Department of Environmental Sciences, Informatics and Statistics, Ca' Foscari University of Venice, Italy (UVV). The identification of wild plants, which were not available during the field study, was conducted based on the folk names and detailed plant descriptions provided (botanical taxa not bearing voucher codes in Table 2); in such cases, after a preliminary evaluation, plant illustrations or photographs related to the quoted folk names of the presumed plants were shown to the study participants for verification. Nomenclature followed the Plants of the World Online database [26], while plant family assignments were consistent with the Angiosperm Phylogeny Group [27]. The local Greek names of plants were recorded in the Latin alphabet following phonetic transcription.

Our collected data in Olympos were coded on the basis of local use and local name. The data were compared with those reported in earlier ethnobotanical studies carried out in Central Crete and other Mediterranean areas, using the matrix adopted by Pieroni et al. [5, Table 2]. We conducted a detrended correspondence analysis (DCA) in Past 4.16c [28] to assess the magnitude of gradients and associations among wild vegetable reports. Through DCA, the data are transformed to eliminate any linear trends, thus enabling a closer examination of the nonlinear relationships between the factors.

Results and discussion

Olympos' Chórta

Table 2 presents the wild-sourced edible greens reported by the informants as traditionally gathered and consumed. Along with the botanical taxa, families, and voucher codes, the folk names that we recorded in the study area are provided, as well as the plant parts used, their traditional culinary uses, and the associated

quotation frequency (proportion of the overall informants citing the specific food use of a given taxon).

In total, 57 wild folk taxa corresponding to 69 wild botanical taxa were recorded and identified as folk wild edible greens. Figure 3 shows that nearly half of the gathered taxa are bitter, i.e. largely members of Asteraceae and Brassicaceae, while the top-quoted greens in Olympos are predominantly bitter. No significant differences were found between the taxa quoted by male and female community members; however, female study participants seemed more prone to provide details on the foraged item and their culinary processes.

This remarkable number of gathered wild food plants shows that the Dodecanese represent an extraordinary hotspot of traditional foraging. Most of the quoted wild vegetables are mainly consumed cooked (boiled or pan-fried, or in pies; less frequently in omelettes), while only a few are used in salads, eaten as snacks, or added as seasoning. As in Crete, the *chórta* plants in Olympos are also locally classified according to their cooking method: boiled, pan-fried, and added as seasoning [1]. This classification, however, does not seem to be as prominent in the minds of locals in Olympos as the one we recorded in Central Crete, i.e. locals did not tend to immediately and automatically associate every plant with its main cooking method (as occurs in Crete).

Olympos' vs. Cretan Chórta

Figures 3 and 4 compare Olympos's and the Central Cretan wild food ethnobotanical data. Nearly half of the quoted taxa (58%) were also previously recorded in nearby central Crete [1]. However, in Olympos, botanical genera referring to *bitter* top-quoted (i.e. quoted by more than 40% of the study participants) wild greens genera are more prominent than the top-quoted bitter genera of Crete [1] (Fig. 4). In contrast, aromatic genera in Central Crete are substantially more frequently mentioned than in Olympos. This could be linked to the fact that the Cretan tradition, apart from boiled *chorta*, prefers pan-fried and pie-cooking methods, in which the occurrence of *aromatic* greens is considered essential. These differences in the top-quoted wild greens in Olympos could signify an influence from external cultures, i.e. from mainland Balkans (where the Doric civilisation is believed to have originated), or a gendered difference in the preference of traditional preparations. In Olympos, the significantly lesser importance of aromatic wild greens, which are generally appreciated for their strong taste and pan-fried by male community members, could represent a legacy of the solid matriarchal society, where male community members were absent from the village and often worked at sea for long periods.

Table 2 Wild-sourced edible greens recorded in Olympos, Karpathos Island, Greece. The higher number of asterisks indicates more frequent utilisation reported

Family	Latin name (Voucher codes)	Recorded local name (s)	Native range	Parts of plants used	Use	Frequency of use
Amaranthaceae	<i>Amaranthus blitum</i> L. (OLY21, OLY72), and possibly other <i>Amaranthus</i> spp. (#)	Stafchóri*, Kokkinoláhanó	Eurasia, America	Leaves	Boiled, pies	+++
Amaranthaceae	<i>Beta vulgaris</i> L. (OLY33) CU	Séfla	Mediterranean	Leaves	Boiled, pies (mixes)	+++
Amaranthaceae	<i>Beta vulgaris</i> subsp. <i>adanensis</i> (Pamukç.) Ford-Lloyd & J.T. Williams (OLY68)	Agriaspánaka	Mediterranean	Leaves	Boiled, pies (mixes)	+++
Amaranthaceae	<i>Chenopodium murale</i> (L.) S.Fuentes, Uotila & Borsch (OLY26)	Vromósá, Agriostathóri*, Maidhiá*	Mediterranean	Leaves	Boiled, pies (mixes)	++
Amaranthaceae	<i>Salsola kali</i> L.	Mirguátana*	Eurasia	Aerial parts	Salads	+
Amaryllidaceae	<i>Allium ampeloprasum</i> L. (OLY39)	Skordaliós	Mediterranean	Whole plants	Seasoning	+
Anacardiaceae	<i>Pistacia lentiscus</i> L. (OLY49)	Skinos	Mediterranean	Fruits	Seasoning and oil (P)	+
Apiaceae	<i>Apium graveolens</i> L.	Agrioselíno	Eurasia	Aerial parts	Seasoning	++
Apiaceae	<i>Critheum maritimum</i> L.	Krítima	Mediterranean	Young aerial parts	Pickled, salads	++
Apiaceae	<i>Daucus carota</i> L. sensu lato (OLY37)	Kafkalína	Eurasia	Young aerial parts	Seasoning, boiled mixes	++
Apiaceae	<i>Foeniculum vulgare</i> Mill. (OLY17)	Ámitho	Mediterranean	Young aerial parts	Boiled, seasoning	+
Apiaceae	<i>Scandix pecten-veneris</i> L. (OLY69)	Velónia*	Mediterranean-European	Young aerial parts	Boiled, pies (mixes)	+
Apiaceae	<i>Smyrniolum olusatrum</i> L. (OLY10)	Ópsa *	Mediterranean-European	Peeled stems	Snack	++
Apiaceae	<i>Tordylium apulum</i> L. (OLY13)	Pervikomáto*, Pervigasmáthi*	Mediterranean	Rosettes	Seasoning boiled mixes	++
Asparagaceae	<i>Asparagus aphyllus</i> L. (OLY22)	Agriasarágia	Mediterranean	Shoots	Omelettes	++
Asparagaceae	<i>Muscari comosum</i> (L.) Mill. (OLY30)	Skordalios	Mediterranean-Asiatic	Bulbs	Boiled	++
Asteraceae	<i>Calendula arvensis</i> L. (OLY02, OLY35)	Lichni*	Mediterranean	Leaves	Pies (mixes)	+
Asteraceae	<i>Carduus pycnocephalus</i> L. subsp. <i>albidus</i> (M. Bieb.) Kazmi (OLY06), <i>Carlina corymbosa</i> L. subsp. <i>graeca</i> (Heldr. & Sartori) Nyman (OLY08)	Angátha	Mediterranean, Mediterranean	Flower receptacles, peeled stems	Snack	++
Asteraceae	<i>Centaurea calcitrapa</i> L.	Chóрто	Mediterranean	Rosettes	Boiled mixes	+
Asteraceae	<i>Centaurea raphanina</i> Sm. subsp. <i>raphanina</i> (OLY57)	Anginaráki	Greek (Aegean) endemic	Flower receptacles	Snack	+

Table 2 (continued)

Family	Latin name (Voucher codes)	Recorded local name (s)	Native range	Parts of plants used	Use	Frequency of use
Asteraceae	<i>Chamaeleon gummifer</i> (L.) Cass	Kollángatha	Mediterranean	Flower receptacles	Snack	+
Asteraceae	<i>Cichorium spinosum</i> L. (OLY71)	Yialóhorto	Mediterranean	Rosettes	Salads, boiled	+++
Asteraceae	<i>Gynura cardunculus</i> L. subsp. <i>cardunculus</i> (OLY38 /# /CU)	Anginária	Mediterranean (West)	Flower receptacles	Cooked	+++
Asteraceae	<i>Gynura cornigera</i> Lindl.	Agrianginária	Mediterranean	Flower receptacles	Cooked	++
Asteraceae	<i>Glebionis coronaria</i> (L.) Cass. ex Spach (OLY32)	Amàrangos	Mediterranean	Young leaves	Salads	+
Asteraceae	<i>Glebionis segetum</i> (L.) Fourr. (OLY31)	Amàrangos	Mediterranean	Young leaves	Salads	+++
Asteraceae	<i>Helminthotheca echioides</i> (L.) Holub (OLY43, OLY56)	Síria, Chirosíria, Kalitzió* (Kalitzius*)	Mediterranean-European	Rosettes	Boiled mix	++
Asteraceae	<i>Hypochaeris glabra</i> L.	Glykoradlki, Glykosirídi	Mediterranean-European	Rosettes	Boiled, pies (mixes)	+
Asteraceae	<i>Reichardia picroides</i> (L.) Roth (OLY16, OLY59)	Valatsína	Mediterranean	Rosettes	Boiled, pies (mixes)	+++
Asteraceae	<i>Scolymus hispanicus</i> L. (OLY46)	Angátha	Mediterranean	Stems	Snack	+
Asteraceae	<i>Sonchus asper</i> (L.) Hill subsp. <i>glaucescens</i> (Jord.) Ball (OLY51) and <i>Sonchus oleraceus</i> L. (OLY36, OLY52)	Čochos (Tzochos)	Temperate, Europe	Young aerial parts	Boiled	++
Asteraceae	<i>Taraxacum megalorrhizon</i> (Forssk.) Hand.-Mazz. (OLY 45, OLY54), <i>Taraxacum</i> spp., <i>Leontodon tuberosus</i> L. (OLY42), <i>Crepis</i> spp. (OLY 27, OLY28, OLY41)	Agrioradlki, Alloidosíria	Mediterranean, Mediterranean	Leaves	Boiled mixes	+++
Boraginaceae	<i>Anchusa azurea</i> Mill. var. <i>azurea</i> (OLY24)	Lichni*	Mediterranean	Young aerial parts	Boiled, pies (mixes)	+
Brassicaceae	<i>Eruca sativa</i> Mill. (OLY12)	Róka	Eurasia	Leaves	Salads	++
Brassicaceae	<i>Hirschfeldia incana</i> (L.) Lagr.-Foss. (OLY29)	Tziméta*	Mediterranean-European	Leaves and shoots	Boiled	+++
Brassicaceae	<i>Nasturtium officinale</i> W.T.Aiton (OLY63)	Kartamélia*	Mediterranean-European	Aerial parts	Salads	+
Brassicaceae	<i>Sinapis alba</i> L. (OLY34, OLY60), <i>Mutarda anvensis</i> (L.) D.A.German (OLY 62), <i>Rapistrum rugosum</i> (L.) All. (OLY65)	Lapsánes	Mediterranean, Eurasia, Mediterranean	Leaves and shoots	Boiled	+++

Table 2 (continued)

Family	Latin name (Voucher codes)	Recorded local name (s)	Native range	Parts of plants used	Use	Frequency of use
Capparaceae	<i>Capparis spinosa</i> L. subsp. <i>rupestris</i> (Sm.) Nyman	Kàppari	Mediterranean	Leaves	Pickled and then used in salads	+++
Caryophyllaceae	<i>Silene vulgaris</i> (Moench) Garcke subsp. <i>angustifolia</i> Hayek (OLY11)	Gobunüllio*, Strufi	Mediterranean	Young aerial parts	Boiled, pies (mixes)	++
	<i>Lathyrus oleraceus</i> Lam. (OLY44 /# /CU)	Fáva	Mediterranean	Shoots	Salads	++
Fabaceae	<i>Lotus orithopodioides</i> L. (OLY07)	Trifilli	Mediterranean	Leaves	Salads	+
Fabaceae	<i>Tetragonolobus purpureus</i> L.	Sándalus*, Agroilli*	Mediterranean	Fruits	Snack	+
Fabaceae	<i>Vicia faba</i> L. (# /CU)	Kukkiá	Irano-Turanian	Shoots	Salads, boiled, pies (mixes)	+
Geraniaceae	<i>Erodium cicutarium</i> (L.) L'Hér. (OLY73), <i>Erodium chium</i> Guiss. (OLY09), and possibly other <i>Erodium</i> spp.	Ladarántzoa*	Mediterranean, Mediterranean	Leaves	Boiled, pies (mixes)	+
Geraniaceae	<i>Pelargonium graveolens</i> L'Hér. (OLY66 /# /CU)	Barbarólla	South Africa	Leaves	Seasoning jams	+
Lamiaceae	<i>Clinopodium brevifolium</i> (Wahlenb.) Bräuchler & Hjertson (OLY67)	Glifuni*	Mediterranean	Leaves	Seasoning	+
Lamiaceae	<i>Mentha spicata</i> L. (OLY61)	Iósmos (Diósmos)	Mediterranean-Asiatic	Leaves	Seasoning	+
Lamiaceae	<i>Origanum onites</i> L. (OLY50)	Aroinos*	Greek (Aegean) subendemic	Inflorescences	Seasoning	++
Lamiaceae	<i>Prasium majus</i> L.	Lağupátima	Mediterranean	Leaves	Seasoning boiled mixes and pies	+
Lamiaceae	<i>Salvia fruticosa</i> Mill. (OLY20)	Kinomialiá*	Mediterranean	Galls	Snack	+
Lamiaceae	<i>Satureja thymbra</i> L. (OLY55)	Thrúmbi	Mediterranean	Leaves	Seasoning	+
Lamiaceae	<i>Thymbra capitata</i> (L.) Cav. (OLY18)	Meráthimo, Thimári	Mediterranean	Leaves	Seasoning	+
Malvaceae	<i>Malva parviflora</i> L. (OLY01, OLY03)	Molóha	Mediterranean-Asiatic	Leaves	Boiled, pies (mixes)	+
Oxalidaceae	<i>Oxalis pes-caprae</i> L. (OLY25 /#)	Ksinóchoro	South Africa	Aerial parts	Seasoning boiled mixes	++
Papaveraceae	<i>Papaver rhoeas</i> L. (OLY23)	Bakúnia*, Papagalo	Mediterranean-European	Rosettes	Boiled mix	++
Poaceae	<i>Hordeum vulgare</i> L. subsp. <i>spontaneum</i> (K.Koch) Asch. & Graebn. (OLY47)	Agriokrisári	Mediterranean-Asiatic	Seeds	Bread	+
Polygonaceae	<i>Rumex acetosella</i> L. subsp. <i>acetoselloides</i> (Balansa) Nijls	Oksialina	European	Leaves	Boiled, pies (mixes)	+

Table 2 (continued)

Family	Latin name (Voucher codes)	Recorded local name (s)	Native range	Parts of plants used	Use	Frequency of use
Polygonaceae	<i>Rumex crispus</i> L. (OLY48, OLY64), <i>Rumex pulcher</i> L. (OLY40)	Lápatho	European, Mediterranean-European	Leaves	Boiled, pies (mixes)	††
Polygonaceae	<i>Rumex tuberosus</i> L. subsp. <i>cre-ticus</i> Rech. f. (OLY15, OLY58)	Agriaspánaka, Chindália*	Greek (Aegean) subendemic	Leaves	Boiled, with rice	†††
Portulacaceae	<i>Portulaca oleracea</i> L. sensu lato	Glistrida	Mediterranean-European	Aerial parts	Salads	††
Rosaceae	<i>Prunus amygdalus</i> Batsch (OLY70 /# /CU)	Amýgdala	Transcaucasus	Unripe fruits	Snack	†
Rosaceae	<i>Sarcopoterium spinosum</i> (L.) Spach (OLY05)	Astivída*	Mediterranean	Young inflorescences	Snack	†
Solanaceae	<i>Solanum nigrum</i> L. sensu lato (OLY04)	Mavrovukíà* (Mavrokukíà*)	Eurasia	Leaves	Boiled, pies (mixes)	†
Urticaceae	<i>Urtica membranacea</i> Poir. ex Savigny (OLY14)	Katzúkñia	Mediterranean	Leaves	Boiled, pies (mixes)	†

* folk names not matching the standard Greek phytonym, possibly of Doric origin; CU: locally-cultivated; #: alien taxon; †: low citation frequency, quoted by 10% or less of the study participants; ††: average citation frequency, 11–39% of the interviewees; †††: high citation frequency, > 40% of the interviewees

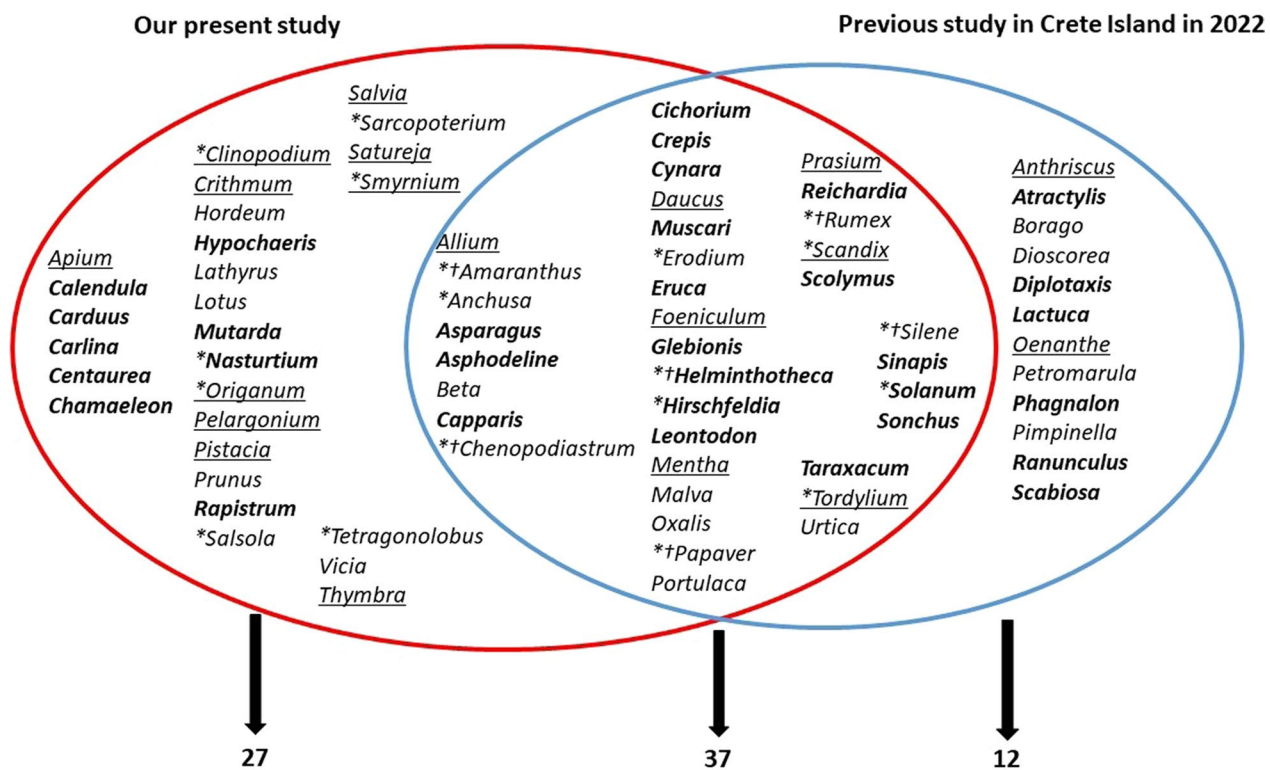


Fig. 3 Venn diagram showing the comparison of the overall quoted wild greens of Olympos with those of Central Crete [1]. Genera highlighted in bold are bitter (including all those belonging Asteraceae and Brassicaceae), while underlined genera are aromatic; genera marked with an asterisk have specific folk names in Olympos, diverging from the Greek ones. The cross symbol refers to shared folk taxa names

Cardus, *Carlina*, *Centaurea*, *Chameleon*, *Lathyrus*, *Lotus*, *Prunus*, *Salvia*, *Sarcopoterium*, *Smyrniium*, *Scolymus*, *Tetranoglobus* are used as snacks in OLY, while snack consumption was *not* considered in the CRE study.

However, the most significant difference was related to folk plant names. Unlike the folk plant names in Crete and the rest of Greece, Olympos retains a few specific folk plant names that do not match the standard Greek ones (N=24 unique phytonyms out of 75 overall recorded phytonyms—see Table 2 and Figs. 3 and 4). Nonetheless, the large majority of wild greens in Olympos are named in standard Greek, likely due to an early exchange between an ancient Doric culture and the dominant Hellenic one.

By comparing the reported local names in our study and the Dictionary of Karpathian Idioms [29], we found that most of the reported names exist in the Dictionary. However, there are some differences regarding the accent, i.e. vowel stressed while pronouncing the word. Examples of different forms of the same word: skordalliös in our study area/skordallúi in Rhodes; lichni in our study area/lichnidia in the rest of Karpathos; Kρίtama-kritamonin our study area/akríthamos in Othos. Some plant names, such as Ópsa (*Smyrniium olusatrum*), are derived from an ancient Greek word that means light

food, finger food, or something accompanying bread, e.g. cheese. There are 18 plant names from Table 2 that were not found in the Dictionary. Some of them are common Greek words, such as agriosélineo, agriasfarágia, sefkla, agriaspánaka, angátha, molóha, agrioradíki. Some idiomatic names, however, were possibly unknown to the dictionary author, or they may have been imported later or used by Olympitan speakers who had been influenced by other Karpathian idioms or even by other languages. Examples: stafchóri, kokkinolàhano, glifúni, ladarántzoa, agriokrisári, glykosirídi, kartamélia, oksialína, chinália, mirguátana, mavrovukià, alloidosíría, and gobunúllio.

Of the 24 specific Olympos phytonyms, only two refer to genera (*Amaranthus* and *Rumex*) among the top-quoted ones in Olympos that were not top-quoted in Central Crete. Figures 3 and 4 show that a possible Doric legacy in phytonyms is prominent among the wild greens that were infrequently quoted in Olympos.

Additionally, the six botanical genera locally named in (presumably) Doric in Olympos are also used in Central Crete; these show, in our opinion, the remarkable linguistic resilience in Olympos.

Moreover, six other botanical genera were named in both standard Greek and Doric in the study sites and

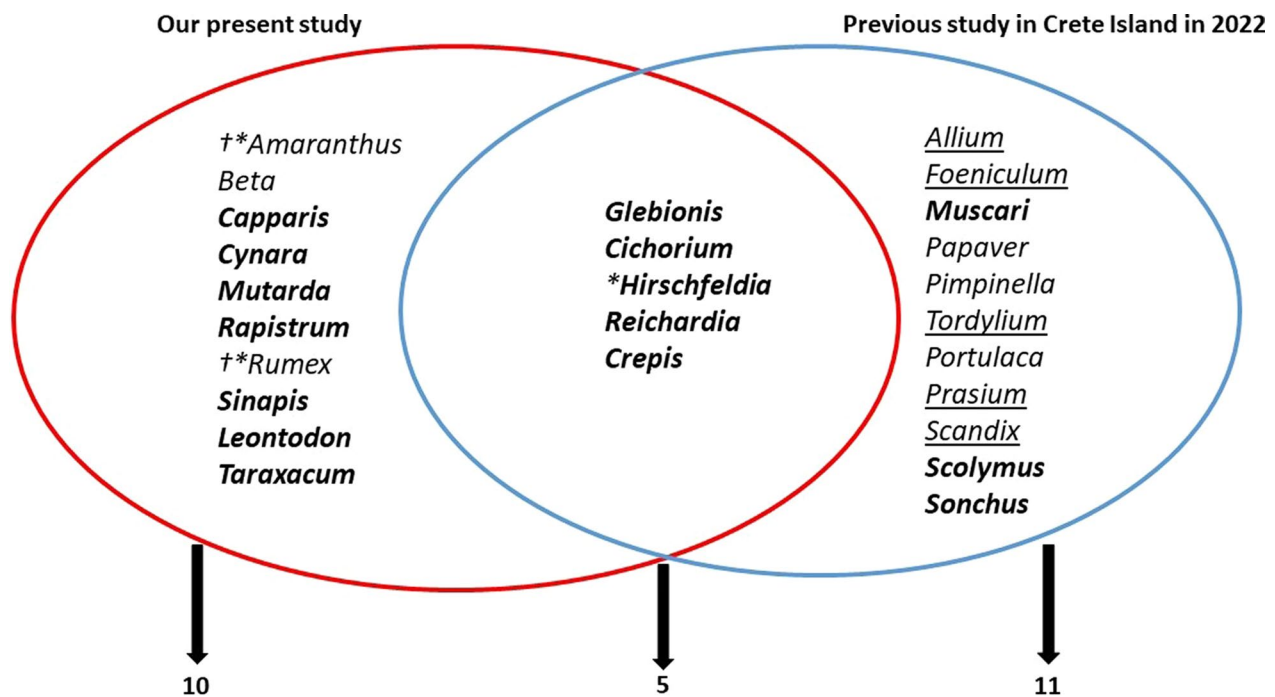


Fig. 4 Venn diagram showing the comparison of the top-quoted used wild greens of Olympos with those of Central Crete [1]. Genera highlighted in bold are bitter, while underlined genera are aromatic; genera marked with an asterisk have specific folk names in Olympos, diverging from the Greek ones. The cross symbol refers to shared folk taxa names

may demonstrate a long transition between the two languages. In any case, the dominance of the standard Greek language in Olympos' phytonyms unfortunately reveals the vanishing of its phytolinguistic uniqueness.

Our study therefore shows that phytolinguistic differences may indicate ancient trajectories of cultural encounters that may not be reflected in differences in plant food reports.

In other words, when a language starts to decline (in our case, the local Doric idiom of Olympos many centuries ago), vernacular "folk generics" (folk plant names given by one lexeme only) may remain as formal nutshells. Still, plant reports may have changed and adapted to the Hellenic mainstream culture, or, more simply, plant reports could already have been similar to the mainstream at the start of the cultural contact. This indicates that a presumed ancient Doric LEK may have existed during the "ancient Greece" period (from the 12th–9th centuries BC to the end of classical antiquity, approximately 600 AD) when the Doric language was widely spoken in the Dodecanese (including Crete), the Southern Cyclades, Southern Peloponnese (Sparta/Laconia, Messenia, and Argolis regions), and a few small portions of Asia Minor and Magna Graecia in Southern Italy. After this classical period, Doric was mainly replaced by the Attic dialect upon which the Koine or "common

Greek language" of the Hellenistic period was based, and the Doric culture started to disappear.

LEK on wild greens in Olympos are, therefore, still partially distinct from the mainstream Hellenic/Greek one in terms of nomenclature and also in the predominance of bitter, and absence of aromatic genera among the top-quoted wild greens. However, some open questions remain: we do not know how exactly the exchange of Olympos' wild plant knowledge with the mainstream dominant Hellenic/Greek culture has occurred during this long period (approximately fifteen centuries, spanning from the fully Doric Olympos to the apparent last phase of its linguistic/cultural adaptation that is taking place today).

We do not know if and how hybrid plant knowledge circulated for centuries (both within Karpathos and with neighbouring islands) because we lack precise historical data on plant use in the study region.

Moreover, if we consider the top-quoted botanical genera used as wild greens in Olympos and those from previous ethnobotanical studies conducted in the Mediterranean [3], Olympos' wild vegetable ethnobotany is similar to that of neighbouring Crete [1] and, to a lesser extent, that of Lebanon and Syria [6, 7, 30], Sicily [31], and Ikaria [3] (Fig. 5). The distance between the sites in the DCA plot reflects similarities and dissimilarities in

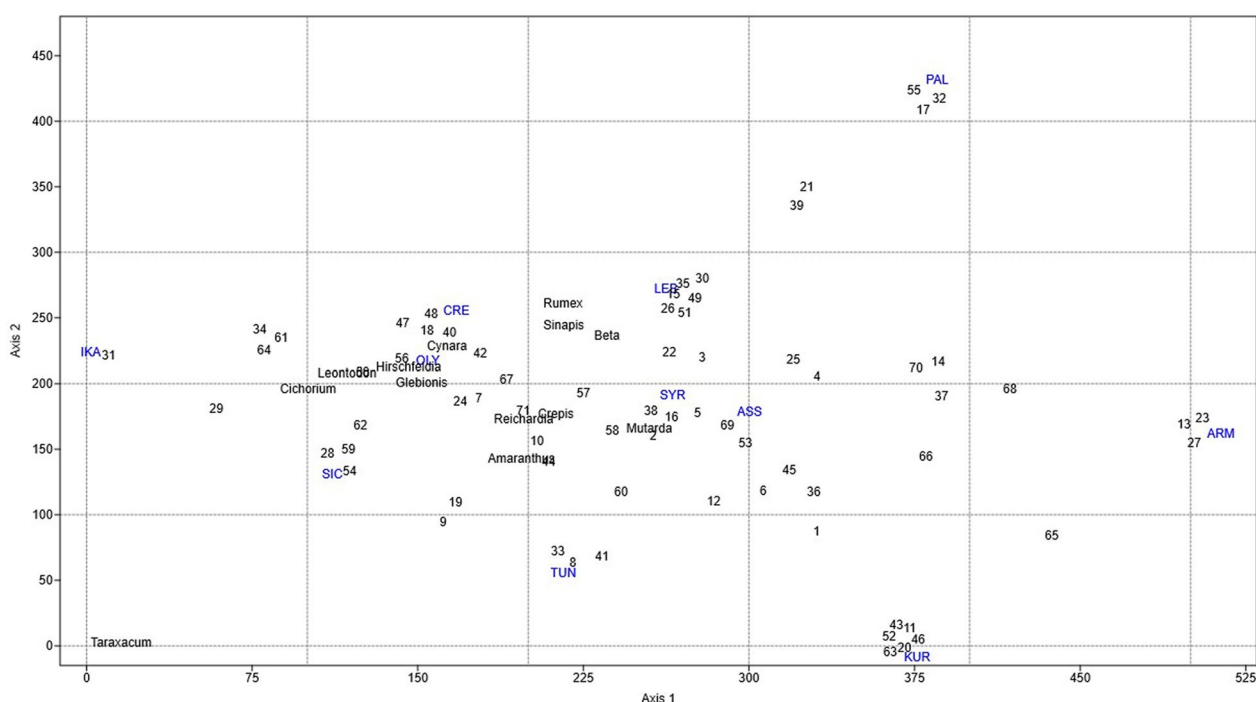


Fig. 5 DCA analysis shows the top-quoted (named by at least 40% of interviewees) wild vegetable genera of Olympos (OLY) compared with those of other Mediterranean areas. ARM: Armenia [32]; ASS: Assyrian [33]; CRE: Crete [1]; IKA: Ikaria [3]; KUR: Kurdistan region of Iraq [34]; LEB: Lebanon [7]; PAL: Palestine [8]; SIC: Sicily [31]; SYR: Syria [30]; TUN: Tunisia [35]. Eigenvalue: Axis 1 = 0.64, Axis 2 = 0.44

wild plant uses, which are, in turn, influenced by ecological and cultural variables. However, the environmental variable that may have influenced the patterns of DCA representation (i.e. plants widely available in one area and less so in others) was mitigated by the fact that we considered only botanical genera and not individual species and also by the fact that these genera refer to synanthropic plants in the Mediterranean that are available nearly everywhere. Moreover, specific non-relevant dissimilarities were reduced or mitigated by considering only comparative field studies and, therefore, data that indicated the most quoted species (i.e. that reported quotation indexes) and not all of the quoted taxa.

Therefore, Olympos's position in the DCA analysis shows that it belongs to the ethnobotany "system" of Greece, the Levant, and Sicily.

The findings of this study could be of some interest to the local economy of Olympos as well. It is essential to highlight that Karpathos, like many other Greek and Mediterranean islands, is characterised by a fragile ecosystem, severely affected by increasing drought, limited water resources, and a disturbed balance between nature and human activities [36]. However, in this ecosystem, vulnerability is further exacerbated by the imbalanced distribution of mass tourism, which is the primary source of income for Olympos and, even more so, for the rest of

the isle. Our study area is nearly deserted in the winter months and heavily overloaded with people and activities at the peak of the tourist season, as all the yearly income needs to be generated within a few months of tourism activities. This creates highly unsustainable economic and environmental conditions, such as significant human migration during the winter, the abandonment of agricultural activities, and the expansion of tourist settlements. In addition, this unsustainable tourism is highly dependent on energy-intensive resources (e.g. transportation to the isle, food for feeding tourists arriving from the mainland, etc.), which may contribute to further global climate change [37]. Thus, the call for ecotourism appears crucial on Karpathos and other similar islands [15]. Wild food plants and their related local dishes could play a vital role in small-scale community-based initiatives, as they may attract attention to wild plant habitats and promote awareness of bio-conservation.

It has been argued that over collection of wild-growing plants from the natural environment can severely impact their populations [38–40], mainly when these wild individuals or populations belong to range-restricted, locally endemic species when they are at risk of extinction and/or involved in international electronic trade [18]. Given that not all plant species are tolerant to the same degree of overharvesting and different plant parts are usually

appreciated in diverse species (e.g. bulbs/roots, leaves, or flowers/inflorescences), attention should be paid to even widespread species with edible roots or bulbs (e.g. *Allium*, *Cichorium*, and *Muscari* spp.) or harvestable flowers/inflorescences (e.g. *Origanum* sp.) when they are directly sourced from the natural environment. It has been reported that the wild populations of such overharvested species can rapidly decline demographically in specific areas due to the hindering of their sexual (flowers) or asexual (bulbs) reproductive potential [18, 38, 40]. Such trends are significant for the herein wild edible greens *Centaurea raphanina* subsp. *raphanina* and *Origanum onites* (Greek endemic and subendemic, respectively), which are highly appreciated for their inflorescences and are therefore directly harvested from wild populations not only in Karpathos (Table 2) but also throughout the Aegean Archipelago [40]. A previous study in Crete examining wild-growing populations of traditional wild edible greens with large distribution ranges (e.g. across the Mediterranean) has shown that high levels of local population heterogeneity are recorded in high-altitude regions associated with limited residential and agricultural development; on the other hand, in the coastal areas that people primarily inhabit, lower heterogeneity levels are detected in their wild populations, probably due to degradation of their wild habitats [39].

As discussed above, initiatives aimed at seriously promoting ecotourism in Karpathos should be fostered; the initiative "Ecotourism Karpathos" has, for example, highlighted that mass tourism has resulted in a significant loss of local traditions [41].

Conclusion

Cross-cultural foraging comparisons in the Mediterranean and the Near East are crucial for better understating the possible exchange and evolution of local plant knowledge under the MD umbrella. Studying how LEK concerning wild edible greens changes across time and space is essential for a better understanding of the diachronic trajectories of wild greens of the MD, as this heritage has a long history. Concrete applications of studies on Mediterranean traditional foraging such as the one presented here could be found in rural development projects aimed at promoting small-scale *sustainable* food products and local gastronomy in the context of the challenges facing communities resulting from highly unsustainable summer tourism. With its robust heritage attached to wild food ethnobotany, Olympos could develop more sustainable tourism strategies outside the summer season, especially if considering those foraged species that are widely available, given their synanthropic nature, and whose aerial parts are used (the large majority of the recorded taxa). Offering foraging sessions and dishes based on

widely available wild vegetables, the community could attract off-season tourists interested in local knowledge and healthy ways of living.

Abbreviations

MD	Mediterranean diet
UNESCO	The United Nations Educational, Scientific and Cultural Organization
LEK	Local ecological knowledge

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Author contributions

AP and RS designed the study, framed the theoretical and methodological setting, and conducted the field research. AP, RS, NS, JP, and SMH analysed the data; AP and NS drafted the preliminary version of the manuscript. AP, RS, NS, JP, SMH, DMZ, NK, VC, interpreted the findings and edited the manuscript. The final version was later revised and approved by all authors.

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Availability of data and materials

The data that support the findings of this study are incorporated in the article. Further inquiries should be directed to the corresponding author.

Declarations

Ethics approval and consent to participate

The International Society of Ethnobiology Code of Ethics was strictly followed, and informed consent was always obtained from each participant before interviews.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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