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A new station for the endangered fern *Woodwardia radicans* (L.) Sm. (Blechnaceae) in Northern Campania (Italy)

Antonio Croce

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***Correspondence:**
antocrx@gmail.com
https://orcid.org/0000-0002-1549-677X

Affiliations:
Via Chiesa, 44 - Tuoro, 81057 Teano (CE), Italy.
Telephone: 3807991091.

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Abstract

The thermophilous fern *Woodwardia radicans*, is an iconic species of the Southern Italian flora. This species, endemic to Southern Europe and Macaronesia, likely represents a Macaronesian relict in Europe. Here, I describe a new station for this endangered species, in the Northern part of the Campania region (Southern Italy), that extends northward the distribution limit in the Italian peninsula. The site is located along the stream Savone delle Ferriere, on the Roccamonfina Volcano, within the Roccamonfina-Foce Garigliano Regional Park. The vegetation of the area shows the same feature of other *Woodwardia radicans* communities in Italy and grows on the very steep slopes in the lower part of the gorge of the stream, in a section characterized by huge waterfalls. The new station extends both the area of occupancy (AOO) and the extent of occurrence (EOO), two parameters used to assess the extinction risk by IUCN. In addition, new observations for other fern species, which are rare at regional level (as *Pteris cretica*, *Struthiopteris spicant* and *Dryopteris affinis* subsp. *affinis*), were reported.

Key words - Biodiversity, conservation, field research, Habitat directive, flora of Community interest

Riassunto

La felce termofila *Woodwardia radicans*, è una specie iconica della flora dell'Italia meridionale. Questa specie, endemica dell'Europa meridionale e della Macaronesia, rappresenta probabilmente un relitto macaronesiano in Europa. In questo lavoro, descrivo una nuova stazione situata nel Nord della regione Campania (Italia meridionale) che estende il limite settentrionale di distribuzione di questa specie nella penisola italiana. Il sito è localizzato lungo il corso del torrente Savone delle Ferriere, sul Vulcano di Roccamonfina, entro i confini del Parco Regionale Roccamonfina-foce Garigliano. La vegetazione è caratteristica delle comunità con *Woodwardia radicans* presenti in Italia e occupa versanti molto acclivi, nella porzione inferiore della gola del torrente, in una sezione caratterizzata da alte cascate. La nuova stazione estende i valori di occupazione dell'area (area of occupancy; AOO) e di tasso di occorrenza (extent of occurrence; EOO), parametri usati per valutare il rischio di estinzione secondo i criteri IUCN. Infine, sono riportate nuovi dati distributivi per alcune felci rare a livello regionale (come *Pteris cretica*, *Struthiopteris spicant* e *Dryopteris affinis* subsp. *affinis*).

Parole chiave - biodiversità, conservazione, ricerche di campo, Direttiva Habitat, flora di interesse comunitario

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Introduction

Distribution data for rare species are essential to assess the extinction risk under the IUCN Red List, as they are used to calculate the Extent of Occurrence (EOO) and the Area of Occupancy (AOO; IUCN, 2012). Therefore, species' conservation planning and management are impossible without a careful description of their distribution ranges.

Woodwardia radicans (L.) Sm. is a thermophilous fern endemic to Southern Europe and Macaronesia (Li *et al.*, 2016) and is considered a macaronesian relict in Europe (Pichi Sermolli, 1979). Its highly fragmented distribution extends from Macaronesia (Azores, Madeira and Canaries) to Atlantic Spain, Portugal, Corse, Southern Italy, Sicily, Algeria and Crete (Gargano *et al.*, 2016). In Italy it is located in 36 stations in Campania, Calabria and Sicily (Fig.1) while in other 24 sites, where it was previously found, it is now considered extinct (Spampinato *et al.*, 2008; Gargano *et al.*, 2016). *Woodwardia radicans* is classified as Vulnerable (VU) for Europe (Christenhusz *et al.*, 2017) and as Endangered (EN) in Italy (Rossi *et al.*, 2016). This species is protected by the Campania Regional law 40/1994 and listed in the annexes II and IV of the Council Directive 92/43/EEC, the so-called Habitat Directive, and so monitoring it is an obligation arising from Art. 11 (Giacanelli *et al.*, 2016). In the Campania region the species only occurs in

two small populations, one located on the island of Ischia and the other near to Amalfi (Caputo & De Luca, 1970), with a total of only 82 individuals out of more than 5400 living in Italy (Spampinato *et al.*, 2008).

The first discover of the species in Italy dates back to the botanist Pietro Antonio Micheli from Florence. In 1706 or 1710 he visited Naples and its surroundings, and recorded the presence of *Woodwardia radicans* in the Sorrentine peninsula and in Ischia (Pampanini, 1911). Several other sites in the two areas were later discovered by other botanists, though in most of them the

Figure 1: Distribution of Woodwardia radicans in Italy. In red the new station. (modified from Gargano et al., 2016).

species has not been recorded anymore in the last decades and is thus supposed to be disappeared. The Roccamonfina volcano is a middle Pleistocene volcanic complex active from 630 kya to 53 kya (De Rita *et al.*, 1997), reaching the altitude of 1005 m a.s.l. and covering a surface of about 250 km^2. A recent floristic detailed checklist for the area listed the remarkable number of 871 taxa (Croce *et al.*, 2008). The area, however, includes zones of difficult accessibility that have been less explored. Therefore, in the last decade the field surveys continued with particular attention to these areas. One of such areas, the Savone delle Ferriere stream, hosts some species of phytogeographic interest such as *Struthiopteris spicant* (L.) Weiss, *Dryopteris affinis* (Lowe) Fraser-Jenk. subsp. *affinis*, *Lysimachia vulgaris* L., which are very rare for the region (Croce *et al.*, 2008), the narrow endemic and Critically Endangered *Epipactis maricae* (Fenu et al., 2018) and a relict beech wood growing from 320 to 450 m a.s.l.

Due to its phytogeographic and conservation interest, the discovery of *Woodwardia radicans* on the Roccamonfina volcano, in a previously unexplorated section of the Savone delle Ferriere stream, in Summer 2019, deserves a note.

Material and Methods

The exploration of the Savone delle Ferriere has been carried each year in the last decade especially in summer, when the flow of the stream is at the minimum and even the deepest gorges can be walked through. The field study aimed at monitoring the population of the endemic *Epipactis maricae* and at improving the floristic knowledge for the area.

Some plants of *Woodwardia radicans* were observed the first time on the 6th of August 2019 and then the site was explored on the 7th and the 21st of August. The fern and the other species growing in the site were identified in the field and later checked according to Pignatti (2017) and Marchetti (2004). The nomenclature follows Bartolucci *et al.* (2018) for vascular plants and Aleffi *et al.* (2008) for mosses and liverworts. A portion of a leaf of *Woodwardia radicans* was collected and the specimen deposited in the Herbarium of the University of Naples (NAP). The other collected specimens were deposited in the author's herbarium.

The plants of *Woodwardia* in the site were counted, the station was georeferenced and delimited by the use of a GPS Device (Garmin etrex). The size of the station was estimated by the use of QGIS3.4 Madeira (Quantum Gis Development Team, 2019). To preserve the site from any disturbance, the coordinates and a detailed map of the station will not be provided in the present note.

As the species is listed in the Annex II and IV of the Council Directive 92/43/EEC, an official communication of the discovery was sent to the institutions

responsible for its conservation (i.e. the Regional Park of Roccamonfina - Foce Garigliano, Campania Region and Italian Ministry for the Environment, Land and Sea).

Results and Discussion

More than one fifth of the known species of plants are at risk of extinction (Pimm & Raven 2017). Therefore new distribution data for rare species, especially the discovering of new sites, is crucial for conservation planning and management (Rondinini *et al.*, 2006). Here, I report a new station for the rare fern species *Woodwardia radicans* located in the northern part of the Campania region. This new station is located along a 250 m long section of the stream, both on the left and the right slopes of the gorge globally oriented E-SE at an altitude of about 180 m a.s.l. (Fig. 2). In this section the stream deeply eroded layers of tuff and flows on a bed of lavas, below a waterfall more than 30 m high. About 160 plants of *Woodwardia radicans* live on very steep slopes, from 1.5 to 10 m above the riverbed. Above them, where the slopes become less steep, and the atmospheric moisture is drastically lowered, the vegetation is a xerophilous woodland dominated by hornbeams and holm oaks. No seedlings were noted and a few plants at the beginning of the sporification were observed only during the visit of the 21st of August.

The rich in ferns plant communities can be referred to the alliance *Polysticho setiferi-Phyllitidion scolopendri* (Ubaldi *et al.,* 2014) due to the presence of the diagnostic species *Asplenium scolopendrium* L. subsp. *scolopendrium*, *Polystichum setiferum* (Forssk.) T.Moore ex Woyn., *Dryopteris affinis* (Lowe) Fraser-Jenk. subsp. *affinis*, *Athyrium filix-femina* (L.) Roth. More precisely the association *Conocephalo-Woodwardietum radicantis* (Brullo *et al.,* 1989) is well represented with the remarkable presence of *Pteris cretica* L. and *Struthiopteris spicant* (L.) Weiss in addition to *Woodwardia radicans* and the liverworts *Conocephalum conicum* (L.) Dumort. Also abundant are *Adiantum capillus-veneris* L., *Staphylea pinnata* L., the mosses *Thamnobryum alopecurum* (Hedw.) Gangulee and *Plagiomnium undulatum* (Hedw.) T.J.Kop. and some species characteristic of riparian habitats as *Angelica sylvestris* L. subsp. *sylvestris* and *Carex pendula* Huds. Less common are *Asplenium onopteris* L., *Asplenium trichomanes* L. subsp. *quadrivalens* D.E.Mey, *Hypericum androsaemum* L., *H. hircinum* L. subsp. *majus* (Aiton) N.Robson while on the top of the communities appear more xerophilous and thermophilous species as *Ruscus aculeatus* L. In addition to *Woodwardia*, the station is also inhabited by three other rare ferns: *Pteris cretica* L. (first record for Roccamonfina volcano of this

species protected by the Campania regional law 40/94); *Struthiopteris spicant* (L.) Weiss (=*Blechnum spicant* L.) (in Campania region it is present only on the volcano (Croce *et al.*, 2008); *Dryopteris affinis* (Lowe) Fraser-Jenk. subsp. *affinis* (very rare in Campania, at present known only for the volcano and lake Corree (Croce *et al.*, 2008, 2011).

The Savone delle Ferriere stream site represents the third station of *Woodwardia radicans* for the Campania region (Caputo & De Luca, 1970, Gargano *et al.*, 2016) and the northern limit of its areal in the Italian peninsula. It is more than 20 km far from the Tyrrhenian sea, 60 km from the site of Ischia and more than 80 km from the site of Amalfi (Valle delle Ferriere). Curiously, the toponymy of both the sites refers to "Ferriere" (i.e., “ironworks") for the presence of iron factories active from the 16th to the 20th century (Rauccio 2010), powered by nearby waterfalls. The same waterfalls provide the right air humidity necessary to the plants (Caputo & De Luca 1970). The new station is at present out of the Natura 2000 network, only 2

Figure 2: A group of plants on the left slope of the Savone delle Ferriere gorge.

km away from the borders of the nearest Site (SIC IT8010022 "Vulcano di Roccamonfina"). Fortunately, the section of the gorge falls inside the Regional Park of Roccamonfina - Foce Garigliano, in the zone B - general reserve. With about 160 plants, the population is almost double than that previously known for Campania (Spampinato *et al.*, 2008).

The access to the site is very difficult, walking on the slippery bed of the stream being possible only in the driest summers. Therefore, the threats to the conservation can be related to the touristic exploitation (e.g., the opening of pathways and trampling) and especially to the modification of the hydraulic regime of the stream (e.g., consequent to water abstraction or building of bridles and dams). Even the gathering of plants must be kept into account as well as the modification of the woods covering the top part of the slopes of the gorge.

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The breaking news on distribution of the Italian hare (Lepus corsicanus) in Cilento, Vallo di Diano e Alburni National Park

Maria Buglione[1*], Claudia Troiano[2], Simona Petrelli[1], Gabriele de Filippo[3], Tommaso Notomista[1], Valeria Maselli[1], Romano Gregorio[4] and Domenico Fulgione[1]

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***Correspondence:**
maria.buglione@unina.it
https://orcid.org/0000-0001-6022-707X

Affiliations:
1 Department of Biology University of Naples Federico II, Naples, Italy
2 Department of Humanities, University of Naples Federico II, Naples, Italy
3 Istituto di Gestione della Fauna, Naples, Italy
4 Ente Parco Nazionale del Cilento, Vallo di Diano e Alburni, Vallo della Lucania, Salerno, Italy

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Abstract

The Italian hare (*Lepus corsicanus*) is an endemic species of the Central-Southern Italy and Sicily, classified as vulnerable by the International Union for Conservation of Nature because of the impact of human habitat alterations, the low density and fragmentation of sub-populations and the ecological competition with the European hare (*Lepus europaeus*), intensively restocked as a game species.

The Cilento, Vallo di Diano e Alburni National Park is one of the most important area of occurrence of the Italian hare in Southern Italy, where it live in sympatry with the European hare. However, from 2010 there are no updated information about the distribution of the Italian hare in this important basin. Here, we provide the "breaking news" on its distribution in the National Park using non-invasive genetically validated data. Our findings could give an effective contribution for management strategies aiming at the conservation of this endemism since that the clear knowledge of the distribution pattern of a species is the first stage required in all ecological studies and management planning.

Keyword: Distribution, faecal pellet, conservation, genetic assignment, non-invasive genetics

Riassunto

La lepre italica (*Lepus corsicanus)* è una specie endemica dell'Italia centro-meridionale e della Sicilia, classificata come vulnerabile dall'Unione Internazionale per la Conservazione della Natura, a causa dell'impatto delle alterazioni antropiche dell'ambiente, la bassa densità e la frammentazione delle sotto-popolazioni e la competizione ecologica con la lepre europea (*Lepus europaeus*), intensamente introdotta a scopo venatorio.

Il Parco Nazionale del Cilento, Vallo di Diano e Alburni è uno dei principali bacini di presenza della lepre italica, che qui si trova in simpatria con la lepre europea in molte aree. Tuttavia, dal 2010 non sono disponibili informazioni aggiornate sulla distribuzione della lepre Italica in questo importante zona di presenza. Qui, noi forniamo le notizie più recenti sulla distribuzione della lepre italica in questo Parco Nazionale usando dati geneticamente validati. Queste informazioni potrebbero rappresentare un contributo concreto per la conservazione di questo endemismo dato che la precisa conoscenza della distribuzione di una specie è il primo step richiesto in tutti gli studi ecologici e piani di gestione.

Parole chiave: Distribuzione, campione fecale, conservazione, assegnazione genetica, genetica non invasiva

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Introduction

The Italian hare (*Lepus corsicanus*) is an endemism of the Central-Southern Italy and Sicily (Trocchi & Riga 2005; Amori & Castiglia 2018; Lo Valvo 2007) and it was introduced in Corsica in XVI century (Vigne 1988).

The species has experienced considerable contraction of distribution range during the past several decades, and, to date, it is classified as vulnerable (VU - A2bcde) in the Red List of the International Union for Conservation of Nature (Randi and Riga 2019). The major threats that affect the status of the species are the human habitat alterations, the low density and fragmentation of sub-populations, the poaching/hunting activities and the ecological competition with native and exotic lineages of the European hare (*Lepus europaeus*), intensively restocked as a game species (Pierpaoli et al., 2003; Kasapidis et al., 2005; Angelici et al., 2008; Fulgione et al., 2009).

While Sicilian sub-population of the Italian hare shows a continuous range (Lo Valvo et al., 1997), on the Italian peninsula the species is widespread as small and fragmented nuclei (Angeli & Luiselli, 2001; Trocchi & Riga 2005; Angelici & Luiselli 2007; de Filippo et al., 2007; Fulgione et al., 2009; Angelici et al., 2010; Scarselli et al., 2016; Dori et al., 2018; Mori et al., 2020). In

particular, the Cilento, Vallo di Diano e Alburni National Park could be considered one of the most important area of occurrence of the species in southern Italy. Previous studies reported a sub-population showing the highest density among Southern Italian peninsular ones on some Apennine mountain areas including in this National Park (de Filippo et al., 2007; Fusco et al. 2007; Fulgione et al., 2009), however, from 2010 there are no updated information about the distribution of the Italian hare in this important basin.

Here, we provide the "breaking news" on distribution of the Italian hare in the Cilento, Vallo di Diano e Alburni National Park using non-invasive genetically validated data.

A clear knowledge of the distribution pattern of a species is the first stage required in all ecological studies (Palomares et al., 2002; Measey et al., 2011) and our data could effectively support management actions in conservation planning for the Italian hare.

Material and Methods

Study area

The study was carried out in the Cilento, Vallo di Diano e Alburni National Park (PNCVDA, 40° 17′ N, 15° 19′ E - Salerno, Campania) (Fig.1). The landscape shows extremely mosaicized structure typically of the Mediterranean basin, with small urban areas alternated with agricultural and natural ones. At higher altitudinal level, it is dominated by Fagus sylvatica forests interspersed with grasslands of secondary origin composed mainly by *Poaceae*, *Fabaceae* and *Cyperaceae*. The underlying altitudinal range is covered by forest of *Alnus cordata* and *Castanea sativa*, followed by deciduous oaks (*Quercus cerris, Quercus pubescens*) and maple trees (*Acer* sp.) in the medium-lower altitude level (Pignatti et al., 1998).

Samples collection

From 2014 to 2019, we conducted a wide field survey to record the presence of the Italian hare, including all four seasons.

The entire protected area was divided into 2.5 km2 squares, in which sampling was performed in medium and high habitat suitability areas for the Italian hare (de Filippo et al., 2007; Fulgione et al., 2009), between 100 and 1900 meters a.s.l. (Fig. 1).

These areas were identified as stable territories of presence for both the Italian hare and the European one (de Filippo et al., 2007; Fulgione et al., 2009; Buglione et al., 2018). To discern between the Italian hare and the European hare using their phenotype (i.e. body measurements and coat color shades, Riga et al., 2001; Trocchi & Riga 2005) is not easy in field and/or without close contact with these species. Thus, in order to use only reliable data, minimising the impact on the vulnerable species, we use only faecal pellets genetically characterized (see below).

The non-invasive sampling was performed by the operators walking along transects of 5 - 8 km, chosen in order to be representative of the different environmental conditions present in the sampled area and in order to cover the largest possible area.

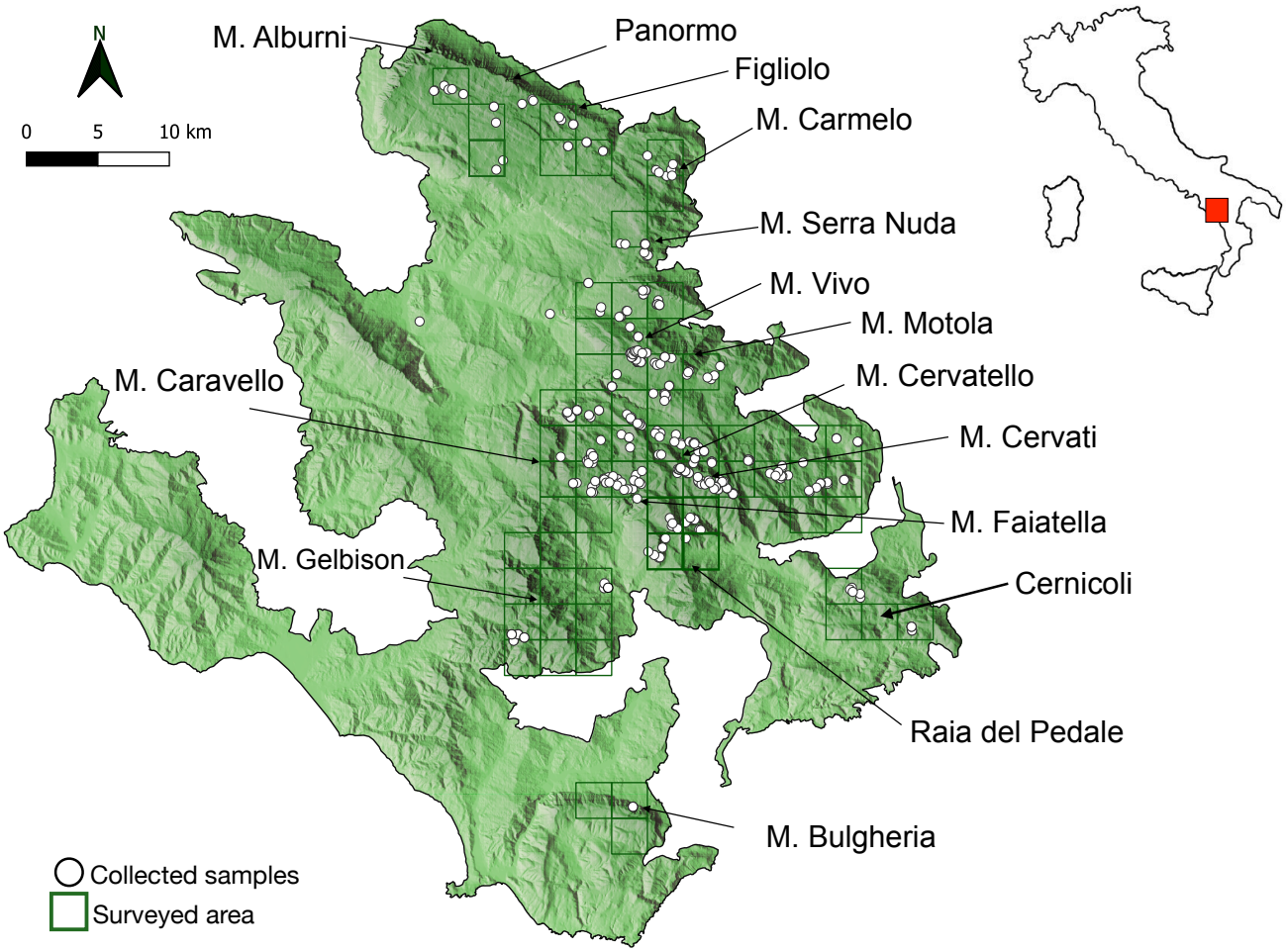

Figure 1: Study area. Cilento, Vallo di Diano e Alburni National Park (PNCVDA). Green squares of 2.5 km2 represent the surveyed areas. White spots indicate collected faecal pellets.

The DNA fragmentation increases with age of samples (Taberlet et al., 1996) and with exposure to environmental agents (Jansman et al., 2001), and depends on way of collection and preservation, leading to limitation in subsequent laboratory procedures. Therefore, to reduce interval from defecation to collection and to minimize efforts using samples to yield high-quality DNA, we performed the sampling of faecal pellet in early morning (Dallas et al., 2000; Goossens et al., 2000), collecting only fresh samples (0-2 day old), aged by skilled field collectors using aspect patterns (Piggott 2005; Santini et al., 2007). All samples were handled with sterilized equipment and preserved in sterile Falcon® tubes with silica desiccant granules (Wasser et al., 1997). Then stored at 4°C (during transport) or -20°C (in laboratory) until their processing.

Species assignment

No studies report difference in the faecal pellet morphology between the Italian hare and the European hare and this made molecular characterization of faecal DNA necessary.

Total genomic DNA was extracted from the external surface of faecal pellet using QIAamp DNA Fast Stool Mini Kit (QIAGEN, Valencia, CA), according to manufacturer's instructions. Blank extractions were included in each extraction to exclude potential contaminations. Integrity of DNA was verified using agarose-gel electrophoresis run while quality and concentration were checked with Nanodrop ND-2000 (Nanodrop, Wilmington, DE, USA) and Qubit Fluorometer 3.0 (Thermo Fisher Scientific).

Species assignment was developed using HRM analysis (Farrar & Wittwer 2017) with experimental protocol and raw data analyses performed according to Buglione et al., 2020. The comparison between the melting profile of the faecal DNA from known Italian hare and European hare samples and that of unknown samples was used to assign these latter to corresponding hare species.

Species distribution map

All records were geo-referenced (by GPS; UTM-WSG 84) and software QGIS 3.4.1. was used to elaborate species-specific distribution map (scale 1:320,000) using geographical coordinate of genetically validated data.

Results

We collected 408 faecal pellets in total, of which 101 were assigned to the Italian hare and 181 to the European hare. For 126 faecal pellets, HRM did not allow the species assignment.

Assuming that the method of collection was the same for the two species, and that, less likely, the species are evenly distributed throughout the National Park, we can say that if a hare pellet is found, there is a 25% probability that it is from the Italian hare and 44% that it was deposited by an European hare. Geographical spazialization of genetically characterised samples showed that the Italian hare was distributed in most of the internal mountain areas of the PNCVDA, including the Mount Alburni, M. Serra Nuda, M. Motola, M. Vivo, M. Faiatella, M. Caravello, Raia del Pedale, M. Cervati, M. Cervatello, M. San Giacomo M. Cernicoli, M. Gelbison and M. Bulgheria (Fig. 2A), spreading in an altitudinal range from 630 to 1848 m a.s.l. The major number of samples was widespread between 1000 and 1300 m a.s.l, with a main peak at about 1150 m a.s.l (Fig. 2B).

The habitat of these locations, mainly on M. Cervati and M. Alburni, was represented by wooded areas with beech, oak and chestnut forests, interspersed with open grassland dominated by the red clover (*Trifolium pratense*) and meadow brome (*Bromus erectus*), that outlines environments with marked ecotonal characteristics and high environmental diversity (Fig. 2C and D).

We found the species also in highland pastures of secondary origin of Festuco-Brometalia and, at higher altitude (>1500 m a.s.l.) on almost all mountain massifs (M. Cervati, M. Alburni, M. Motola, M. Serra Nuda and M. San Giacomo), the Italian hare was

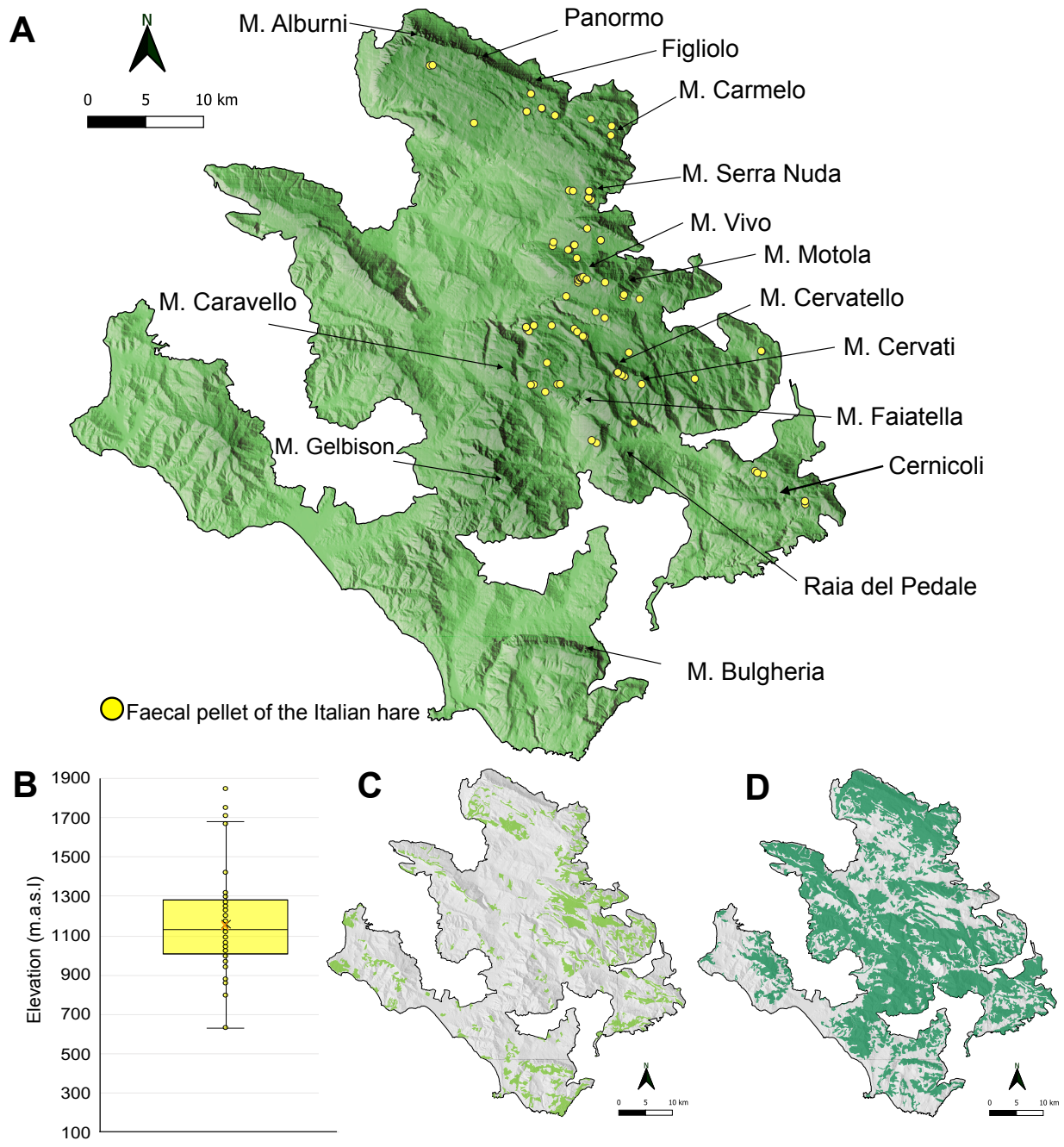

Figure 2: A) Distribution of the Italian hare (*Lepus corsicanus*) in Cilento, Vallo di Diano e Alburni National Park (PNCVDA) based on genetic validated data. Yellow spots represent the faecal pellets assigned to the Italian hare. B) The Italian hare (*Lepus corsicanus*) distribution related to the elevation. Distribution of C) pastures and grassland and D) woods and forests in PNCVDA according to CORINE Land Cover 2000, Class 3.

localised in dry grasslands with low vegetation, interrupted by rocks, stones, shrubs and low scrub with scattered conifers. In addition, in particular on the M. Vivo, the Italian hare faecal pellets were sampled also in very small residual cultivated areas.

Discussion

We provide updated information on the distribution of the Italian hare in the PNCVDA, about which little was known since 2010.

Our data confirm a fragmented distribution of the Italian hare in internal mountains of the National Park (M. Alburni, M. Motola, M. Cervati and M. Faiatella (de Filippo et al., 2007; Fulgione et al., 2009) and define new areas of occurrence (i.e. M. Cernicoli, M. Caravello and Raia del Pedale).

On most of the territory, the Italian hare is in sympatry with the European hare (data not shown), even if we found some areas of exclusive presence of the endemic species, for example on M. Serra Nuda, where, however, it is less abundant. This could depend on low population density, that reduce the probability to localise faecal samples. However, these territories could be consider as suitable sites for reintroduction of new individuals aiming to revert population decline induced by the low densities.

Another factor affected the probability to found the faecal pellets could be the characteristics of the habitat. This, in some areas, made sampling difficult, as on Monte Gelbison, where most of territories are dominated mainly by the common bracken (*Pteriudium aquilinum*), probably due to the lithological nature of mountains, where overgrazing and subsequent abandonment of the areas promoted the growth of this fern.

The *Lepus* sp. samples collected on M. Gelbison did not provide yield high-quality DNA suitable for species characterization and further studies should be performed to validate the absence/presence of the Italian hare in these territories.

On M. Bulgheria, we collected only one faecal sample ascribable to the Lepus sp. As before, this result could depend on low population density of the hare, and furthermore, this condition could become worse because of the geographical isolation of M. Bulgheria. Indeed, the massif shows a high degree of isolation from the rest of mountain system of the Cilento, as emerged by analyses of habitat connectivity for the PNCVDA territories (data not shown). Also here other deepened analyses need to define what hare species live in these territories.

The major number of samples assigned to the Italian hare was collected at mean at 1150 m a.s.l., in wooded areas interspersed with open grassland and in mountain highland pastures. These habitats mirror the environmental preferences of the species in the PNCVDA (de Filippo et al., 2007; Fulgione et al., 2009) and in other localities (Trocchi & Riga 2005; Angelici & Luiselli 2007; Angelici et al., 2010), and agree also with its trophic requirements (Freschi et al., 2016; Buglione et al., 2018).

The next steps should be to continue the monitoring of the species to keep information on its distribution up to date and to extend the survey to other areas of the PNCVDA that have not yet been investigated, both in the mountainous internal territories and on the coast. Indeed, the Italian hare in other Italian regions (i.e. in Latium) or in Corsica was reported also at

low altitude and close to coastline (Trocchi & Riga 2001; Petri 2015), meanwhile for coasts of the Cilento there are only few and old reports attributable to the European hare (de Filippo et al., 2000).

Our data on precise distribution of the Italian hare in PNCVDA represent an effective support for management strategies. Indeed, they suggest what could be the useful areas for reintroductions or for definition of ecological corridors aimed at connecting isolated sub-populations or, considering the ecological requirement of the Italian hare, for environmental improvements aiming at the conservation of this important tile of global biodiversity.

Acknowledgments

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Author contributions

Conceptualization: Maria Buglione and Domenico Fulgione; Data curation: Maria Buglione, Domenico Fulgione, Claudia Troiano and Gabriele de Filippo. Formal analysis: Maria Buglione, Domenico Fulgione, Claudia Troiano; Investigation: Maria Buglione, Domenico Fulgione, Claudia Troiano, Simona Petrelli, Gabriele de Filippo, Tommaso Notomista, Valeria Maselli. Methodology: Maria Buglione, Domenico Fulgione and Gabriele de Filippo; Project Administration: Maria Buglione and Domenico Fulgione; Resources: Domenico Fulgione, Gabriele de Filippo and Romano Gregorio; Writing – original draft: Maria Buglione and Domenico Fulgione; Writing – final draft preparation: Maria Buglione, Domenico Fulgione, Claudia Troiano, Simona Petrelli, Gabriele de Filippo, Tommaso Notomista, Valeria Maselli and Romano Gregorio.

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Ocean Acidification alters the composition of decapod crustacean communities associated to *Posidonia oceanica beds*

Valerio Zupo* and Thomas Viel

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***Correspondence:**
vzupo@szn.it
Affiliations:
Stazione Zoologica Anton Dohrn. BluBiotech Department. Punta San Pietro. 80077 Ischia (Naples)
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Abstract

Ocean Acidification (OA) produces manifest changes in the species assemblages of stable marine ecosystems, although the general levels of biodiversity may be partially conserved. In the case of decapod crustaceans, that represent an interesting taxon because it reacts both to direct and indirect effects of OA, a lowering of pH induces clear changes in the structure of species assemblages. In this study we collected decapod crustaceans at two sites at low pH located at Castello d'Ischia, two control sites at normal pH located at Castello d'Ischia and one external control site. The results confirm that a lower biodiversity characterizes the acidified zones over the year and indicate that key species, normally very abundant in normal conditions all over the year, exhibit impoverished populations associated to the *Posidonia oceanica* beds off the island of Ischia.

Keyword - *Posidonia oceanica,* Ocean Acidification, decapod crustaceans

Riassunto

L'acidificazione degli oceani altera la composizione delle comunità di crostacei decapodi associate ai letti di *Posidonia oceanica*

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Introduction

Everyday anthropogenic pressures trigger clear and deep degradation of marine ecosystems and of the services they should provide (Zunino et al., 2019), causing alterations of planktonic and benthic communities all over the world (Harfoot et al., 2014). Ocean Acidification (OA) is one of the most important and recent effects of anthropogenic activities and it is influencing all marine ecosystems, at any latitude and in every continent. Due to CO2 emissions produced in the last century (Campbell & Fourqurean 2013) and of those still influencing our atmosphere, the pH of oceans is likely to drop 0.3–0.4 units over the next century (Caldeira & Wickett 2005; Pachauri et al., 2014). Some ecosystems are more resistant to OA than others; however, besides the direct effects on individual species (e.g., on calcareous algae or calcified organisms, as corals), several indirect effects of OA are impacting marine ecosystems and changing their structure and functioning, including the biodiversity trends, both locally and at larger scales (Munday et al., 2009; Zupo et al., 2015; Zupo et al., 2016). Consequently, the species assemblages of "stable" ecosystems may be dramatically modified due to direct effects of OA on the physiology of organisms and to the drastic modification of interspecific relationships, as the plant-animal relationships and the chemical communications among organisms. In fact, although some organisms may adapt to O.A. (Tynyakov et al., 2015; Porzio et al., 2017) (e.g., by tuning the expression of genes involved in the calcification process), they might not survive to changed trends of chemical signal communications (Dixson et al., 2010; Zupo et al., 2014).

Decapod crustaceans are quite stimulating organisms to investigate the changes of biodiversity triggered by O.A., because they have an external exoskeleton partially or totally calcified (according to the species) that is directly impacted by the pH of the medium, and they also demonstrated prompt responsiveness to chemical signals produced by various plant items, that may be interrupted or disturbed by the acidification processes (Mutalipassi et al., 2020). In this study we compare the species assemblages of decapod crustaceans in various sites in the island of Ischia taking into account both stations at normal pH (about 8.1) and stations located in a special area influenced by volcanic emissions that trigger a drastic drop of the pH.

Material and Methods

Study area

Various sites in the island of Ischia have been considered for collections of decapods. In particular, we sampled in two acidified stations, S2 and N3 (Fig. 1) located at the Castello d'Ischia and characterized by pH of 7.83 and 7.09, respectively (Fig. 1). We compared the species assemblages with

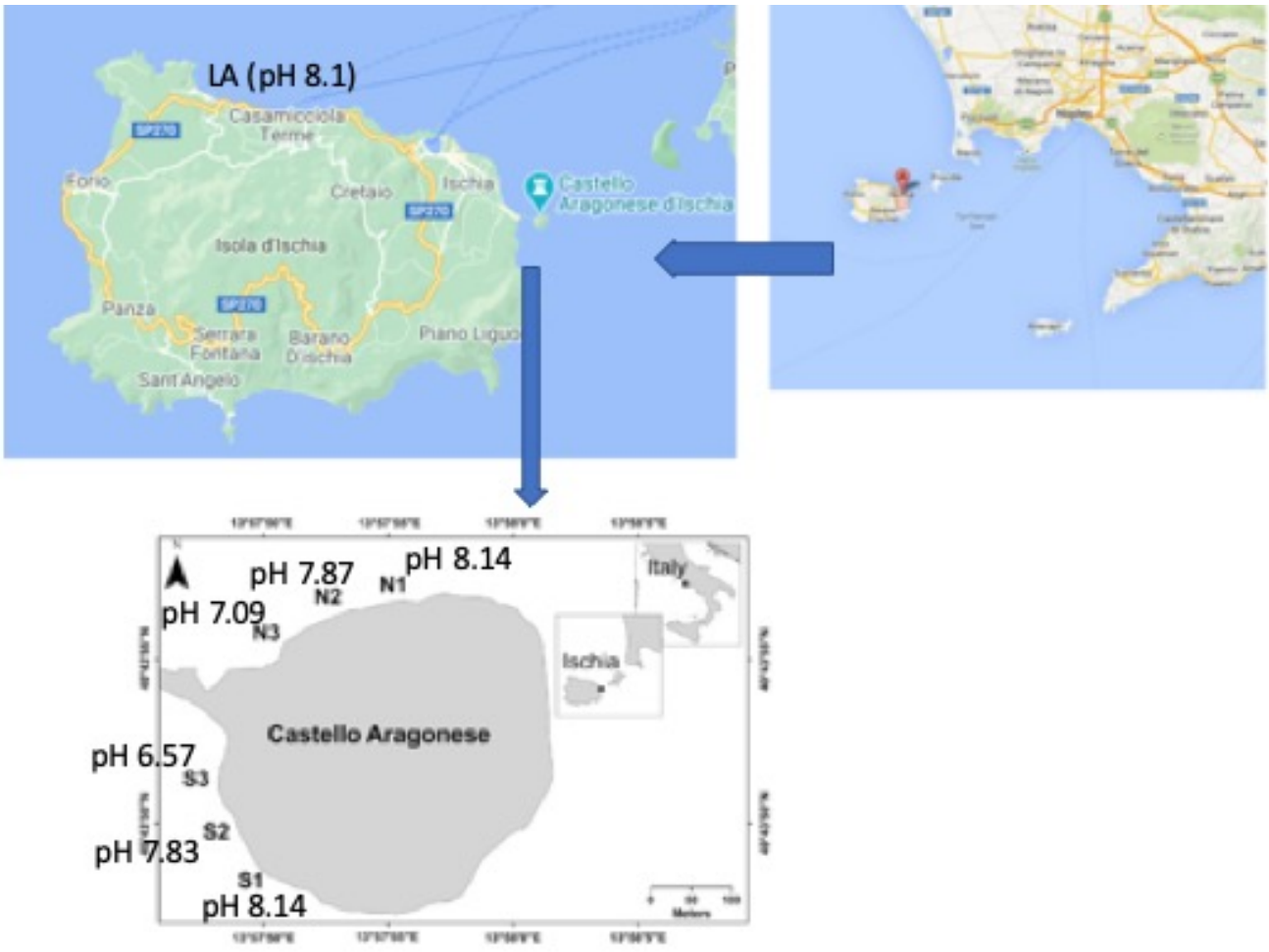

Figure 1. Study area. LA, Lacco Ameno Lacco d'Ischia.

those of sites at normal pH named S1 and N1, both at pH of 8.14, located in the area of Castello d'Ischia (Fig. 1). In addition, we set a control area in a zone far from the CO^2 vents, located in Lacco Ameno d'Ischia (LA in Fig.1)

Collection of specimens

Specimens of decapod crustaceans were collected in three periods of the year (*i.e.*, March, July and November, corresponding to winter, summer and fall, in the considered areas) using an airlift sampler operated in a surface area of 1 square meter by divers, at depths of 5 meter, over the leaves of *Posidonia oceanica*. In particular, 4 replicate samples (indicated as a, b, c, d) were collected in each site, at each season. Samples collected were immediately fixed in 70% alcohol and conserved for taxonomic identification under the optical microscope.

Statistical treatment of the data

All the collected specimens were identified, where possible, at the species level, and their numerical abundance was recorded for each site and each season. Some graphical representations were obtained to show the trends of abundance according to seasons and sites, with special attention to the differences observed at the two pH levels considered. We performed a t-test analysis

to establish the significance of differences between samples at different pH.

Results

The species assemblages characterizing the acidified site are reported in table 1. The species assemblages characterizing the normal pH sites are reported in table 2. Both tables are offered integrally, to allow further computations and hypothesis testing by other authors. In total, 25 species were collected all over the year in the acidified

Table 1: Number of individuals of each species of decapods collected in the acidified sites (S2, N3) in four replicates (a, b, c, d) in three months

	Acidified sites																							
	March								July								November							
	S2				N3				S2				N3				S2				N3			
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
Acanthonyx lunulatus											2			1			1							
Achaeus gracilis															1								1	
Alpheus dentipes		1			1	5	1				1		4	8	1	1	1	8	2		9	1	16	19
Athanas nitescens	3	1	4	7	5	8	6	3	7		4	2	2	12	4		26	17	26	20	28	9	67	75
Brachynotus sexdentatus										2	2		4	4		1	3							
Calcinus tubularis																								
Cestopagurus timidus	5	5	3	4	1	16	7	4	3	1	2	4	7	21				6	5	11	7	2	6	8
Dromia personata	1																							
Ebalia edwardsi																								
Ebalia nux																								
Eriphia verrucosa														1										
Eualus pusiolus														1										
Galathea bolivari							1	2															1	
Hippolyte inermis		1				1								1		7	12	12	4	5	7	8	13	11
Hippolyte leptocerus							1	1		1	1		1		1	1	17	16	20	12	9	7	13	12
Ilia nucleus																								
Inachus phalangium																								
Liocarcinus arcuatus																								
Lysmata seticaudata																	1	2						
Microcassiope minor																								
Munida curvimana																								
Munida sp														2										
Pagurus anachoretus																								
Palaemon serratus																			1					
Parthenope massena																								
Pasiphaea multidentata																								
Philocheras fasciatus														1										
Pilumnus hirtellus	1								1	1	2							3		1			1	5
Pisa carinimana												1												
Pisa nodipes														1										
Pisa tetradon																								
Pisidia bluteli			1	1						1		1					2	1	1					
Processa canaliculata																								
Scyllarus sp.							1																	
Sicyonia carinata																			1					
Sirpus zariquieyi																								
Thoralus chranchii	2	1	1		1		2				1		1				2	2	1	1	1	1		3
Upogedia deltaura																								
Xantho pilipes														5										1
Xantho poressa						3	1	1	1						1			1	1	1	1	1		4

Table 2: Number of individuals of each species of decapods collected in the control sites (S1, N1 and Lacco Ameno) in four replicates (a, b, c, d) in three months

	Control sites																															
	Marzo												Luglio												Novembre							
	S1				N1				LA				S1				N1				LA				S1				N1				LA			
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	c	a	b	c	d
Acanthonyx lunulatus																																				
Achaeus gracilis			1					1								1					1			1	1		2	1		1		1	2	2	3
Alpheus dentipes			4	2		2	3			1	1	2		1			3	3	2	1	2			1	1			9	6	6	8	1	7	5	4	11
Athanas nitescens		5	4	2	4	3	7	15	16	13	4	2	5	32	1	6	3	4	8	10	9	4		13	17	26	2	24	11	20	27	9	45	29	28	58
Brachynotus sexdentatus					1								1	1	3	1			1	1																
Calcinus tubularis									3	1				7	1		1	2	2							1		1	1	1				1	1
Cestopagurus timidus	26	9	41	11	8	10	26	36		31	32	45	55	118	16	18	16	17	18	87	12	4	8	19	18	11	14	39	41	27	27	18	54	58	89	102
Dromia personata																															1					
Ebalia edwardsi										2		1											1	1											2	1
Ebalia nux																					1															
Eriphia verrucosa																																				
Eualus pusiolus																							1													
Galathea bolivari						1	3	6			2	2		2			1	5	6	4	2	1	1	2	1			3	4	3	10	2	1	2	5	7
Hippolyte inermis						1				1			2		1	2					3	2	2	1	8	6	3	1	13	3	1	11	4	2	9	4
Hippolyte leptocerus		1									1	1	10						4		1	2			5	3	1	4	5	4	3	2	12	4	4	22
Ilia nucleus			1										1																							
Inachus phalangium																																			1	
Liocarcinus arcuatus																										1										
Lysmata seticaudata	1															1																				
Microcassiope minor													1																							
Munida curvimana													1																							
Munida sp																																				
Pagurus anachoretus	1																																			
Palaemon serratus																																				
Parthenope massena																															1					
Pasiphaea multidentata													1																							
Philocheras fasciatus												1	1											1			1									
Pilumnus hirtellus	2		2				1	1	1	1		1	5	3	1	6										6	4	7			1	1	5		3	2
Pisa carinimana																																				
Pisa nodipes			1																																	
Pisa tetradon																1																	2			
Pisidia bluteli							2	2		1	1			7		1		2		1	1				1			1		1	5	1	1		2	
Processa canaliculata																		2		1									1	1		1				
Scyllarus sp.			1																																	
Sicyonia carinata																																				
Sirpus zariquieyi																																		1		
Thoralus chranchii		2	1		1	1	3	4		3	2	1	4	1		4		6		3						3	2	2	4	7	10	6	7		7	11
Upogedia deltaura													1																							
Xantho pilipes													2	2					1	1							1									2
Xantho poressa							2	3				1						1								1	1		1		2		1		1	1

sites, while 34 species of decapods were collected in the sites at normal pH (Fig. 2). In the acidified sites we recorded 12, 19 and 17 species in March, July and November, respectively. Alternatively, the "normal pH" site exhibited 20, 18 and 20 species in March, July and November, respectively. The differences in alpha diversity measured in sites at different pH were significant. The species assemblages also significantly differed between the different acidified stations but not among the normal pH sites.

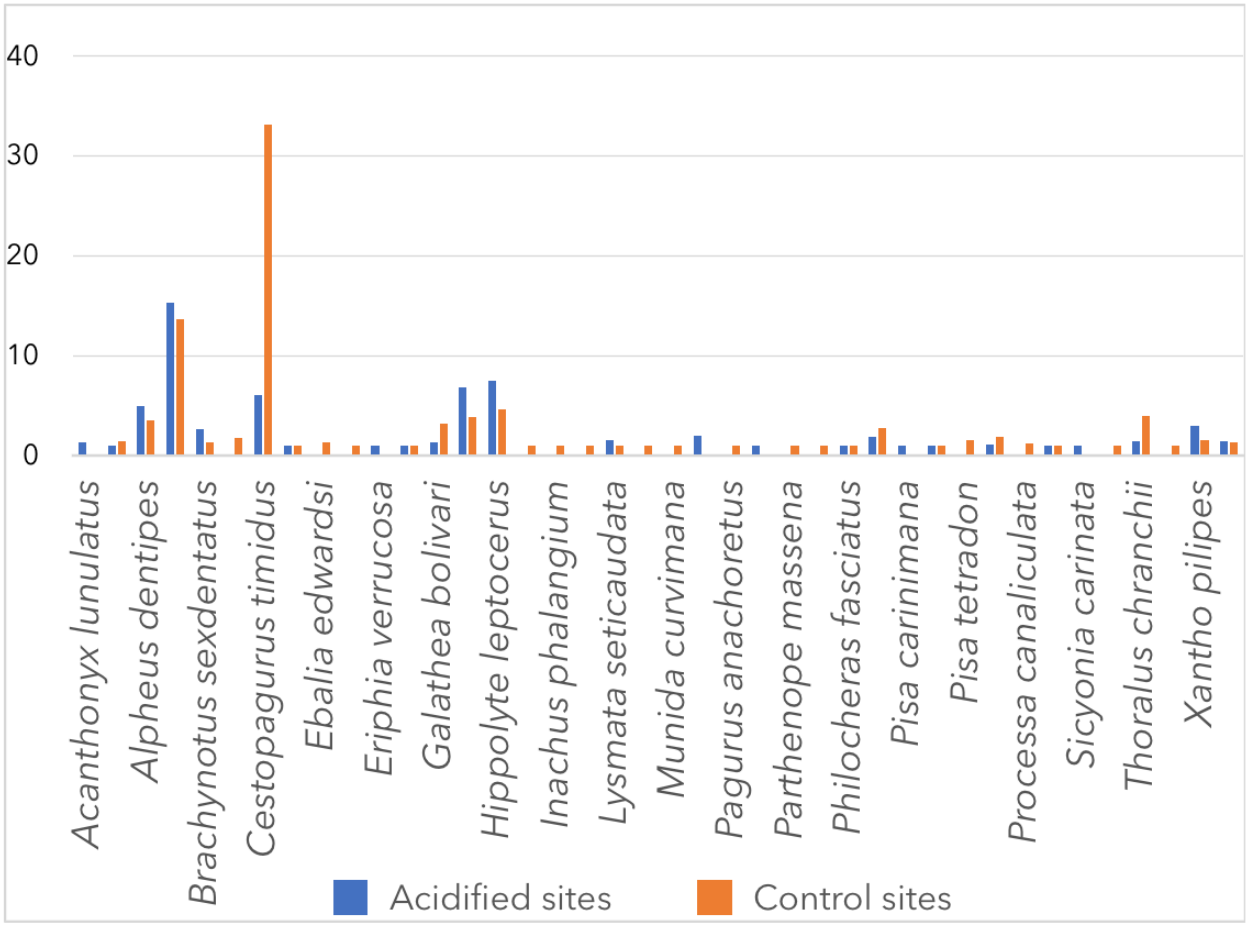

Figure 2: Averages of numerical abundances of decapod species in sites at normal pH and acidified ones.

Discussion

Ocean acidification produces clear shifts in the assemblages of decapod crustaceans and a general lowering of biodiversity, in the stations affected by low pH. Key species characterizing *P. oceanica* meadows in normal conditions (Mazzella et al., 1989), as *Cestopagurus timidus* (averaging at 33 individuals per square meter in each month of the year) and *Athanas nitescens* (averaging at 14 individuals per square meter in each month) (Tab.3) are replaced by other species more tolerant to O.A. in the acidified sites, and a general flattening of the abundances of species is observed at lower pH. Further analyses will be possible using the tables contained in this article, to test various hypotheses on the effects of O.A. on the species assemblages of future oceans in the world.

Table 3: Distribution of species in acidified and control areas and their preferences for low or normal pH.

Acid-preferring species	Average acidified sites	Average control sites	Average control-acid
Munida sp	2,00	0,00	-100,00
Acanthonyx lunulatus	1,33	0,00	-100,00
Eriphia verrucosa	1,00	0,00	-100,00
Palaemon serratus	1,00	0,00	-100,00
Pisa carinimana	1,00	0,00	-100,00
Sicyonia carinata	1,00	0,00	-100,00
Neutral species			
Brachynotus sexdentatus	2,67	1,29	-34,94
Xantho pilipes	3,00	1,50	-33,33
Hippolyte inermis	6,83	3,81	-28,41
Hippolyte leptocerus	7,53	4,68	-23,32
Lysmata seticaudata	1,50	1,00	-20,00
Alpheus dentipes	4,94	3,58	-15,89
Athanas nitescens	15,27	13,71	-5,41
Xantho poressa	1,45	1,36	-3,23
Dromia personata	1,00	1,00	0,00
Eualus pusiolus	1,00	1,00	0,00
Philocheras fasciatus	1,00	1,00	0,00
Pisa nodipes	1,00	1,00	0,00
Scyllarus sp.	1,00	1,00	0,00
Achaeus gracilis	1,00	1,38	16,13
Pilumnus hirtellus	1,88	2,79	19,61
Pisidia bluteli	1,14	1,88	24,26
Galathea bolivari	1,33	3,17	40,74
Thoralus chranchii	1,43	3,96	46,96
Basic preferring species			
Cestopagurus timidus	6,10	33,17	68,95
Ebalia nux	0,00	1,00	100,00
Ilia nucleus	0,00	1,00	100,00
Inachus phalangium	0,00	1,00	100,00
Liocarcinus arcuatus	0,00	1,00	100,00
Microcassiope minor	0,00	1,00	100,00
Munida curvimana	0,00	1,00	100,00
Pagurus anachoretus	0,00	1,00	100,00
Parthenope massena	0,00	1,00	100,00
Pasiphaea multidentata	0,00	1,00	100,00
Sirpus zariquieyi	0,00	1,00	100,00
Upogedia deltaura	0,00	1,00	100,00
Processa canaliculata	0,00	1,20	100,00
Ebalia edwardsi	0,00	1,33	100,00
Pisa tetradon	0,00	1,50	100,00
Calcinus tubularis	0,00	1,77	100,00

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Molluscs of the "Real Orto Botanico di Napoli"

Sergio Duraccio[1], Giuseppe Fasulo[2], Gianni D'Anna[3], Alberto Pingitore[4] and Ottavio Soppelsa[5,6]*

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***Correspondence:**
soppelsa@unina.it
https://orcid.org/0000-0002-1886-4136

Affiliations:
1 m. 4 july 2020
2 Via G. Merliani, Naples, Italy
3 Via Epomeo, Naples, Italy
4 Via Fabio Massimo, Naples, Italy
5 Department of Biology, University of Naples Federico II, Italy.
6 Orto Botanico di Napoli, University of Naples Federico II, Via Foria, Italy.

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Abstract

The results of two years of research on the molluscs present in the Botanical Garden of Naples are reported and compared with the sole similar study published in 1875 and with other reports in the literature, the last of which published in 1930 by Boettger. As a general result, a noticeable decrease in the number of species present in the site was recorded. However, some species not reported before have also been observed, and namely *Vallonia costata* (O.F. Müller, 1774), *Orcula dolium* (Draparnaud, 1801) and *Planorbarius corneus* (Linnaeus, 1758), all recorded for the first time in Campania, and in addition *Carychium minimum* O.F. Müller, 1774, which appears to be well settled in the studied enclave; for this latter species the only previous indication was found in the bibliography for Campania (Bellini 1898). Finally, some limacid slugs, previously found and recorded only by Boettger (1930), have been found.

Keyword: terrestrial malacofauna; freshwater molluscs; Botanical Garden

Riassunto

Sono riportati i risultati di due anni di ricerca sulle specie di molluschi presenti nell'Orto Botanico di Napoli e confrontati con l'unico studio simile pubblicato nel 1875 e con altri resoconti in letteratura, l'ultimo dei quali pubblicato nel 1930 da Boettger. Come risultato generale, è stata registrata una notevole diminuzione del numero di specie presenti nel sito. Tuttavia, sono state osservate anche alcune specie non segnalate prima e precisamente *Vallonia costata* (OF Müller, 1774), *Orcula dolium* (Draparnaud, 1801) e

Planorbarius corneus (Linnaeus, 1758), tutte registrate per la prima volta in Campania, e in aggiunta *Carychium minimum* OF Müller, 1774, che sembra essersi ben insediata; per quest'ultima specie l'unica indicazione precedente è stata trovata in bibliografia per la Campania (Bellini 1898). Infine, sono stati trovati alcuni limacidi, precedentemente trovati e riportati solo da Boettger (1930).

Parole chiave: malacofauna terrestre; molluschi d'acqua dolce; Orto Botanico

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Introduction

The study of malacofauna, both terrestrial and freshwater, of a place as controlled and varied as the Royal Botanical Garden of Naples (Orto Botanico di Napoli – OBN, at present a research center of the University of Naples "Federico II") poses many methodological obstacles, but provides important information on the composition of the "urban malacofauna" of the City of Naples. The importance is not only due to the historical and cultural value place but also to the fact that, in large urban settlements, it is rarely possible to have "green" places so controlled and rich of different environments.

About one hundred and forty years from the publication of the first systematic study on molluscs in the grounds and pools of the Botanical Garden of Naples (1875) by the Director of the structure at the time, prof. Vincenzo Cesati, we carried out a comparative study to verify the variations in the composition of the malacofauna.

In addition to this most important work by Cesati (1875); other minor contributions have been published by Oronzio Gabriele Costa (1829; 1839), Rudolph-Amandus Philippi (1844), Raffaello Bellini (1898; 1899a; 1899b; 1904; 1907; 1915) and Caesar-Rudolf Boettger (1930); the most recent of these works, however, is over one century old.

During this long period, the deep changes that have affected the area where the Botanical Garden of Naples is located and the increasingly dense anthropization of the surrounding places have certainly influenced the malacofauna present on the site; for this reason, some brief historical information will certainly be helpful in providing a better understanding of the modifications of places from the time of the first study to present.

Historical notes

To better understand the reasons that induced the reigning houses of Naples, the Bourbons first and later the French to prepare a botanical garden, it is necessary to refer to the major public works realized after the middle of the XVIII century. The original area of the Botanical garden was approx. 13

ha; later, after a compulsory purchase by the Municipality in order to open a road, the garden area was reduced to the present-day 12 ha. From then onwards Naples spread out of the narrow constraints of the city walls, now devoid of strategic value, and the obvious expansion took place towards the neighbouring countryside. At the same time Naples was reaching a European stance, rich of intellectual ferments, and had to be provided with public structures adequate to its rank. In those years, for example, the Zoological and Mineralogical Museums, the Astronomical Observatory and the San Carlo Theatre were founded. With this in mind, the layout of the new road axis (via Foria), designed and built as a straight, wide and tree–lined avenue, favoured the connection between the city and the Real Albergo dei Poveri which overlooks the wide Piazza Carlo III. The road then proceeds towards the sites where the Cemetery of the Three Hundred and Sixty–Six Graves and that of Poggioreale arose. Along the new road numerous noble palaces and the Teatro San Ferdinando was built; the same area was chosen for the Royal Botanical Garden (Doria 1979).

Material and Methods

As the research site is a closed enclave far from any possibility of exchange with cement–free and asphalt–free land, being completely surrounded by the urbanized areas, it was decided not to collect live animals as far as possible. For cases where further observations were necessary, the specimen were brought back *in situ* after being photographed. The material was collected in about two years (from June 2013 to September 2015) in order to cover all seasonal, climatic and reproductive conditions. The collection of macroscopic specimens was made *ictu oculi*. In addition, transepts of about one square meter for a depth of about 5 cm of the litter, have been sampled and observed under an optical microscope, to collect small specimen. The retaining walls built with blocks of tuff (a typical volcanic rock of the Neapolitan subsoil, widely used in construction; it is a very light and porous stone that retains moisture well) were also explored on various occasions and weather conditions. The pools for aquatic plants have been explored by collecting sediment samples, where possible, with a mesh of less than 0.5 mm. The mesh has also been used for the collection of the material present along the walls and on the plants themselves. These pools have an average depth of no more than one meter, but for the most part they are provided with a thick iron grate that rises from the bottom and on which the plant pots rest. Some samples were provided to us by the staff responsible for the maintenance of the garden; they offered a fruitful collaboration facilitating the work in any possible way. Particular attention was then given to the material coming from the pruning and cutting of tall trees, observing what was under the bark of the plants themselves; this material had been accumulated in areas of the Garden specifically set for this purpose. It should be noted that during the research some sites of the OBN have undergone radical maintenance and renovation work.

The nomenclature was set in accordance with Bank (2017) and MolluscaBase (www.molluscabase.org, accessed on October 7, 2019).

The collected material is housed in the museum connected to the OBN (www.ortobotanico.unina.it/p_aree_espositive/Zone_espo.htm, accessed on October 7, 2019).

Results and Discussion

As reported in the Tab 1, 37 species have been found and identified, plus some specimens belonging to the Limacidae that require further investigation to be classified. The species found are much less than the 49 reported in the bibliography but few additional species were also found. Specifically: *Vallonia costata* (O.F. Müller, 1774) and *Planorbarius corneus* (Linnaeus, 1758) for the first time in Campania; *Orcula dolium* (Draparnaud, 1801) reported for the first time for southern Italy, *Carychium minimum* O.F. Müller, 1774 reported for southern Italy only once by Bellini back in 1898.

In addition to the progressive urbanization of the surrounding areas, the injuries of the Second World War have certainly had an impact on the marked depletion of the malacofauna. The OBN, in fact, was used as a station for troops based in Naples. Last but not least, the crop protection products, including molluscicides, frequently used not only in cultivated areas but also in green areas, certainly have detrimental effects. Given the extreme contiguity of land lots prepared to accommodate various types of plants, a full correspondence between the various species and their elective habitats has not always been found.

Twenty–five terrestrial and nine freshwater gastropods species have been found, as well as two species of bivalves. Among the terrestrial species, the Helicidae family is the one most represented, with four species; the dominant species is *Cornu aspersum* (O.F. Müller, 1774) followed by *Massylaea vermiculata* (O.F. Müller, 1774). Among the freshwater species we mention *Unio mancus* Lamarck, 1819, purposely introduced in the pools by the OBN staff, but not detected in the last weeks of research and sampling.

The strong disparity of the species found in terrestrial environments with respect to freshwater ones is due both to the small extent of freshwater environments in OBN and to their isolation.

The lack of a museum hosting the species reported in the literature did not allow comparison and control over the classification of the items previously reported by the other authors in the literature, as also highlighted in the case of *Carychium minimum*. We therefore take the exact determination of the material itself for granted, also recalling that the malacological collection of prof. Cesati was included in his private collection, all traces of which have been lost. On the other hand, there is a noteworthy and definite presence of *Vallonia costata*, *Planorbarius corneus* and *Orcula dolium* which represent, as already said, the first indication of their existence in Campania and, for the second species, even in peninsular Italy. The present report, given the peculiarity of the area of discovery, does

not allow to consider the species found as fully belonging to the Campanian malacofauna but shows, however, their adaptability to our land and latitude. The need for further investigations on *Carychium minimum* is reiterated. The question of the absence of limacid slugs in previous works remains insoluble.

The possibilities for the colonisation of new species are mainly due to possible phenomena of phoresy (due to birdlife) and anthropogenic contributions through the acquisition of plant specimen.

Finally, for historical completeness, we should mention that the information relative to the OBN, taken from a card without corresponding specimens, is present at the Museum of Zoology of the University of Naples Federico II for *Physa hypnorum,* currently *Aplexa hypnorum* (Linnaeus, 1758).

For more exhaustive consultation see Tab. S1 (Checklist of Molluscs of the "Real Orto Botanico di Napoli").

Table 1: Historical Mollusca checklist of Orto Botanico di Napoli (alphabetical order).
Species: actual scientific name; Current presence: Y = yes, N = no, (l) =living specimen; Synonyms (as reported in the source) and references: [n] = 1 Costa, 1829; 2 Costa, 1839; 3 Philippi, 1844; 4 Cesati, 1875; 5 Bellini, 1898; 6 Bellini, 1899a; 7 Bellini, 1899b; 8 Bellini, 1904; 9 Bellini, 1907; 10 Bellini, 1915.

Species	Current presence	Synonyms and references
GASTROPODA		
Melanoides tuberculata (O.F. Müller, 1774)	Y (l)	
Aplexa hypnorum (Linnaeus, 1758)	N	*Physa hypnorum* (Linnaeus, 1758) [8, 10]
Pomatias elegans (O.F. Müller, 1774)	Y (l)	*Cyclostoma elegans* (O.F. Müller, 1774) [4]
Platyla gracilis (Clessin, 1877)	Y	
Bithynia tentaculata (Linnaeus, 1758)	Y (l)	[4, 8, 10]
Bithynia boissieri (Küster, 1852)	N	[7, 8, 10]
Bithynia rubens (Menke, 1830)	N	[10];
		Paludina rubens Menke, 1830 [8];
		Codiella rubens Menke [9]
Valvata piscinalis (O.F. Müller, 1774)	N	[7]
Pseudamnicola macrostoma (Küster, 1853)	N	[8, 10]
Xerosecta explanata (O. F. Müller, 1774)	N	*Helix explanata* O.F. Müller, 1774 [1]
Galba truncatula (O. F. Müller, 1774)	N	*Lymnaea truncatula* (O. F. Müller, 1774) [10]
Peregriana peregra (O.F. Müller, 1774)	Y (l)	*Limnaea peregra* O.F. Müller, 1774 [7]
Radix auricularia (Linnaeus, 1758)	Y	*Limnaea auricularia* (Linnaeus, 1758) [7, 8, 10]

Stagnicola palustris (O.F. Müller, 1774)	Y (I)	*Limnaea palustris* (O. F. Müller, 1774) [4, 8, 9, 10]
Physa fontinalis (Linnaeus, 1758)	N	[7, 8, 10]
Physella acuta (Draparnaud, 1805)	Y (I)	
Planorbarius corneus (Linnaeus, 1758)	Y (I)	
Planorbis planorbis (Linnaeus, 1758)	Y (I)	*Planorbis marginatus* Draparnaud, 1805 [7]
Planorbis carinatus O.F. Müller, 1774	N	[7]
Hippeutis complanatus (Linnaeus, 1758)	Y	*Planorbis complanatus* (Linnaeus, 1758) [4, 8, 10]; *Planorbis fontanus* (Lightfoot, 1786) [10]
Acroloxus lacustris (Linnaeus, 1758)	Y	
Carychium tridentatum (Risso, 1826)	Y	
Carychium minimum O.F. Müller, 1774	Y	[4]
Succinea putris (Linnaeus, 1758)	N	[7]
Lauria cylindracea (da Costa, 1778)	Y	*Pupa umbilicata* Draparnaud, 1801 [4]
Orcula dolium (Draparnaud, 1801)	Y	
Vallonia pulchella (O.F. Müller, 1774)	Y (I)	
Vallonia costata (O.F. Müller, 1774)	Y (I)	
Acanthinula aculeata (O.F. Müller, 1774)	Y	*Helix aculeata* O.F. Müller, 1774 [4, 7]
Truncatellina callicratis (Scacchi, 1833)	Y	*Pupa callicratis* Scacchi, 1833 [4]
Merdigera obscura (O.F. Müller, 1774)	Y	*Bulimus obscurus* O.F. Müller, 1774 [4]
Vertigo pusilla O.F. Müller, 1774	N	[9, 10] *Pupa pusilla* O.F. Müller, 1774 [4]
Vertigo antivertigo (Draparnaud, 1801)	N	[10]
Rumina decollata (Linnaeus, 1758)	Y (I)	*Bulimus decollatus* (Linnaeus, 1758) [4]
Cecilioides acicula (O.F. Müller, 1774)	Y	*Cionella acicula* O.F. Müller, 1774 [4]
Ferussacia folliculum (Schröter, 1784)	N	*Cionella folliculus* Gronovius, 1781 [4]
Hohenwartiana hohenwarti (Rossmässler, 1839)	N	*Cionella hohenwarthi* Rossmässler, 1839 [4 (fide Tiberi)]
Papillifera papillaris (O.F. Müller, 1774)	Y (I)	*Clausilia papillaris* (O.F. Müller, 1774) [4]
Charpentieria gibbula (Rossmässler, 1836)	Y	
Punctum pygmaeum (Draparnaud, 1801)	N	*Helix pygmaea* Draparnaud, 1801 [4, 9]
Discus rotundatus (O.F. Müller, 1774)	Y (I)	*Helix rotundata* O.F. Müller, 1774 [4]
Aegopinella nitens (Michaud, 1831)	Y	
Zonitoides nitidus (O.F. Müller, 1774)	N	*Helix nitida* O.F. Müller, 1774 [10]
Vitrea crystallina (O.F. Müller 1774)	N	*Helix crystallina* O. F. Müller, 1774 [4, 9, 10]
Oxychilus draparnaudi (H. Beck, 1837)	Y (I)	[4]

Mediterranea hydatina (Rossmässler, 1838)	N	*Helix hydatina* Rossamässler 1838 [4 (fide Tiberi)]
Limax maximus Linnaeus, 1758	Y (I)	
Limax spp.	Y (I)	
Campylaea planospira setulosa (Briganti, 1825)	Y (I)	
Theba pisana (O.F. Müller, 1774)	Y (I)	*Helix pisana* O.F. Müller, 1774 [4]
Massylaea vermiculata (O.F. Müller, 1774)	Y (I)	*Helix vermiculata* O.F. Müller, 1774 [4]
Cornu aspersum (O.F. Müller, 1774)	Y (I)	*Helix adspersa* O.F. Müller, 1774 [4]
Marmorana muralis (O.F. Müller, 1774)	N	*Helix muralis* O.F. Müller, 1774 [4]
Cantareus apertus (Born, 1778)	N	*Helix aperta* Born 1778 [4]
Helicodonta obvoluta (O.F. Müller, 1774)	N	*Helix obvoluta* O.F. Müller, 1774 [4]
Xerotricha conspurcata (Draparnaud, 1801)	Y (I)	*Helix conspurcata* Draparnaud, 1801 [4]
Cernuella cisalpina (Rossmässler, 1837)	Y (I)	
Cernuella virgata (da Costa, 1778)	N	*Helix variabilis* Draparnaud,1801 [4];
		Helix profuga Schmidt, 1854 [4, 6, 7]
Candidula unifasciata (Poiret, 1801)	N	*Helix candidula* Studer, 1820 [4, 9];
		Helix unifasciata Poiret, 1801 [10]
Cochlicella acuta (O.F. Müller, 1774)	N	*Bulimus acutus* O.F. Müller, 1774 [4]
Hygromia cinctella (Draparnaud, 1801)	N	*Helix ranzani* O.G. Costa, 1839 [2];
		Helix cinctella Draparnaud, 1801 [10]
Monacha cartusiana (O.F. Müller, 1774)	N	*Helix carthusiana* O.F. Müller, 1774 [4]
Monacha cantiana (Montagu, 1803)	N	*Helix cantiana* Montagu, 1803 [4]
Monachoides incarnatus (O.F. Müller, 1774)	N	*Helix incarnata* O.F. Müller, 1774 [4 (fide Tiberi), 9, 10]
BIVALVIA		
Unio mancus Lamarck, 1819	Y	
Euglesa casertana (Poli, 1791)	Y	*Pisidium fontinale* Draparnaud [5, 6, 7];
		Pisidium pusillum Gmelin, 1799 [8, 9, 10];
		Pisidium australe Philippi, 1836 [10]
Pisidium nitidum Jenyns, 1832	N	[9, 10]

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Author contributions

All authors contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Data availability

The collected material is housed in the museum connected to the OBN (www.ortobotanico.unina.it/p_aree_espositive/Zone_espo.htm, accessed on October 7, 2019).

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Supporting Information

Table S1: Checklist of Molluscs of the "Real Orto Botanico di Napoli"

GASTROPODA

Order Caenogastropoda

Superfamily Cerithioidea

Family Thiaridae

Genus *Melanoides* Olivier, 1804

Melanoides tuberculata (O.F. Müller, 1774): its presence is due to the anthropic contribution. Live specimens were found both at young and adult stages, so the presence of the species is established (Fig. S1a). Incidentally, in the pools there is an abundance of ornamental fishes freed from repentant aquarists; this presence has created problems related to the survival and reproductive cycle of *Lissotriton italicus* (Peracca, 1898) present in the pools of the Fern groove; thus, it was decided to transfer the fishes to other pools.

Order Littorinimorpha

Superfamily Littorinoidea

Family Pomatiidae

Genus *Pomatias* S. Studer, 1789

Pomatias elegans (O.F. Müller, 1774): this species was found frequently and in various stages of growth (Fig. S1b).

Order Architaenioglossa

Superfamily Cyclophoroidea

Family Aciculidae

Genus *Platyla* Moquin–Tandon, 1856

Platyla gracilis (Clessin, 1877): found only on the lawn of the pool in front of the Succulents' area with very few specimens; it is absent in the literature concerning the OBN but reported in 2008 for Campania (Bodon & Cianfanelli 2008). The species is present in Italy with a sparse distribution and greater density in the north of the peninsula; it is reported as absent in Sicily and Sardinia (Boeters et al., 1989). In view of the particular nature of the OBN and the small number of specimens found, no one of which living, we cannot consider for the moment the species as part of the OBN malacofauna.

Order Littorinimorpha

Superfamily Truncatelloidea

Family Bithyniidae

Genus *Bithynia* Leach, 1818

Bithynia tentaculata (Linnaeus, 1758): always well represented in the pools (Fig. S1c).

Order Basommatophora

Superfamily Lymnaeoidea

Family Lymnaeidae

Genus *Radix* Montfort, 1810

Radix auricularia (Linnaeus, 1758): some of the specimens collected present the spire more depressed than usual; the species is present only in a pool with papyrus and water lilies, facing the area of the Succulents. Given the minimal diffusion, only 3 specimens were taken that are on display in the malacological showcase of the Botanic Museum.

Genus *Peregriana* Servain, 1881

Peregriana peregra (O.F. Müller, 1774): present in various pools always in good numbers (Fig. S1d).

Genus *Stagnicola* Jeffreys, 1830

Stagnicola palustris (O.F. Müller, 1774): also represented by large specimen (32 mm), flanked by young specimen. In addition to the pools, it is also present in some large pots with a constant presence of water, particularly in the area of the Fern groove.

Family Physidae

Genus *Physella* Haldeman, 1843

Physella acuta (Draparnaud, 1805): abundant and present in all the pools. It was observed at all stages of growth and only few large specimens were collected (Fig. S1e). Many studies have highlighted the constant rarefaction, until the disappearance in Italy, of *Physa fontinalis* (Linnaeus, 1758) in favour of *Physella acuta*, introduced in Europe from North America since the mid–1800s (Cianfanelli et al., 2007). The comparison between the current specimens and those of the historical reports is impossible by now. As a consequence, we are unable to state whether *Physa fontinalis* was indeed present at OBN.

Family Planorbidae

Genus *Planorbis* O. F. Müller, 1773

Planorbis planorbis (Linnaeus, 1758): it is very abundant in all the areas with the exception of the Fern groove, where it is rare. However, *Planorbis carinatus* O.F. Müller, 1774, reported in the literature for OBN, has not been found (Fig. S1f).

Planorbarius corneus (Linnaeus, 1758): found in various stages of growth; abundant and very active in a pool in the central alley. The species is reported here for the first time in Campania

in the wild. The species had already been found in 1979 in the fern-groove area of the Botanical garden, but this information was never published (Carlo Guarino, pers. comm.).

Genus *Hippeutis* Charpentier, 1837

Hippeutis complanatus (Linnaeus, 1758): present in the bottom sediments of some pools.

Family Acroloxidae

Genus *Acroloxus* H. Beck, 1838

Acroloxus lacustris (Linnaeus, 1758): a good number of specimens was found in the sludge of the bottom of the pool overlooking the Succulents' area, in which *Radix auricularia* was also collected. The presence of this species is not new for southern Italy (Paulucci 1879).

Order Ellobiida

Superfamily Ellobioidea

Family Ellobiidae

Genus *Carychium* O.F. Müller, 1773

Carychium tridentatum (Risso, 1826): absent in the historical OBN checklist, is today well represented with a large population. Specimen were collected in various growth stages; it is therefore reasonable to assume its stable presence.

Carychium minimum O.F. Müller, 1774: signalled for southern Italy only by Bellini (1898), precisely in the malacofauna of the OBN. There are no subsequent reliable reports for southern Italy; it is limited to the north of Italy. A limited number of specimens was collected (Califano greenhouse), all fresh but lacking the soft parts (Fig. S1g). This does not allow to confidently affirm its stable presence in the OBN. This species is therefore reported as doubtful, awaiting for further studies. It is to point out, however, that no recent releases of material coming from the typical localities of the species into the OBN are known that could justify its presence.

Order Stylommatophora

Superfamily Pupilloidea

Family Pupillidae

Genus *Lauria* Gray, 1840

Lauria cylindracea (da Costa, 1778): well represented in some stations such as the flowerbed of the rocks and Gasparrini area.

Family Orculidae

Genus *Orcula* Held, 1838

Orcula dolium (Draparnaud, 1801): it is not mentioned by any of the authors who sampled the OBN. The distribution area in Italy is limited to the Alps and the Pre-Alps (Alzona 1971; Kerney & Cameron 1979). Field research conducted by prof. Folco Giusti while expanding the distribution area of *Vallonia costata* (reported here for the first time in Campania), do not affect

Orcula dolium. The specimen collected in the soil are always numerous and present at various stages of growth. It is true that the particular habitat of the present study cannot configure a real expansion of the distribution range of the two species. However, it is still interesting to note the setting of the species in a climatic situation far from the usual ones. The original diagnosis of *Orcula dolium* is reported: «8. M. Baril. P. dolium. Coq[uille] ventrue, lisse; ouverture blanche, I-plissée, bord columellaire sub-3-plissé. Long. 6-7 mill. diam. 3½-4 m. H[abitat] Avec la précédente, dont elle est un peu voisine. (8-9 tours), Coq[uille] roussâtre.» (Draparnaud 1801).

Family Vallonidae

Genus *Vallonia* Risso, 1826

Vallonia pulchella (O.F. Müller, 1774): found sometimes numerous and rarely alive. In some soil samples, the congeneric *Vallonia costata* was also present.

Vallonia costata (O.F. Müller, 1774): reported now for the first time in Campania. Until now the species has been reported, for southern Italy, by Ferreri, Bodon and Manganelli (2005) for the province of Lecce. In Alzona (1971) the spread of the species was indicated as limited to northern and central Italy; the same spread was also indicated in the work of Cossignani and Cossignani (1995). Ferreri et al. (2005) expanded the distribution area of *Vallonia costata* up to Puglia. The species is also present in Sicily (Viviano 2017). Numerous specimens have been found in different stations, almost all fresh and well preserved (Fig. S1h). The species, due to its diagnostic morphology, cannot be confused with other members of the same genus. The spread of the species in the territory should be further investigated to better define its distribution. The first specimen was found in very small numbers in loam collected at the foot of a laurel tree (*Laurus nobilis* L.), along Viale Giuseppe Caputo, in the first period of the study (October 2013). Subsequently the presence of *Vallonia costata* was confirmed in numerous stations, in the presence of different tree species, with an abundant number of specimens, as previously mentioned. The comparison between the original description of the species and the photos of the specimen can be useful: Müller in his *Vermium terrestrium et fluviatilum* of 1774 describes the species as follows: «Helix head subdepressa, umbilicata, cinerea; spiris costatis; circular opening; labro albo, reflexo.»

Kerney and Cameron (1979) give these identification data: «discoidal shell, with a nearly flat spire; 3 ¼ whorls, often slightly shouldered; umbilicus very broad. Mouth almost circular, oblique; mouth-edge sharply reflected to form a strong, pure-white flange-like lip. Shell greyish-white, slightly translucent, with a sculpture of rather regularly-spaced sharp ribs, often giving a characteristic sparkle to fresh shell».

Genus *Acanthinula* H. Beck, 1847

Acanthinula aculeata (O.F. Müller, 1774): very few specimens were found, near the Califano greenhouse.

Family Truncatellinidae

Genus *Truncatellina* R. T. Lowe, 1852

Truncatellina callicratis (Scacchi, 1833): often found during the analysis of the soil of various stations.

Family Enidae

Genus *Merdigera* Held, 1838

Merdigera obscura (O.F. Müller, 1774): never frequent or abundant.

Superfamily Achatinoidea

Family Achatinidae

Genus *Rumina* Risso, 1826

Rumina decollata (Linnaeus, 1758): found in a living state, only in a flower bed in the coastal dune area; in the remaining territory only very few shells were found.

Family Ferussacidae

Genus *Cecilioides* J. Férussac, 1814

Cecilioides acicula (O.F. Müller, 1774): found in a limited number of stations and still rare (Fig. S1i).

Superfamily Clausilioidea

Family Clausiliidae

Genus *Papillifera* W. Hartmann, 1842

Papillifera papillaris (O.F. Müller, 1774): found in numerous sites but only a few living specimens have been collected on a tufaceous stones wall (Fig. S1l).

Genus *Charpentieria* Stabile, 1864

Charpentieria gibbula (Rossmässler, 1836): very few samples were collected on tufaceous stones walls.

Superfamily Punctoidea

Family Discidae

Genus *Discus* Fitzinger, 1833

Discus rotundatus (O.F. Müller, 1774): found living and always in good number of individuals.

Superfamily Gastrodontoidea

Family Gastrodontidae

Genus *Aegopinella* Lindholm, 1927

Aegopinella nitens (Michaud, 1831): poorly represented, found mainly in the Fern groove.

Family Oxychilidae

Genus *Oxychilus* Fitzinger, 1833

Oxychilus draparnaudi (Beck, 1837): present only in the area of the Fern groove in a good number of specimens. As foreseen by Boettger (1930), at present *O. cellarius* (O. F. Müller, 1774) has been substituted by the more resistant *O. draparnaudi*.

Superfamily Limacoidea

Family Limacidae

Genus *Limax* Linnaeus, 1758

Limax maximus Linnaeus, 1758: it is certainly the most striking limacid among those found, due to the considerable size it reaches; the population is abundant and widespread in the OBN.

Limax spp.: Various found specimen require further studies such as anatomical and radular examination.

Superfamily Helicoidea

Family Helicidae

Genus *Campylaea* H. Beck, 1837

Campylaea planospira setulosa (Briganti, 1825): found a small number of specimen and only in an area adjacent to the greenhouse for the cultivation of orchids and other epiphytic plants. It is a fairly widespread species in Campania.

Genus *Theba* Risso, 1826

Theba pisana (O.F. Müller, 1774): a good number of specimens was observed in the area of succulent plants among the thorns of *Astrophytum ornatum*; it is also present in other stations.

Genus *Massylaea* Möllendorff, 1898

Massylaea vermiculata (O.F. Müller, 1774): it is abundant but, as always, after having ascertained the presence of living and vital specimen, only fresh shells have been collected without any soft parts.

Genus *Cornu* Born, 1778

Cornu aspersum (O.F. Müller, 1774): invasive and dominant throughout the territory.

Family Geomitridae

Genus *Xerotricha* Monterosato, 1892

Xerotricha conspurcata (Draparnaud, 1801): always well represented.

Genus *Cernuella* Schlüter, 1838

Cernuella cisalpina (Rossmässler, 1837): quite common (Fig. S1m).

BIVALVIA

Order Unionida

Superfamily Unionoidea

Fam. Unionidae

Genus *Unio* Philipsson, 1788 (in: Retzius A.J., 1788)

Unio mancus Lamarck, 1819: the maintenance staff provided a full sample from the tropical greenhouse pools.

Order Venerida

Superfamily Sphaerioidea

Family Sphaeriidae

Genus *Euglesa* Jenyns, 1832

Euglesa casertana (Poli, 1791): only very few valves were found, scraping on the bottom not protected by metal grids of one of the pools. Said grids, present in almost all the other pools for both the arrangement of the vases containing the various species of aquatic plants and safety reasons, did not allow a systematic collection of the sediment. Bellini (1898) records this species, attributing the original report to (1836), but no reference to the botanical Garden is present in the latter source.

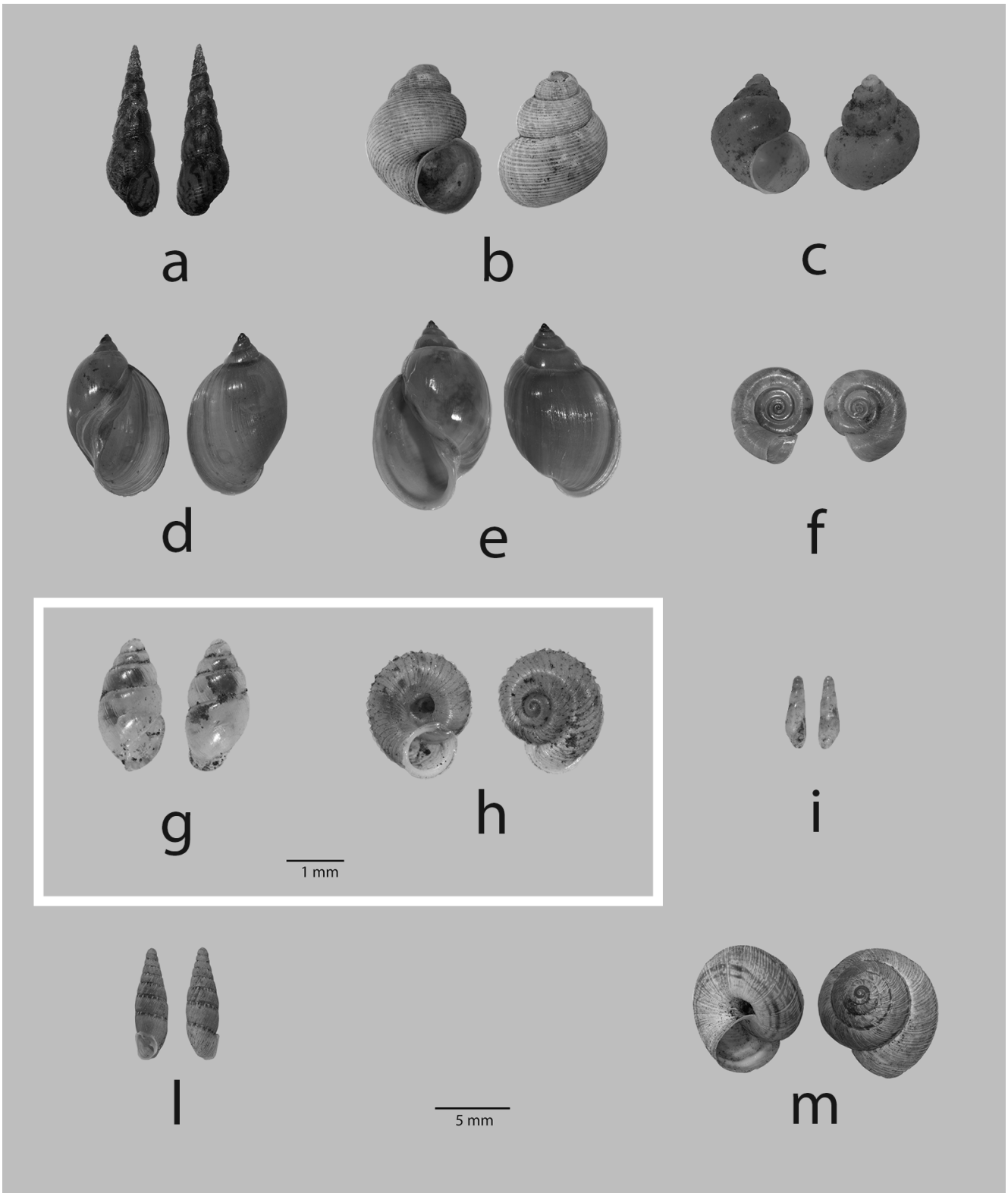

Figure S1: Shells of: a) *Melanoides tuberculata*; b) *Pomatias elegans*; c) *Bithynia tentaculata*; d) *Peregriana peregra*; e) *Physella acuta*; f) *Planorbis planorbis*; g) *Carychium minimum*; h) *Vallonia costata*; i) *Cecilioides acicula*; l) *Papillifera papillaris*; m) *Cernuella cisalpina*.

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An ethnobotanical survey of wild edible plants of Campania (Italy)

Antonino De Natale, Bruno Menale, Serena Di Lecce and Antonino Pollio*

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***Correspondence:**
anpollio@unina.it
https://orcid.org/0000-0003-3018-7921
Affiliations:
Dipartimento di Biologia, Università Federico II di Napoli, Complesso Universitario di Monte S. Angelo, Via Cintia 26, 0126, Naples, Italy

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Abstract

A survey of the knowledge on edible wild plants in Campania (Italy) is presented. The checklist is based not only on literature data but also on unpublished results coming from archives of the authors. 639 records of alimentary uses related to 198 taxa are listed. Asteraceae, Lamiaceae, Brassicaceae and Rosaceae are the most represented families. The predominant biological forms are Hemycriptophytes, Terophytes and Phanerophytes. The parts of plant used as food mainly include leaves and aerial parts, followed by flowers, fruits and seeds, whereas roots and other underground parts are less frequently used. Many species are consumed in salads or soups and served in mixtures. The alimentary uses of most species are widespread in Campania, but the uses of 28 species are strictly linked to limited territories.

Keyword: Ethnobotany, Campania, edible wild plants

Riassunto

Viene presentata una rassegna delle conoscenze sulle piante selvatiche commestibili in Campania (Italia). La checklist non si basa solo su dati di letteratura ma anche su risultati inediti provenienti dagli archivi degli autori. Sono stati elencati 639 record di usi alimentari relativi a 198 taxa. Asteraceae, Lamiaceae, Brassicaceae e Rosaceae sono le famiglie più rappresentate. Le forme biologiche predominanti sono: Emicriptofite, Terofite e Fanerofite. Le parti delle piante utilizzate come cibo sono principalmente foglie e parti aeree delle piante, seguite da fiori, frutti e semi, mentre radici e altre parti sotterranee sono usate meno frequentemente. Molte specie si consumano in

insalate o zuppe e si usano in combinazione con altre. La maggior parte delle specie sono adoperate in tutto il territorio Campano, ma gli usi di 28 specie sono strettamente legati a territori circoscritti.

Parole chiave: Etnobotanica, Campania, piante selvatiche commestibili

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Introduction

The use of edible wild plants in southern Europe is still lively, albeit on decline. Throughout the Mediterranean region these plants played a role in the surviving strategy of rural communities for centuries, and there is a diffused awareness that such a heritage should be preserved as it represents a source of untapped information about numerous neglected species (Vanzani et al. 2011).

Wild food plants differ among regions of the Mediterranean basin. Yet, as a general rule, wild greens are largely consumed, having a seasonal usage (Hadjichambis et al. 2008). Often, edible wild plants are weeds, considered noxious to crop cultivation. For this reason, they are controlled by using herbicides and mechanical eradication, even though weeds also play important ecological roles, as sources of biodiversity, as key components of seminatural edge habitats and preventing soil erosion (Turner et al. 2011). The first report on Italian wild edible plants dates back to 1980s (Aliotta 1987). Recent research confirms that in Italy, and particularly in southern regions, numerous wild edible species are still commonly consumed. In Apulia more than 220 wild herbaceous species are used as food (Biscotti et al. 2018), whereas in Sicily about 300 native edible wild plants were identified in a recent study, based on a review of the extant literature and on recent field investigations (Pasta et al. 2020).

As far as concerns the Campania Region, numerous ethnobotanical reports have been published in the last decades, frequently including information on local uses of edible wild plants. The present study provides the first compilation of ethnobotanical data collected in this territory, aiming to delineate a comprehensive picture of the geographical distribution of these data. This contribution could promote future field investigation, focusing the attention on the Campanian territories where information on edible wild plants is scanty or worse lacking.

Material and Methods

The list of the edible wild plants of Campania was based on a critical review of recent literature available on this topic, namely: De Natale et al. (2009); De Natale and Pollio (2007); De Rosa et al. (2008); Di Novella et al. (2012); Guarino et al. (2008); La Palometa and Grieco (2003); Mautone et al. (2019); Menale et al. (2016); Menale and

Muoio (2014); Motti et al. (2009); Motti and Motti (2017); Salerno and Guarrera (2008); Savo et al. (2015); Savo et al. (2019); Scherrer et al. (2015).

The recent ethnobotanical bibliography was integrated with information coming from the archives of Antonino De Natale (ADN) and Bruno Menale (BM), that further includes unpublished data (u.d.), collected during fieldworks carried out in different areas of the Campania region. As basic references from neighboring regions we considered: Biscotti et al. (2018), for Apulia; Menale et al. (2006), for Molise; Guarrera et al. (2006), for Basilicata; Passalacqua et al. (2006), Nebel et al. (2006), for Calabria; Pasta et al. (2020), for Sicily.

The checklist of edible wild plants reports for each taxon the scientific name and the plant family, as reported by Pignatti (2017-2018). Local names, Province, Locality, Part of the plant used, and Food uses are the other fields included in the check list, that provide an updated information about the uses of edible wild plants in Campania. Life form and chorotypes were recorded in keeping with Pignatti (1982). The taxa are listed in alphabetical order according to their scientific name.

Results

In the Supplementary Table S1 we list 639 records of alimentary uses, that are related to 198 different taxa. The most represented families are Asteraceae (25.2%), Lamiaceae (9.4%), Brassicaceae (7.9%) and Rosaceae (6.4%) (Fig. 1).

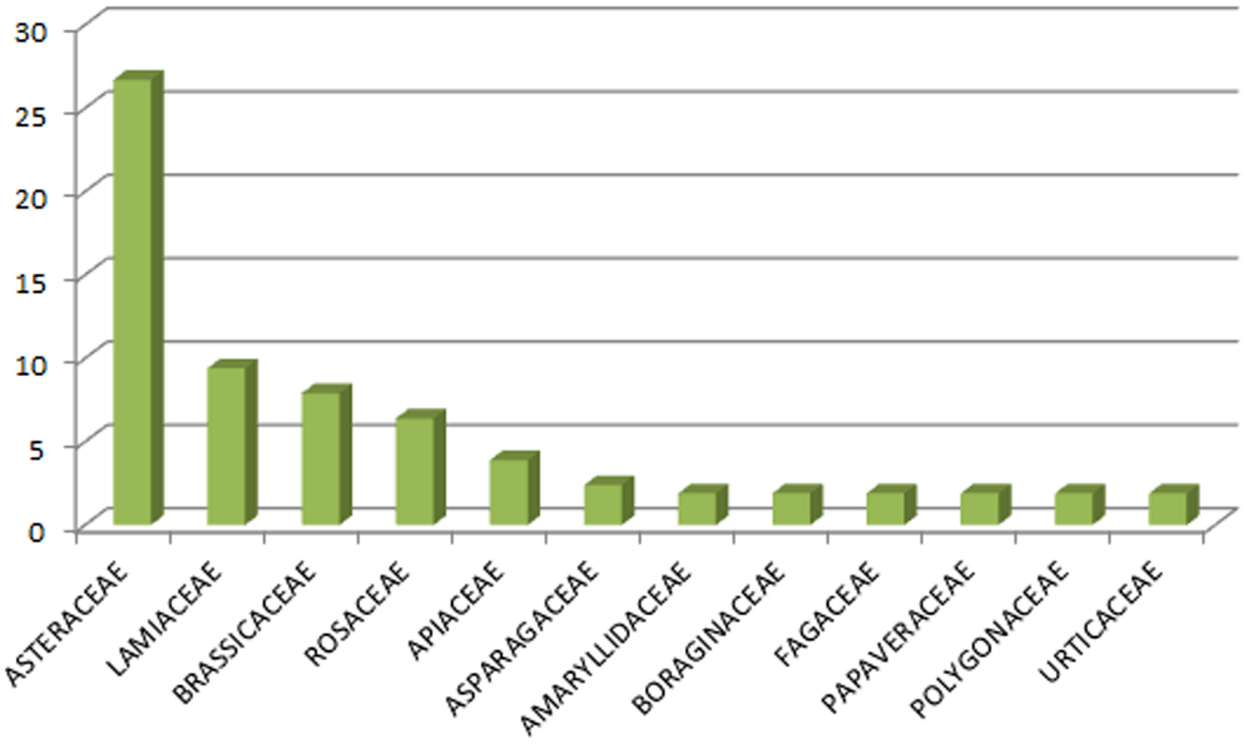

Figure 1: Families of food plants used in Campania. The families with a score < 2% are not represented in the figure.

The biological spectrum highlights a predominance of Hemicryptophytes, followed by Terophytes and Phanerophytes (Fig. 2), whereas the chorological spectrum represent some 37% of the taxa included in the checklist, yet only 2.48 % are endemic to Campania (Fig. 3).

The parts of plant most frequently used are

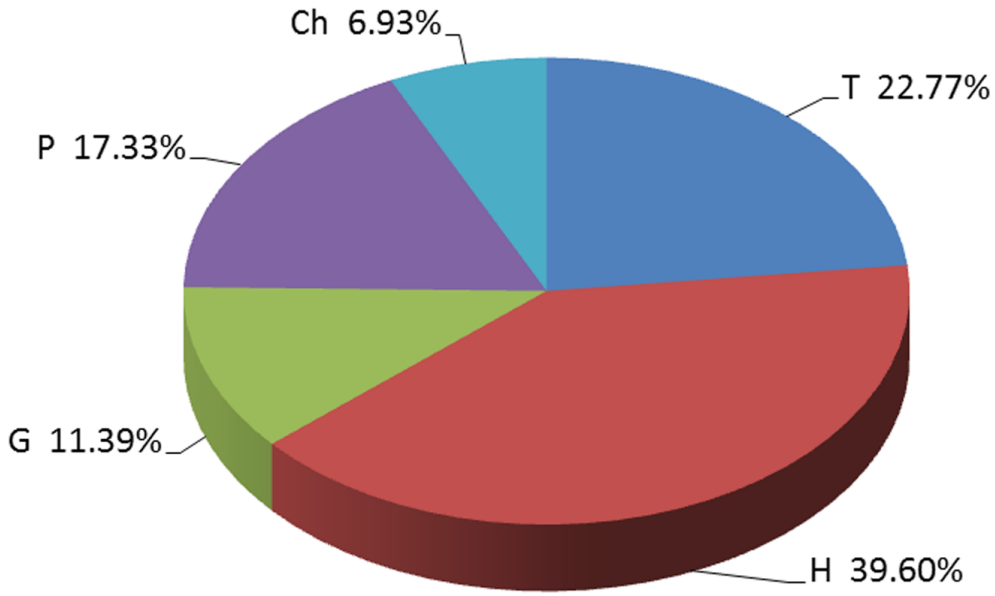

Figure 2: Frequency of growth forms among Campanian food plants expressed as percentage (Ch = Chamaephytes, G = Geophytes, H = Hemicryptophytes, P = Phanerophytes, T = Therophytes).

shows the prevalence of Euroasiatic (22.77%) and Cosmopolitan (21.29%) taxa, that account for almost half of the species overall. Steno- and Euri-mediterranean taxa

leaves and tender twigs, followed by seeds, fruits and flowers. The hypogean organs, either roots or bulbs are less represented. On a

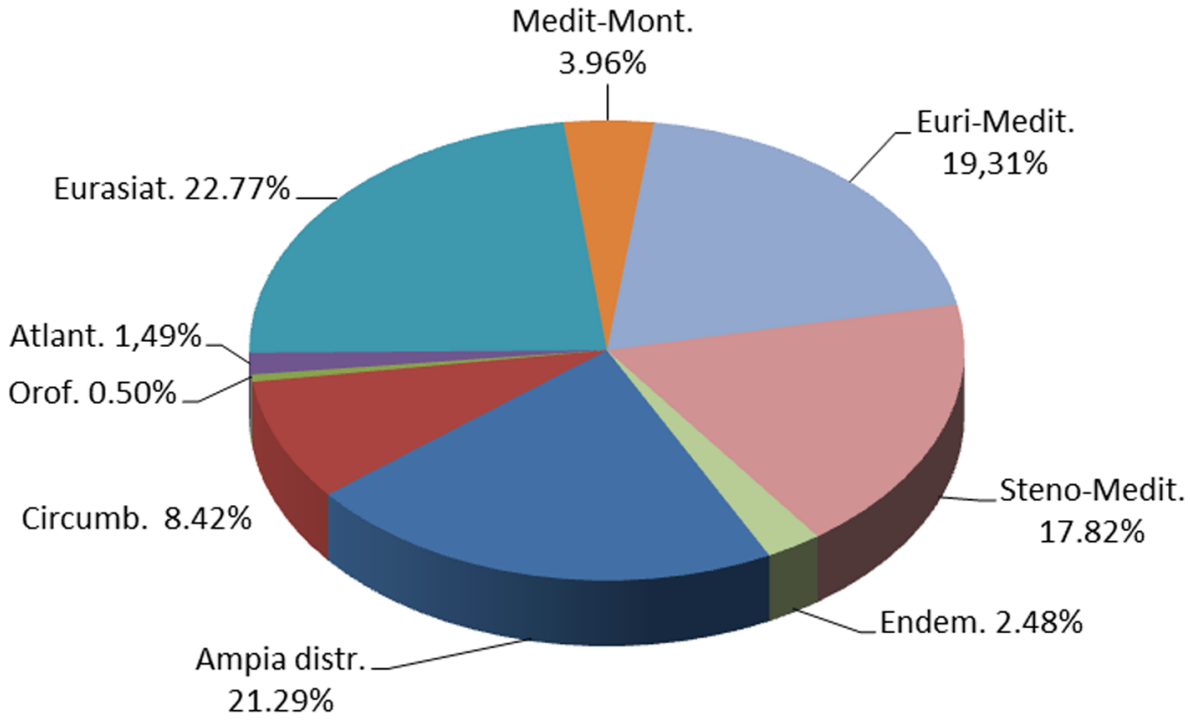

Figure 3: Chorological distribution of food plants in Campania.

gastronomic level, plants are mainly consumed in salads or soups, frequently mixing more species (as in the case of the very frequently cited "minestra maritata", or "minestra terrana"). Plants and gastronomic uses common to different territory of the region account for more than 50% of the total, but for 26 plants (28%) an alimentary use was reported only for small territories (Table 1).

Table 1: Edible wild plants whose use was reported only for small territories.

Species / Family	Locality
Anthemis arvensis L. s.l.	Montecorvino Rovella
Asphodeline liburnica (Scop.) Rchb.	Montecorvino Rovella
Bituminaria bituminosa (L.) Stirt.	Ischia
Cardamine hirsuta L.	Montecorvino Rovella
Carlina acanthifolia All. subsp. acanthifolia All.	Sanza
Centaurea calcitrapa L.	Baselice, S. Giorgio la Molara Roccabascerana
Colchicum autumnale L.	Montecorvino Rovella
Cytisus scoparius (L.) Link subsp. scoparius	Montecorvino Rovella
Equisetum telmateia Ehrh.	Castel San Lorenzo
Ficaria verna Huds.	Montecorvino Rovella
Fraxinus ornus L.	Cava de' Tirreni
Fumaria officinalis L. s.l.	Montecorvino Rovella
Lamium purpureum L.	Cirignano
Limbarda crithmoides (L.) Dumort. s.l.	Ascea
Mentha aquatica L. s.l.	Montecorvino Rovella
Pteridium aquilinum (L.) Kuhn s.l.	Monti Picentini Regional Park
Quercus ilex L.	Acerra, Aversa
Rumex acetosa All.	San Mauro Cilento
Sanguisorba officinalis L.	Cava de' Tirreni
Senecio vulgaris L. s.l.	Ischia
Silene vulgaris (Moench) Garcke s.l.	Montecorvino Rovella
Sisymbrium officinale (L.) Scop.	Acerra
Sixalix atropurpurea (L.) Greuter et Burdet	Montecorvino Rovella
Taxus baccata L.	Monti Picentini Regional Park

Tussilago farfara L.	Montecorvino Rovella
Ulmus minor Miller s.l.	Monti Picentini Regional Park

Discussion and Conclusion

The data collected in this survey show a non-homogeneous distribution of knowledge on wild edible plants in Campania. The information is mainly concentrated over Naples and Salerno provinces, whereas it is still scanty in the remaining parts of the region (Fig. 4). It is noteworthy the occurrence of food taxa belonging to Lamiaceae and Rosaceae that ranks second and third, after Asteraceae. The prevalence of species belonging to the latter is common to the rest of Italian regions, whereas Rosaceae are more frequently used in Northern Italy (Biscotti et al. 2018). The high frequency of Lamiaceae is due to their large use as flavoring spices.

The frequency of biological forms shows a prevalence of Hemicryptophytes and Terophytes, together with a relevant occurrence of Phanerophytes, that could be related to the widespread occurrence in Campania of hillslopes, where woody plants represent a relevant proportion of species spectrum.

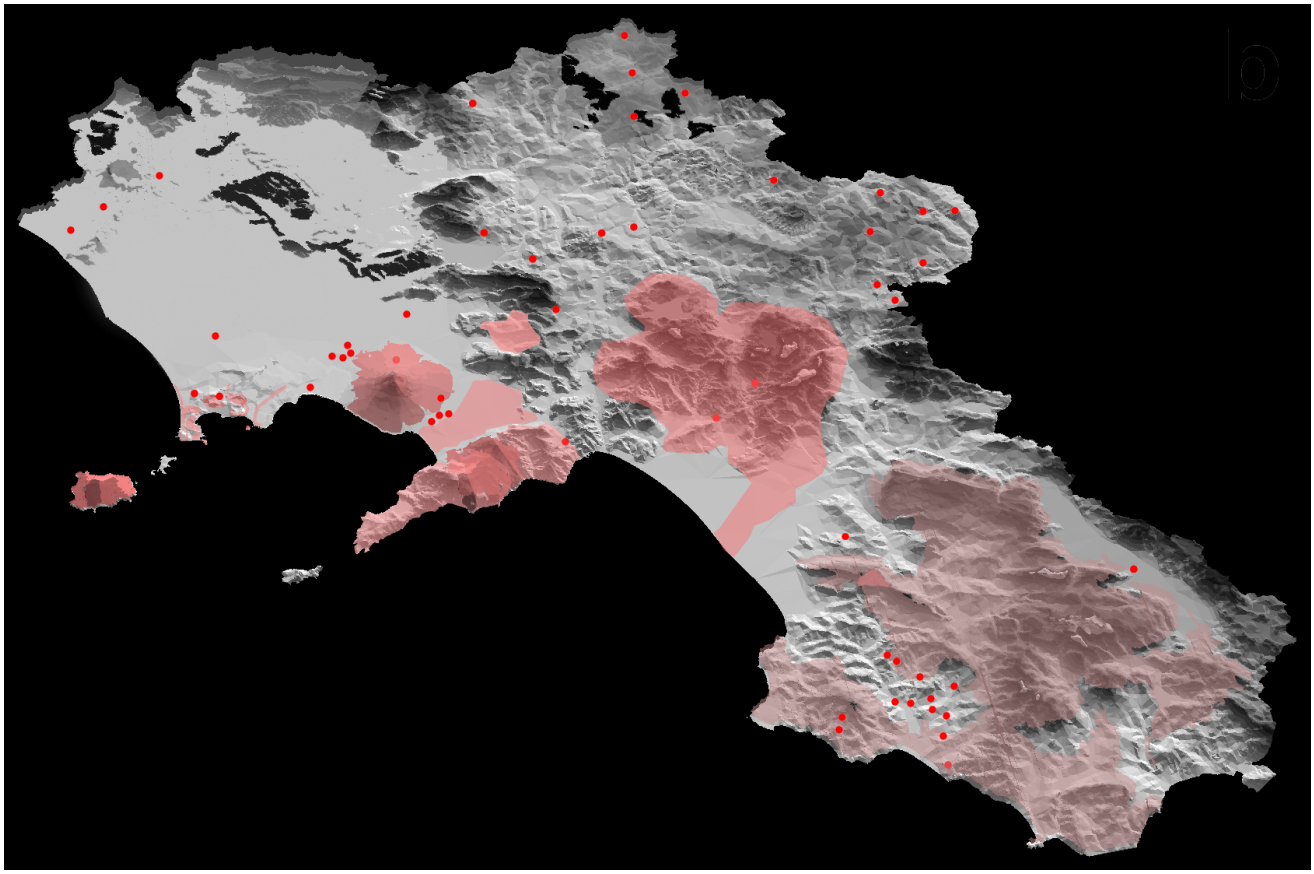

Figure 4: Distribution of ethno-alimentary information in Campania region during the XX and XXI Century. Points (red circle) designate local information (territories up to 10 km). Colored areas are related to data generically attributed to large territories.

The predominance of food plants belonging to Cosmopolitan and Eurasiatic chorological groups over the Mediterranean ones is another remarkable trait of alimurgic flora of Campania that could be explained under an ecological perspective.

Among the species whose edible utilization is restricted to a single or few locality, *Centaurea calcitrapa* is worthy of mention. The aerial parts of the plant are boiled and consumed in Sicily (Lentini and Venza 2007), and in Cyprus (Della et al. 2006), and a similar use in Campania is reported only for three municipalities of the Benevento Province.

An interesting trait showed by the Picentini edible flora (Savo et al. 2019) is the use of some potentially toxic plant species (i.e., *Pteridium aquilinum* and *Taxus baccata*). The presence of these species in the list of edible plants could represent a trace of a "famine diet" exploited by local people in times of food shortage.

Author contributions

Conceptualization: Antonino De Natale and Antonino Pollio; Data curation and Formal analysis: Serena Di Lecce, Bruno Menale, Antonino De Natale, Antonino Pollio. Investigation: Bruno Menale, Antonino De Natale. Project Administration: Antonino Pollio and Antonino De Natale; Writing – original draft: Antonino De Natale and Antonino Pollio; Writing – final draft preparation: Serena Di Lecce, Bruno Menale, Antonino De Natale, Antonino Pollio.

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Table S1. Check-list of wild edible plants of Campania (u.d.: unpublished data)

Botanical name	Local name	Province	Locality / toponimo	Part(s) used	Food uses	References
Achillea millefolium L. s.l. ASTERACEAE	Stagnasango	Salerno	National Park of Cilento and Vallo di Diano	Flowers, leaves	Leaves finely chopped to flavor salads, omelettes and fresh cheeses. Flowering tops used to make pancakes.	La Palometa and Grieco 2003
	Troneto	Salerno	Cava de' Tirreni	Flowering tops	For the preparation of spirits.	Mautone et al. 2019
Alliaria petiolata (M. Bieb.) Cavara et Grande BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Leaves, bulbs	Spice or salads and dishes.	De Rosa et al. 2008
Allium sp. pl. AMARYLLIDACEAE	Agliardièddu	Salerno	Castel San Lorenzo	Bulbs	Usually fried, for human consumption.	Salerno and Guarrera 2008
Allium ampeloprasum L. AMARYLLIDACEAE	Porro selvatico	Salerno	Monti Picentini Regional Park	Bulbs, stems	Spice or salads and dishes.	Savo et al. 2019
Allium ursinum L. AMARYLLIDACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or boiled.	De Rosa et al. 2008
	Agliustro, Aglio selvatico	Salerno	Monti Picentini Regional Park	Bulbs, stems	Spice.	Savo et al. 2019
Allium vineale L. AMARYLLIDACEAE	Agliardieddo	Salerno	Sanza	Bulbs	In omelette with potatoes and *Ornithogalum* sp.	u.d.
		Salerno	National Park of Cilento and Vallo di Diano			Di Novella et al. 2013
Amaranthus sp. AMARANTHACEAE	Jetìddu	Salerno	Castel San Lorenzo	Leaves	For human nutrition.	Salerno and Guarrera 2008

Amaranthus retroflexus L. AMARANTHACEAE	-	Avellino	Baianese and Lauretana areas	Leaves, young shoots	In salads, soups or boiled.	De Rosa et al. 2008
	Amaranto	Salerno	Monti Picentini Regional Park	Young shoots, young leaves	In soups.	Savo et al. 2019
		Napoli	Aversa	Leaves	In salads or boiled.	u.d.
Angelica sylvestris L. s.l. APIACEAE	-	Avellino	Baianese and Lauretana areas	Young shoots, young leaves	In salads. Used during Pasqua holidays to prepare the "*pizza d'erbe*".	De Rosa et al. 2008
	Rarrica addirosa	Salerno	National Park of Cilento and Vallo di Diano	Fresh roots	To flavor chicken and pork broth.	Di Novella et al. 2013
Anthemis arvensis L. s.l. ASTERACEAE	Campumilla salvatica	Salerno	Montecorvino Rovella	Leaves	As ingredient for soup preparation.	u.d.
Anthriscus cerefolium (L.) Hoffm.	-	Avellino	Baianese and Lauretana areas	Leaves	As a component of the "*minestra cotta*" with: *Borago officinalis, Plantago* sp. pl., *Taraxacum officinale*, *Urtica dioica.* In salads, as ingredients for pizzas ("*pizza irpina*"), as a cooked vegetable.	De Rosa et al. 2008
Apium graveolens L. APIACEAE	Accio	Salerno	Monte Vesole e Ascea	Aerial part	As aromatic herb.	Scherrer et al. 2005
		Salerno	Sanza	Whole plant	In salads, also mixed with other herbs.	u.d.
		Napoli	Phlegrean Fields Regional Park	Leaves	As aromatic herb.	Motti et al. 2009
		Salerno	Monti Picentini Regional Park	Roots, stems	Raw, as component of salads.	Savo et al. 2019
	Sedano	Salerno	Amalfi Coast	Aerial part	As a component of the "*minestra maritata*".	Savo 2010
Apium nodiflorum (L.) Lag. APIACEAE	Accio selvatico	Benevento	Foiano Valfortore	Leaves, shoots	In soups and salads.	u.d.
	Scavoune, Crescione, Scavouni, Scaioni, Ascaiuoli	Salerno	Monti Picentini Regional Park	Leaves, shoots	In soups and salads.	Savo et al. 2019

Arbutus unedo L. ERICACEAE	Sorbe, Sorba pelosa	Salerno	Monte Vesole e Ascea	Fruits	Eaten fresh or used to make an alcoholic beverage "*vino di sorba*".	Scherrer et al. 2005
	Sovr' pelose	Avellino	Roccabascerana			u.d.
	Sòrva, Sòrva pelosa	Salerno	Castel San Lorenzo		Eaten fresh	Salerno and Guarrera 2008
	Suorvo piluso	Salerno	National Park of Cilento and Vallo di Diano			Di Novella et al. 2013
	Sovera pelosa	Salerno	Cava de' Tirreni			Mautone et al. 2019
	Fraolaro, Fragola d'albero, Corbezzolo, Musina di montagna, Fragola d'inverno, Sorbo peloso, Fragola pelosa, Sorola pelosella, Sorole peloso, Sorolo peloso	Salerno	Monti Picentini Regional Park		Eaten fresh, alcoholic beverages, jams.	Savo et al. 2019
	Sovera pelosa	Napoli	Vesuvio National Park		Eaten fresh	Menale et al. 2016
	Sovera pelosa	Salerno	San Mauro Cilento		Eaten raw; mashed and put in hot water for few days to make a beverage that was preserved in fridge; as fodder for goats.	u.d.
Arctium minus (Hill) Bernh. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Roots, stalks	In salads, fried.	De Rosa et al. 2008
Artemisia absinthium L. ASTERACEAE	Nascienzo	Napoli	Peninsula Sorrentina	Aerial part	For the preparation of digestive liqueurs.	De Feo et al. 1992
		Salerno	Cava de' Tirreni	Fresh leaves		Mautone et al. 2019
Asparagus acutifolius L. ASPARAGACEAE	-	Avellino	Baianese and Lauretana areas	Roots, stalks	Turions in salads or cooked to make omelettes, souces, salads, pasta, etc.	De Rosa et al. 2008

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	Asparago selvatico	Salerno	Monte Vesole e Ascea	Shoots	Eaten with eggs or rice.	Scherrer et al. 2005
	Apannaro, Sparaci	Salerno	Sanza	Shoots	Turions in salads or cooked to make omelettes, souces, etc.	u.d.
	Spagaròngna	Salerno	Castel San Lorenzo		Turions, called spagàri, in omelettes.	Salerno and Guarrera 2008
	Spalice	Salerno	Cava de' Tirreni	Aerial part	Cooked with pasta or eggs.	Mautone et al. 2019
Asparagus acutifolius L. ASPARAGACEAE	Sparaci selvatici, Spalici selvatici, Sparici selvatici, Asparago di montagna, Spairi, Spauri, Spalaci selvatici, Asparago selvatico	Salerno	Monti Picentini Regional Park	Shoots	Added to omelettes, salads, marinated or pickled vegetables, pasta, soups.	Savo et al. 2019
	Aspaligi	Salerno	Montecorvino Rovella		Turions used in the preparations of many dishes.	u.d.
	Spalice	Taburno	Cirignano		Boiled turions or in omelettes.	u.d.
		Napoli	Acerra, Casoria	Shoots	In omelettes, risotto or eaten raw with vinegar.	u.d.
		Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania		With pasta and especially in omelettes.	u.d.
Asphodeline liburnica (Scop.) Rchb. ASPHODELACEAE	Liembr'	Salerno	Montecorvino Rovella	Whole plant	Used before blooming to prepare omelettes.	u.d.
Asphodeline lutea (L.) Rchb. ASPHODELACEAE	-	Avellino	Baianese and Lauretana areas	Stems before flowering	Roasted, in omelettes or soups.	De Rosa et al. 2008
	Lembari	Salerno	Sanza	Aerial part	Used before blooming to prepare omelettes.	u.d.

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Asphodeline lutea (L.) Rchb. ASPHODELACEAE	Liémbari	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	Before blooming eaten in soups.	Di Novella et al. 2013
Asphodelus macrocarpus Parl. s.l. ASPHODELACEAE	Cipolla selvatica	Salerno	Monti Picentini Regional Park	Bulbs	As cooked vegetables.	Savo et al. 2019
Avena sativa L. s.l. POACEAE	Viena	Benevento	Castelvetere in Val Fortore	Seeds collected in June - August	Used for both nutritional and medicinal properties.	u.d.
Bellevalia romana (L.) Sweet ASPARAGACEAE	Aliuolo bianco	Salerno	Monti Picentini Regional Park	Bulbs	In omelettes.	Savo et al. 2019
Bellis perennis L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	As cooked vegetables.	De Rosa et al. 2008
	Margaritella	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	As a component of the "*minestra terrana*".	Di Novella et al. 2013
Bituminaria bituminosa (L.) Stirt. FABACEAE	Fasolara	Napoli	Ischia	Leaves	As a component of the soup called "*mnesta salvagioia*". For the preparation of the soup were used: *Beta vulgaris*, *Borago officinalis*, *Centranthus ruber*, *Cichorium intybus*, *Eruca vesicaria*, *Papaver rhoeas*, *Bituminaria bituminosa*, *Rapistrum rugosum*, *Reichardia picroides*, *Senecio vulgaris*, *Sonchus oleraceus*.	Vallariello 2003
Blitum bonus-henricus (L.) Rchb. CHENOPODIACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	Cooked, preferibly in soups.	De Rosa et al. 2008
	Spinacio selvatico	Salerno	Monti Picentini Regional Park	Shoots, young leaves	Cooked, preferibly in soups.	Savo et al. 2019

	-	Avellino	Baianese and Lauretana areas	Leaves	Cooked, preferibly in soups. As a component of the "*minestra cotta*" with: *Anthriscus cerefolium, Plantago* sp. pl., *Taraxacum officinale*, *Urtica dioica.*	De Rosa et al. 2008
	Vorraina, Vurraina	Salerno	Monte Vesole e Ascea	Flowers, shoots, young leaves	Shoots and young leaves boiled and fried, occasionally used as stuffing in bread pizza, with ricotta. Flowers sucked or eaten for their sweetness; also added to sweet omelettes.	Scherrer et al. 2005
	Vurraina, Lengua re voie	Salerno	National Park of Cilento and Vallo di Diano	Leaves	The most tender leaves used to prepare soups. Leaves used raw in salads, omelettes, for filling of rustic pizzas and ravioli. Large leaves stuffed with eggs, flour, grated cheese.	La Palometa and Grieco 2003
Borago officinalis L. BORAGINACEAE	Vorraccia	Napoli	Ischia		As a component of the soup called "*mnesta salvagioia*".	Vallariello 2003
	Vurraina antica	Salerno	Montecorvino Rovella	Young leaves	Tender leaves used for the preparation of a stuffed pizza cooked in the oven.	u.d.
	Vurraccia	Avellino	Roccabascerana	Young leaves	Used to prepare soups with beans.	u.d.
	Vurraccia	Benevento	Cirignano	young leaves	Leaves used to prepare soups with beans.	u.d.
	Vurròina, vurraggine	Napoli	Agro Nocerino Sarnese	Leaves	One of the seven herbs of "*minestra maritata*", a soup with meat broth traditionally eaten at Easter.	Motti and Motti 2017
	Vurràina	Salerno	Castel San Lorenzo	Leaves	Basal rosette of leaves for human consumption (in mixed soup or fried with batter).	Salerno and Guarrera 2008

	Vurraina	Salerno	National Park of Cilento and Vallo di Diano	Aerial part, leaves	Used for the preparation of "*minestra terrana*".	Di Novella et al. 2013
	Verracine, Vurraina	Salerno	Cava de' Tirreni	Aerial part	In salads or cooked with eggs.	Mautone et al. 2019
	Borraggine	Napoli	Phlegrean Fields Regional Park	Leaves	Young leaves for soups and omelettes.	Motti et al. 2009
	Borragine, Burraina, Buraine, Borraine, Boragine, Borracina, Burragine, Vurraina, Burraine, Borraina, Vorraina, Burrasca, Borracine	Salerno	Monti Picentini Regional Park	Basal leaves, flowers	In salads, vegetable pies, snack, pasta, soups and as cooked vegetables.	Savo et al. 2019
Borago officinalis L. BORAGINACEAE	Verraina	Salerno	San Mauro Cilento	Leaves	Eaten raw in salads or cooked in soups or omelettes; boiled leaves used for fillings or pies with vegetables.	u.d.
	Burraina	Avellino	Pietrastornina		Young leaves in pancakes, salads, vegetable minestrone, boiled with oil and lemon and as ravioli filling.	u.d.
	Vorraccia	Napoli	Acerra, Casalnuovo, Pomigliano, Aversa	Young stems/leaves/flowers	Young stems, leaves and flowers in salads; leaves in soups.	u.d.
	Vorraccia	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Leaves	In salads.	u.d.
		Napoli	Boscoreale, Boscotrecase, Trecase, Terzigno	Aerial part	As ingredient of the "*minestra maritata*".	u.d.
Brassica fruticulosa Cyr. s.l. BRASSICACEAE	Cavulicieddo	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013
Brassica incana Ten. BRASSICACEAE	Cavulicieddo	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013

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Brassica rapa L. subsp. *campestris* (L.) Clapham BRASSICACEAE	Broccoli di rapa	Salerno	Monte Vesole e Ascea	Leaves	Eaten boiled and fried. Ingredient of "*minestra*".	Scherrer et al. 2005
Bryonia dioica Jacq. CUCURBITACEAE	Taggicieddo, Puntirole	Salerno	Monti Picentini Regional Park	Shoots	In omelettes or soups.	Savo et al. 2019
Bunias erucago L. BRASSICACEAE	Aruchèdda	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In salads.	Di Novella et al. 2013.
	Foglia di Laceno	Salerno	Monti Picentini Regional Park	Basal leaves	In soups.	Savo et al. 2019
Campanula rapunculus L. CAMPANULACEAE	-	Avellino	Baianese and Lauretana areas	Leaves, roots	As a component of "minestra di campagna'". Leaves with roots thin cut as a seasoning for pizzas.	De Rosa et al. 2008
Capsella bursa-pastoris (L.) Medik. s.l. BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Basal leaves	Boiled with other herbs.	De Rosa et al. 2009
	Zeppolelle sarvatiche	Salerno	Cava de' Tirreni	Leaves	As a component of "*minestra maritata*".	Mautone et al. 2019
Cardamine bulbifera (L.) Crantz BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs. Cooked vegetables.	De Rosa et al. 2008
Cardamine hirsuta L. BRASSICACEAE	Cardilli santi	Salerno	Montecorvino Rovella	Young plants	In salads.	u.d.
Carduus pycnocephalus L. s.l. ASTERACEAE	Carduni, Cardone	Salerno	Monti Picentini Regional Park	Young leaves	In soups, salads, or eaten alone after cooking.	Savo et al. 2019
Carlina acanthifolia All. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Inflorescences, roots	The unripe inflorescences eaten like artichokes. A sauce like that of mustard is obtained. The roots used to make candied.	De Rosa et al. 2008
	Cardo selvaggio, Scopetta	Salerno	Monti Picentini Regional Park	Flowers, roots	As snack.	Savo et al. 2019

Carlina acanthifolia All. subsp. *acanthifolia* ASTERACEAE	Carcioffola servaggia	Salerno	Sanza	Unripe inflorescences	After being roasted, preserved in olive oil to be consumed during the year.	u.d.
Carlina corymbosa L. ASTERACEAE	Cardo, Savone (M. Vesole)	Salerno	Monte Vesole e Ascea	Stems, young leaves	Inner part of the tender stem eaten row. Young leaves and shoots as ingredient of "*minestra*".	Scherrer et al. 2005
	Scardesse, Evra e' muntagna	Benevento	Cirignano	Leaves before blooming	Cooked in the stew, heated with the "*pan cotto*".	u.d.
Carlina vulgaris L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young stems collected in spring	Peeled stems cut for a length of 6-7 cm and then eaten boiled.	De Rosa et al. 2008
Castanea sativa Mill. FAGACEAE	Castagno	Salerno	Monte Vesole e Ascea	Fruits	Fruits dried for conservation, used as flour for bread or cooked in soups with laurel and beans.	Scherrer et al. 2005
		Caserta	Roccamonfina	Fruits	Used in soups with beans.	u.d.
		Avellino	Bisaccia, Sant'Andrea di Conza	Fruits	Used to prepare traditional desserts ("panzerotti"), with chocolate, sugar, honey, cinnamon, and orange peel.	u.d.
		Salerno	San Mauro Cilento	Fruits	Used to prepare the "pasticelle", typical desserts of Cilento.	u.d.
	Castagna	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio della Civitella, Perito, Orria), Castelnuovo Cilento	Fruits	Flour used with chocolate and vermouth to prepare the dough of "pastorella", a Christmas cake.	u.d.
		Salerno	Montecorvino Rovella	Fruits	Fruits roasted or boiled and used during Christmas holidays to prepare small cakes, called "*pasticelle*".	u.d.
		Salerno	Sanza	Fruits (chestnuts)	The fruits cooked differently; to make a kind of flour	u.d.

	Castagna	Salerno	Castel San Lorenzo	Fruits	Dried fruits consumed with beans, or mixed with fruits to prepare cakes.	Salerno and Guarrera 2008
Castanea sativa Mill. FAGACEAE	Castagno	Salerno	Cava de' Tirreni	Seeds	For the preparation of pasta and cakes.	Mautone et al. 2019
		Napoli	Phlegrean Fields Regional Park	Fruits	Boiled with *Laurus nobilis* leaves or roasted.	Motti et al. 2009
	Castagna	Salerno	Amalfi Coast	Fruits	Dried fruits.	Savo 2010
Celtis australis L. s.l. CANNABACEAE	Cirasiello	Benevento	Foiano Valfortore	Fruits	Fruits.	u.d.
	Pipilipì	Salerno	Monti Picentini Regional Park	Fruits	Fresh fruit..	Savo et al. 2019
Centaurea calcitrapa L. ASTERACEAE	Occhi lucenti	Benevento	Baselice, S. Giorgio la Molara	Leaves collected in August - September	The leaves eaten before blooming.	u.d.
	Cardogni	Avelino	Roccabascerana	Leaves, aerial parts	In soups.	u.d.
Centranthus ruber (L.) DC. s.l. VALERIANACEAE	Cannocchiara	Napoli	Ischia	Leaves	Eaten as a component of the soup called "*mnesta salvagioia*".	Vallariello 2003
	Cannaviello	Salerno	Amalfi Coast	Leaves	In salads eaten raw or boiled.	Savo 2010
	Valeriana	Napoli	Aversa	Young shoots	Boiled in salads.	u.d.
Ceratonia siliqua L. FABACEAE	Sciuscella	Salerno	National Park of Cilento and Vallo di Diano	Fruits	Eaten raw or cooked.	La Palometa and Grieco 2003
	Sciuscella, Erbacavalli	Salerno	Castel San Lorenzo	Pods	Dry pods for human consumption.	Salerno and Guarrera 2008
	Sciuscella	Salerno	National Park of Cilento and Vallo di Diano	Fruits	Used as food; used as food for horses.	Di Novella R. et al.

Ceratonia siliqua L. FABACEAE	Sciuscella	Salerno	Cava de' Tirreni	Fruits	Food for children.	Mautone et al. 2019
		Napoli	Vesuvio National Park		Eaten raw.	Menale et al. 2016
	Sciuscella	Salerno	Amalfi Coast		Eaten dried.	Savo 2010
	Sciuscella	Salerno	Serramezzana, San Mauro Cilento		Eaten raw	u.d.
	Suscella	Napoli	Acerra	Fruits and seeds	As coffee substitute.	u.d.
Cerinthe major L. s.l. BORAGINACEAE	Campanelle	Salerno	Castel San Lorenzo	Flower base	Flower base sucked (especially by children) for the sweet juice.	Salerno and Guarrera 2008
	-	Salerno	Monti Picentini Regional Park	Flowers		Savo et al. 2019
Chenopodium album L. s.l. CHENOPODIACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	Cooked, preferibly in soups.	De Rosa et al. 2008
	Jetìddu	Salerno	Castel San Lorenzo	Leaves	For human consumption (tender shoots).	Salerno and Guarrera 2008
	Lattarulo	Napoli	Pomigliano, Acerra		Cooked in salads or in consommé.	u.d.
		Napoli	Aversa	Seeds	In soups.	u.d.
Chondrilla juncea L. ASTERACEAE	Lattarole	Salerno	Cava de' Tirreni	Aerial part	Used in the preparation of "*minestra maritata*".	Mautone et al. 2019
	Corla, Lattaruli, Lattarulo	Salerno	Monti Picentini Regional Park	Basal leaves, stems	In salads, soups, pasta, as a cooked vegetable.	Savo et al. 2019
Cichorium intybus L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves and shoots	In salads or boiled.	De Rosa et al. 2008
	Cicoria	Salerno	Monte Vesole e Ascea	Young leaves and shoots	Inner part of the tender stem eaten raw. Young leaves and shoots as ingredient of "*minestra*".	Scherrer et al. 2005

	Cecoria	Salerno	National Park of Cilento and Vallo di Diano	Leaves, roots	Eaten cooked in soups, boiled, fried. As a component of the "*pizza cù l'erba*".	La Palometa and Grieco 2003
		Salerno	National Park of Cilento and Vallo di Diano	Roots	In the early 1900s, root usually used as a coffee substitute.	La Palometa and Grieco 2003
	Cicoria	Napoli	Ischia	Leaves	As a component of "*mnesta salvagioia*".	Vallariello 2003
	Cecoria	Salerno	Sanza	Leaves	Cooked, stuffed or fried.	u.d.
	Cicorie	Taburno	Cirignano	Leaves	In soups.	u.d.
	Cicorie é bosco	Avellino	Roccabascerana	Leaves	In salads.	u.d.
Cichorium intybus L. ASTERACEAE	Cicoria	Napoli	Agro Nocerino Sarnese	Leaves	In soups.	Motti and Motti 2017
		Salerno	National Park of Cilento and Vallo di Diano	Aerial part	As a component of "*minestra terrana*".	Di Novella et al. 2013
		Salerno	Cava de' Tirreni	Aerial part	As a component of "*minestra maritata*".	Mautone et al. 2019
		Napoli	Phlegrean Fields Regional Park	Leaves	Used in the preparation of soups	Motti et al. 2009
	Cicoria selvatica, Cicoria pazza	Salerno	Monti Picentini Regional Park	Leaves	In soups, salads or as a cooked vegetable.	Savo et al. 2019
	Cicoria	Salerno	Amalfi Coast	Leaves	As a component in the "*minestra maritata*".	Savo 2010
	Cicoria	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio, Perito, Orria), Castelnuovo Cilento	Roots	As coffee substitute.	u.d.
	Cecoria	Napoli	Roccarainola, Cicciano	Leaves	In soups.	u.d.

Cichorium intybus L. ASTERACEAE	Cecoria	Napoli	Casalnuovo, Acerra, Pomigliano	Leaves	As coffee substitute or in soups.	u.d.
	Cicoria	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania		In salads.	u.d.
	Cecoria	Napoli	S. Giovanni a Teduccio			u.d.
	Cicoria	Avellino	Bisaccia, Aquilonia, Calitri, Andretta, Lacedonia, Monteverde, Sant'Andrea di Conza, Conza della Campania		In soups and salads.	u.d.
Cirsium arvense (L.) Scop. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves and shoots	In salads or boiled.	De Rosa et al. 2008
	Matronnola, Cardogne	Salerno	Monti Picentini Regional Park	Basal leaves, shoots	As soup ingredient, or as a cooked vegetable.	Savo et al. 2019
Cirsium vulgare (Savi) Ten. s.l. ASTERACEAE	Cardone	Salerno	Monti Picentini Regional Park	Basal leaves, shoots	As soup ingredient, or as a cooked vegetable.	Savo et al. 2019
		Salerno	San Mauro Cilento	Leaves	Raw in salads or boiled.	u.d.
	Cardoncello	Napoli	Acerra		Leaves without thorns eaten raw in salads or boiled.	u.d.
Clematis vitalba L. RANUNCULACEAE	-	Avellino	Baianese and Lauretana areas	Young shoots	Eaten like asparagus.	De Rosa et al. 2008
	Vitosa	Salerno	Monte Vesole e Ascea	Shoots	Young shoots eaten like asparagus.	Scherrer et al. 2005
	Vitaglia	Salerno	Montecorvino Rovella	Shoots	Sprouts appreciated for their asparagus-like taste, and generally eaten in salads or in omelettes.	u.d.
	Vitosa	Salerno	Sanza		The tender shoots as ingredients for omelettes.	u.d.

	Vitacchie, Viticelle	Avellino	Roccabascerana		The tender shoots as ingredients for omelettes and pancakes.	u.d.
	Vtaulo, Vetusa	Napoli	Agro Nocerino Sarnese		Boiled sprouts eaten in salads or fried.	Motti and Motti 2017
	Vetaglia	Salerno	Castel San Lorenzo		Young sprouts for human consumption.	Salerno and Guarrera 2008
	Vitosa	Salerno	National Park of Cilento and Vallo di Diano		Young twigs in omelettes.	Di Novella et al. 2013
Clematis vitalba L. RANUNCULACEAE	Vitaglia	Salerno	Cava de' Tirreni	Shoots	In salads or omelettes.	Mautone et al. 2019
	Butalva, Vetalva, Vutaleva, Butaleve, Vtosa, Vtose, Vtalve, Vitaje, Vitaleve, Vetaleva, Vitaleva, Vetaleve, Vitajo, Vetaje, Vtaje, Vitaja, Vetalica	Salerno	Monti Picentini Regional Park		In omelettes, pickled in vinegar, in oil, soups or cooked vegetables.	Savo et al. 2019
	Vetaglia	Salerno	San Mauro Cilento		In omelettes.	u.d.
	Vetaglia	Napoli	Aversa		Eaten roasted.	u.d.
Clinopodium nepeta (L.) Kuntze s.l. LAMIACEAE	Mentuccia, Nèpeta	Napoli	Phlegrean Fields Regional Park	Leaves	To flavour fish dishes.	Motti et al. 2009
Clinopodium nepeta (L.) Kuntze subsp. *nepeta* LAMIACEAE	Mentuccia	Napoli	Agro Nocerino Sarnese	Leaves	In salads.	Motti and Motti 2017
	Mentastra	Salerno	Monti Picentini Regional Park	Leaves	Used to flavour dishes.	Savo et al. 2019
Colchicum autumnale L. COLCHICACEAE	Zafferanone	Salerno	Montecorvino Rovella	Flowers (stamina)	Used to replace saffron.	u.d.
Cornus mas L. CORNACEAE	Curnàlo	Salerno	National Park of Cilento and Vallo di Diano	Fruits	Preserved in vinegar and eaten in winter salads.	Di Novella et al. 2013

Cornus mas L. CORNACEAE	Cornale, Crugnale, Crugnali	Salerno	Monti Picentini Regional Park	Fruits	As a liqueur or as fresh fruit.	Savo et al. 2019
Crataegus monogyna Jacq. ROSACEAE	Spina servateca	Salerno	National Park of Cilento and Vallo di Diano	Buds	In some countries of Cilento, preserved in vinegar and then used as a condiment, in place of capers.	La Palometa and Grieco 2003
	Biancospino	Salerno	Montecorvino Rovella	Branches, flowers, fruits	Fruits eaten raw or used to prepare marmalades. Branches and flowers to flavour soups.	u.d.
	Biancospino, Spina calaurice, Cerasieddi, Biancospino, Cerasieddi, Ciccispini, Spinaianca, Ceraselle, Spinulella, Spinulelle, Spinaporci, Uva spinunella	Salerno	Monti Picentini Regional Park	Fresh fruit	Used as a spice or eaten as a fresh fruit.	Savo et al. 2019
	Peraino	Salerno	San Mauro Cilento		Used to prepare a wine. 1 l of red wine, sugar, lemon peel, cloves and a handful of hawthorn fruits are boiled. Then, the wine has cooled, filtered and preserved in fridge.	u.d.
Crepis bursifolia L. ASTERACEAE	Margarita	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	Used in the preparation of "*minestra terrana*".	Di Novella et al. 2013
	-	Salerno	Monti Picentini Regional Park	Basal leaves	In salads and soups.	Savo et al. 2019
Crepis lacera Ten. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetables.	De Rosa et al. 2007
Crepis leontodontoides All. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetables.	De Rosa et al. 2008
	Margarita	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	As ingredient of "*minestra terrana*".	Di Novella et al. 2013
Crepis neglecta L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetables.	De Rosa et al. 2009

Crepis neglecta L. s.l. ASTERACEAE	Spaccapreti	Salerno	Monti Picentini Regional Park	Basal leaves	Eaten in soups or as a cooked vegetable.	Savo et al. 2019
Crepis neglecta L. subsp. *corymbosa* (Ten.) Nyman ASTERACEAE	Lattarulo	Benevento	Foiano Valfortore	Basal leaves	In soups.	u.d.
Crepis pulchra L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetable.	De Rosa et al. 2007
Crepis setosa Haller f. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetable.	De Rosa et al. 2008
	Occhi neureddi, Occhineurelli, Occhi neurelli, Occhineurella, Occhineurello, Occhi rossi, Ragno purcello	Salerno	Monti Picentini Regional Park	Basal leaves	Eaten in soups or as a cooked vegetable.	Savo et al. 2019
Crepis vesicaria L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves, flower buds	In salads or cooked vegetables.	De Rosa et al. 2008
	Lattarole	Salerno	Cava de' Tirreni	Aerial part	As ingredient of "*minestra maritata*".	Mautone et al. 2019
	Cicurioni, Scazzuoppoli, Occhi rossi	Salerno	Monti Picentini Regional Park	Basal leaves	Eaten in soups or as a cooked vegetable.	Savo et al. 2019
Crocus vernus (L.) Hill s.l. IRIDACEAE	-	Avellino	Baianese and Lauretana areas	Flowers (stamina)	Used to replace saffron.	De Rosa et al. 2008
Cynara cardunculus L. s.l. ASTERACEAE	Carcioffola servaggia	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Inflorescences, stems	Inflorescences and stems without outer parts eaten raw or cooked.	u.d.
Cynodon dactylon (L.) Pers. POACEAE	-	Avellino	Baianese and Lauretana areas	Young rhizomes	In times of famine the rhizomes were dried, ground and mixed with other flours to make bread. In the past, the roasted rhizomes were used as a coffee substitute.	De Rosa et al. 2008

Cytisus scoparius (L.) Link subsp. *scoparius* FABACEAE	Ginestra	Salerno	Montecorvino Rovella	Flowers	Eaten in salads.	u.d.
Daucus carota L. s.l. APIACEAE	Pastenaca salvatica	Salerno	Montecorvino Rovella	Roots	Eaten raw, boiled or fried.	u.d.
	Pastenaca selvàteca	Salerno	Castel San Lorenzo	Roots	Fried in batter.	Salerno and Guarrera 2008
	Pastinaca	Salerno	National Park of Cilento and Vallo di Diano	Roots	Used as food.	Di Novella et al. 2013
	Pastinaca, Pastinaca selvatica, Carota selvatica, Pastenaca	Salerno	Monti Picentini Regional Park	Roots, young leaves	Eaten in soups, salads or as a cooked vegetable.	Savo et al. 2019
Dioscorea communis (L.) Caddick et Wilkin DIOSCOREACEAE	Spalaci selvatici, Spalici selvatici, Vitarelle, Asparagi di serpe, Spairi di serpa, Spairi di serve, Sparaci selvatici, Puntirole, Viticelle, Viticielli, Verdicelle, Virdicelli, Sparici selvatici, Vituzzelle	Salerno	Monti Picentini Regional Park	Shoots	Eaten in soups, with pasta or as a cooked vegetable.	Savo et al. 2019
	Vitucella	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Shoots	Tender shoots eaten like asparagus.	u.d.
	Spannaro fauzo, Vitacchi	Salerno	Sanza	Young shoots	First boiled and then used to make omelettes.	u.d.
		Salerno	National Park of Cilento and Vallo di Diano		First boiled and then used to make omelettes.	Di Novella et al. 2013
Diplotaxis erucoides (L.) DC. BRASSICACEAE	Rapesta	Benevento	Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Leaves	In salads.	u.d.

Diplotaxis erucoides (L.) DC. BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or cooked vegetables.	De Rosa et al. 2008
Diplotaxis tenuifolia (L.) DC. BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or cooked vegetables.	De Rosa et al. 2008
	Rucola, Ruchetta	Salerno	Monte Vesole e Ascea		Eaten as salad or with fish.	Scherrer et al. 2005
	Rucola	Benevento	Apollosa, Cautano, Foiano Valfortore		In salads.	u.d.
	Rucola	Benevento	Cirignano		Used, alone or with other species, to prepare salads.	u.d.
	Rucola, rughetta	Napoli	Phlegrean Fields Regional Park		In salads.	Motti et al. 2009
	Rucola selvatica, Rugola selvatica, Rucola, Aruncolo	Salerno	Monti Picentini Regional Park	Leaves	In salads, as ingredients for pizzas, as a cooked vegetable.	Savo et al. 2019
	Arucola	Napoli	Vesuvio National Park		Eaten raw.	Menale et al. 2016
	Rucola	Salerno	Amalfi Coast		In salads.	Savo 2010
	Rucola	Napoli	Pomigliano		In salads or eaten with sheep cheese or with pasta.	u.d.
		Napoli	Pompei, Boscoreale, Trecase		In salads.	u.d.
Echium plantagineum L. BORAGINACEAE	Buglossa	Napoli	Monteruscello	Young leaves, shoots	Commonly used as a substitute for borage. Tender shoots also appreciated raw, seasoned with a few drops of lemon.	u.d.
		Napoli	Phlegrean Fields Regional Park	Young leaves, shoots	Leaves for soups and boiled leaves and sprouts for salads or soups.	Motti et al. 2009
Echium vulgare L. s.l. BORAGINACEAE	Buglossa	Napoli	Phlegrean Fields Regional Park	Leaves, shoots	Leaves for soups and boiled leaves and sprouts for salads or soups.	Motti et al. 2009

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Equisetum arvense Ehrh. EQUISETACEAE	-	Avellino	Baianese and Lauretana areas	Young stems	Eaten like Asparagus.	De Rosa et al. 2008
Equisetum telmateia Ehrh. EQUISETACEAE	Curivulpi, Spezzagghjungi	Salerno	Castel San Lorenzo	Cone	The cones of fertile shoots eaten fried with batter.	Salerno and Guarrera 2008
Eruca vesicaria (L.) Cav. BRASSICACEAE	Rucola	Napoli	Ischia	Leaves	Component of the soup called "*mnesta salvagioia*".	Vallariello 2003
	Rucola	Benevento	Cirignano	Leaves	Eaten alone or with other species, to prepare salads, as it has a taste similar to rocket.	u.d.
Fagus sylvatica L. s.l. FAGACEAE	Fahu	Salerno	Sanza	Fruits (faggiole)	Eaten as peanuts.	u.d.
	Faio	Avellino	Roccabascerana	Fruits (fagiole)	Edible, with an almond-like taste	u.d.
	Fàhu, Fàho, Faùsto	Salerno	National Park of Cilento and Vallo di Diano	Seeds	Edible.	Di Novella et al. 2013
	Faggio, Faustro	Salerno	Monti Picentini Regional Park	Seeds	As snack.	Savo et al. 2019
Ficaria verna Huds. RANUNCULACEAE	Cupputielli	Salerno	Montecorvino Rovella	Leaves (before blooming season)	In salads.	u.d.
Ficus carica L. MORACEAE	Fica	Salerno	Sanza	Fruits	As dessert.	u.d.
	Fica, Ficucèdde	Salerno	National Park of Cilento and Vallo di Diano			Di Novella et al. 2013
	Fico	Salerno	Montecorvino Rovella			u.d.
		Napoli	Piano di Sorrento			u.d.
	Ficozze	Salerno	Amalfi Coast			Savo 2010
	Ficu	Salerno	M. Vesole e Ascea			Scherrer et al. 2005
	Ficu	Salerno	Castel San Lorenzo			Salerno and Guarrera

	Funucchiello	Napoli	Piano di Sorrento	Seeds	Flavouring in bread, dried figs, salami and sausages.	u.d.
	-	Avellino	Baianese and Lauretana areas	Whole plant	As spice or in salads and other dishes.	De Rosa et al. 2008
	Fenucchio, Fenucchio selvatico, Finucchiello	Salerno	Monte Vesole e Ascea	Leaves	As ingredient of "*minestra*".	Scherrer et al. 2005
		Salerno	Monte Vesole e Ascea	Seeds	For the preparation of the liquour called *finocchietto*.	Scherrer et al. 2005
	Finocchio di vigna	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Fruits collected in September-October when ripe; roots collected by the end of the first year in September-October	Seeds used in the preparation of some typically Mediterranean dishes to which they give a spicy aroma and flavour. Fleshy bases of the leaves used cooked with other vegetables.	u.d.
Foeniculum vulgare Mill. APIACEAE	Pipolo	Benevento	Foiano Valfortore	Leaves	Widespread food use of the fleshy bases of the leaves both raw and cooked.	u.d.
	Fenucchio	Salerno	National Park of Cilento and Vallo di Diano	Leaves, seeds	Seeds used to flavor olives, cheese, sausages, biscuits, etc. Fresh leaves used in broth, or to wrap the fish which is then barbecued.	La Palometa and Grieco 2003
	Fenucchio	Salerno	Sanza	Fruits	Raw to flavour olives, dried to flavour salami.	u.d.
	Fnucchiu	Napoli	Agro Nocerino Sarnese	Seeds	Liquor called "*finocchietto*" obtained from the infusion of seeds in pure alcohol. Seeds used to flavour dried figs and taralli.	Motti and Motti 2017
	Fenucchiu salevatecu	Salerno	Castel San Lorenzo	Fruits	Used to flavour sausages, dried figs and biscuits.	Salerno and Guarrera 2008

	Finucchio	Salerno	National Park of Cilento and Vallo di Diano	Seeds, fresh stems	Used in the preparation of seasoned meat and as a flavouring for marinated olives.	Di Novella et al. 2013
	Finucchiello	Salerno	Cava de' Tirreni	Fresh leaves	To flavor foods or liqueurs.	Mautone et al. 2019
	Finocchio	Napoli	Phlegrean Fields Regional Park	Seeds	Biscuits prepared with seeds and maize flour.	Motti et al. 2009
	Finucchio, Fnocchio selvatico, Fnucchio selvatico, Fenocchio, Fnocchiello, Finocchietto, Finocchio selvatico	Salerno	Monti Picentini Regional Park	Fruits, flowers, young leaves	Used as a spice, or in the preparation of salads, alcoholic beverages, soups, cooked vegetables.	Savo et al. 2019
	Fenucchiello	Napoli	Vesuvio National Park	Seeds	Eaten raw.	Menale et al. 2016
Foeniculum vulgare Mill. APIACEAE	Finocchietto	Salerno	Amalfi Coast	Fruits	To flavor meat, taralli, ricotta, dried figs and other dishes.	Savo 2010
	Finocchietto	Salerno	Amalfi Coast	Various parts	In the "*minestra maritata*".	Savo 2010
	Fenucchiello	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Shoots, leaves	Young shoots or leaves in soups together with endive.	u.d.
	Fenucchio	Napoli	Aversa	Leaves	In salads or in omelettes.	u.d.
	Fenucchio	Salerno	San Mauro Cilento	Leaves	As a flavouring during the cooking of broad beans.	u.d.
		Avellino	Sant'Andrea di Conza	Fruits	Used to prepare a liqueur (with alcohol, water and sugar).	u.d.
	Fragola	Salerno	Montecorvino Rovella	Fruits	Eaten fresh	u.d.
Fragaria vesca L. s.l. ROSACEAE	Fraula servaggia	Avellino	Roccabascerana	Fruits	Eaten fresh or for marmalades.	u.d.
	Fraula	Salerno	Sanza	Fruits	Eaten raw or used to prepare sorbets.	u.d.

	Fraula	Salerno	National Park of Cilento and Vallo di Diano	Fruits	For the preparation of ice creams.	Di Novella et al. 2013
Fragaria vesca L. s.l. ROSACEAE	Fragola di bosco, Fragola di montagna, Fragola selvatica, Fragola selvaggia, Fragoline di bosco, Fragolina, Fragolina di bosco, Fragole selvagge, Fraole	Salerno	Monti Picentini Regional Park	Fruits	Eaten raw or to prepare, alcoholic beverages and jams.	Savo et al. 2019
Fraxinus ornus L. OLEACEAE	Uorn	Salerno	Cava de' Tirreni	Bark	Water macerate used as a refreshing drink.	Mautone et al. 2019
Fumaria capreolata L. subsp. *capreolata* PAPAVERACEAE	Campanielli misti	Salerno	Montecorvino Rovella	Stems, young leaves	Raw, accompanied by other herbs, to make salads.	u.d.
	Olatro	Caserta	S. Gregorio Matese	Leaves (collected in June)	In salads.	u.d.
Fumaria officinalis L. s.l. PAPAVERACEAE	Campanielli	Salerno	Montecorvino Rovella	Aerial part	Raw, accompanied by other herbs, to make salads.	u.d.
Galactites tomentosus Moench ASTERACEAE	Carduognolo	Napoli	Phlegrean Fields Regional Park	Young stems, leaves	Used as ingredient for pizza and soups.	Motti et al. 2009
Helminthotheca echioides (L.) Holub ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or cooked vegetables. Component of "*minestra di radichelle*".	De Rosa et al. 2008
	Lattarole	Salerno	Cava de' Tirreni	Aerial part	Component of "*minestra maritata*".	Mautone et al. 2019

Helminthotheca echioides (L.) Holub ASTERACEAE	Cicorione de ciuccio, Sprunia, Sprunia, Sporone, Sprunia grassa, Spurunia, Aspurunia di ciuccio, Spredda, Asprelle, Aspredda, Aspredda di vigna, Cicoria selvatica	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, soups, cooked vegetables, vegetable pie.	Savo et al. 2019
	Aspredde	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio della Civitella, Perito, Orria), Castelnuovo Cilento	Leaves	In soups.	u.d.
Humulus lupulus L. CANNABACEAE	-	Avellino	Baianese and Lauretana areas	Shoots	The tender shoots as ingredients for omelettes.	De Rosa et al. 2008
	Asparago selvatico, Luparo, Lupulo, Lupili, Lupiri, Lupuli, Uvarella, Arucolo, Viticelle, Aruncolo	Salerno	Monti Picentini Regional Park	Shoots	In omelettes or as cooked vegetable.	Savo et al. 2019
Hypochaeris cretensis (L.) Bory et Chaub. ASTERACEAE	Lattuchedda	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	Component of "*minestra terrana*".	Di Novella et al. 2013
Hypochaeris radicata L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves	In salads or cooked vegetables.	De Rosa et al. 2008
	Foja, Pere e voje, Cicoria, Ingrassapuorci, Cicurioni, Spaccapreti, Spaccapietre, Spaccaprete	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, soups, cooked vegetables, vegetable pie.	Savo et al. 2019

Juniperus communis L. JUNIPERACEAE	Citrieddi, Paddocule	Salerno	National Park of Cilento and Vallo di Diano	Cones	Edible.	Di Novella et al. 2013
	Ginepro	Salerno	Monti Picentini Regional Park	Cones	As spice.	Savo et al. 2019
Juglans regia L. JUGLANDACEAE	Noce	Salerno	Monte Vesole e Ascea	Husk	For drinks / dessert.	Scherrer et al. 2005
		Salerno	Sanza			u.d.
		Salerno	Amalfi Coast			Savo 2010
Knautia integrifolia (L.) Bertol. s.l. DIPSACACEAE	Occhi neura, Occhi neuri, Occaneura, Occhi neri, Uocchi neura	Salerno	Monti Picentini Regional Park	Basal leaves	To prepare soups or as cooked vegetable.	Savo et al. 2019
Lactuca saligna L. ASTERACEAE	Lattuchedda	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In soups.	Di Novella et al. 2013
	Lattuca, Lattuga selvatica	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, cooked vegetables, soups.	Savo et al. 2019
Lactuca sativa L. subsp. *serriola* (L.) Galasso, Banfi, Bartolucci et Ardenghi ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	Cooked vegetables, in soups.	De Rosa et al. 2008
	Scarola	Salerno	Monte Vesole e Ascea	Leaves	Eaten boiled and fried.	Scherrer et al. 2005
	Lattuca, Lattuga selvatica	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, cooked vegetables, in soups.	Savo et al. 2019
	Cicoria campestre	Salerno	Amalfi Coast	Leaves	In salads.	Savo 2010
Lamium album L. s.l. LAMIACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or cooked vegetables.	De Rosa et al. 2008

Lamium album L. s.l. LAMIACEAE	Falsa ortica	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Aerial part collected from May to August.	Fresh spring shoots eaten boiled and seasoned with oil, in soups and omelettes.	u.d.
Lamium maculatum L. LAMIACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads or cooked vegetables.	De Rosa et al. 2008
Lamium purpureum L. LAMIACEAE	Miele	Benevento	Cirignano	Flowers	Closed flowers sucked for their honey-taste.	u.d.
Lapsana communis L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves	In salads or cooked vegetables.	De Rosa et al. 2008
	Lattuchedda	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	As ingredient of "*minestra terrana*".	Di Novella et al. 2013
Lathyrus sylvestris L. s.l. FABACEAE	Cicerchia	Salerno	National Park of Cilento and Vallo di Diano	Aerial part, seeds	In soups.	Di Novella et al. 2013
Laurus nobilis L. LAURACEAE	Alloro	Napoli	Phlegrean Fields Regional Park	Leaves	As spice.	Motti et al. 2009
		Salerno	Montecorvino Rovella			u.d.
	Lauro	Salerno	Sanza			u.d.
		Napoli	Penisola Sorrentina			De Feo et al. 1992
	Lauro, Lauriello	Salerno	Amalfi Coast			De Feo and Senatore 1993
	Lauru	Salerno	Castel San Lorenzo			Salerno and Guarrera 2008

	Laur’	Napoli	Polvica	As spice.	u.d.
	Lauriell’	Napoli	Aversa	To prepare an alcoholic beverage called “*laurino*”.	u.d.
	Lauriell’	Napoli	Pomigliano, Aversa, Acerra, Casalnuovo	As spice.	u.d.
		Napoli	Piano di Sorrento		u.d.
		Salerno	Monte Vesole e Ascea		Scherrer et al. 2005
	Lauro	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	As spice / drinks.	u.d.
Laurus nobilis L. LAURACEAE		Cilento	National Park of Cilento and Vallo di Diano		La Palometa and Grieco 2003
		Salerno	Cava de' Tirreni		Mautone et al. 2019
		Salerno	Comunità Montana Gelbison-Cervati (Perito, Orria, Salento, Gioi, Moio della Civitella, Cannalonga, Vallo della Lucania)		u.d.
	Lauro	Salerno	San Mauro Cilento	As spice.	u.d.
		Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania		u.d.

Laurus nobilis L. LAURACEAE	Lauro	Avellino	Bisaccia, Sant'Andrea di Conza		As spice.	u.d.
Leontodon hispidus L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Aerial part	In salads or cooked vegetables.	De Rosa et al. 2008
	Lattucaina	Benevento	Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Leaves	In salads and soups.	u.d.
Leontodon tuberosus L. ASTERACEAE	Cicuriona	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013
Limbarda crithmoides (L.) Dumort. s.l. ASTERACEAE	Critami	Salerno	Ascea	Leaves	In salads, for its salty taste.	Scherrer et al. 2005
Malva sylvestris L. MALVACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves	Boiled or in soups.	De Rosa et al. 2008
	Malva	Salerno	Monti Picentini Regional Park	Young leaves	In soups.	Savo et al. 2019
		Salerno	Amalfi Coast	Flower buds	Raw in salads.	Savo 2010
Matricaria chamomilla L. ASTERACEAE	Cambumilla, u' Camumillo	Salerno	National Park of Cilento and Vallo di Diano	Flowering heads, whole plant	To make a liqueur.	La Palometa and Grieco 2003
Melissa officinalis L. s.l. LAMIACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves before flowering	In salads or cooked vegetables.	De Rosa et al. 2008
	Erba cedrata, Limunina	Salerno	National Park of Cilento and Vallo di Diano	Flowers	In salads, beverages, spirits.	La Palometa and Grieco 2003
	Melissa	Salerno	Monti Picentini Regional Park	Young leaves	As spice.	Savo et al. 2019

Melissa officinalis L. s.l. LAMIACEAE	Melissa	Salerno	San Mauro Cilento	Leaves	To make a liqueur.	u.d.
Mentha sp. pl. LAMIACEAE	Menta	Salerno	Castel San Lorenzo		As flavouring.	Salerno and Guarrera 2008
		Salerno	Amalfi Coast	Leaves		Savo 2010
		Avellino	Partenio Regional Park		To make a liqueur.	Menale and Muoio 2014
Mentha aquatica L. s.l. LAMIACEAE	Mentuccia, Mentella	Salerno	Montecorvino Rovella	Aerial part	Eaten raw; fresh juice mixed with garlic.	u.d.
Mentha pulegium L. s.l. LAMIACEAE	Menta	Benevento	Cirignano		In salads and to flavour land snails (maruccas).	u.d.
	Menta	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi Velia, Cannalonga, Gioi, Moio della Civitella, Perito, Orria), Castelnuovo Cilento e Salento	Leaves	Flavouring of the Cilento pizza, that is prepared using origan and anchovies too.	u.d.
Mentha spicata L. LAMIACEAE	Menta servaggia, Mentastra	Benevento	Castelvetere in Val Fortore, Foiano Valfortore	Leaves and flowering parts collected in July-October	As flavouring of many dishes that, due to their composition, are not too appetizing.	u.d.
	Amenta	Salerno	Amalfi Coast	Whole plant, leaves	Used as flavouring agents.	De Feo and Senatore 1993
		Napoli	Peninsula Sorrentina	Leaves	Fresh leaves are used as flavouring agents.	De Feo et al. 1992
		Salerno	Cava de' Tirreni	Leaves	Main ingredient of a typical dish based on veal or pork spleen.	Mautone et al. 2019

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Mentha suaveolens Ehrh. s.l. LAMIACEAE	Amenta sarvatica, Nepetone	Salerno	Amalfi Coast	Leaves	Fresh leaves used as flavouring agents.	De Feo and Senatore 1993
Muscari comosum (L.) Mill. ASPARAGACEAE	-	Avellino	Baianese and Lauretana areas	Bulbs	In salads or cooked vegetables, also used as an onion substitute.	De Rosa et al. 2008
	Cipullu	Salerno	Castel San Lorenzo	Bulbs	In omelettes.	Salerno and Guarrera 2008
	Cipoddone	Salerno	National Park of Cilento and Vallo di Diano	Bulbs	In omelettes.	Di Novella et al. 2013
	Cipudde, Aliuolo, Agliuoli, Aiuoli, Agliuoli rossi, Aiuoli rossi, Agliustrelli, Cipoduzze selvatiche, Mammalone, Lampascioni, Lampacione, Cipolline selvatiche, Cipuddi, Agliustreddi	Salerno	National Park of Cilento and Vallo di Diano	Bulbs	Omelettes, pickled and in-oil vegetables, cooked vegetables.	Savo et al. 2019
		Benevento	Castelvetere in Val Fortore	Bulbs	Used as onion substitutes.	u.d.
	Cipollino	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Fresh bulbs collected in March-April	The bulbs, even if slightly bitterishused after boiling. They are pleasant in salad, as a side dish and in omelettes, but especially in pickled preserves.	u.d.
	Ciupullino	Salerno	Montecorvino Rovella	Bulbs	Eaten with salad or fried and dressed with sweet and sour sauce.	u.d.
	Erba di Santa Maria, Fili fini	Avelino	Roccabascerana	Bulbs	In salads.	u.d.
	Lampascione	Caserta	Roccamonfina, Ponte, Cescheto, Valogno		Used as onions.	u.d.

Muscari comosum (L.) Mill. ASPARAGACEAE	Lampascione	Avellino	Monteverde	Bulbs	Without outer tunic eaten boiled.	u.d.
	Mortella, Murtedda	Salerno	Monte Vesole e Ascea	Leaves, branches, frutis	Burned in the oven before fuel wood to give a special perfume to the bread. Branches put around fresh cheese to give aroma. Fruits also used to perfume meat and soups.	Scherrer et al. 2005
		Salerno	Monte Vesole e Ascea	Leaf, fruits, branches	To make a liqueor	Scherrer et al. 2005
	Mortedda, Murtedda	Salerno	National Park of Cilento and Vallo di Diano	Fruits		La Palometa and Grieco 2003
Myrtus communis L. s.l. MYRTACEAE	Mortella	Napoli	Piano di Sorrento	Leaves	The leaves of laurel, myrtle, mastic and rosemary burnt to make smoke that addressed on sausages both as a flavouring and as an adjuvant in storage.	u.d.
	Murtella	Salerno	Cava de' Tirreni	Fruits	To make a liqueur	Mautone et al. 2019
	Mirto	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga), Castelnuovo Cilento	leaves	Put in the baskets where milk products were stored, for flavouring them.	u.d.
		Salerno	San Mauro Cilento	Fruits, leaves	Macerated in white wine for 10 days to obtain, after filtration, the wine myrtle; fruits as flavouring of the pork sausage.	u.d.
		Napoli	Acerra	Fruits	Eaten raw or used to prepare jams.	u.d.
Nasturtium officinale R. Br. BRASSICACEAE	Sanacciuolo	Salerno	National Park of Cilento and Vallo di Diano	Plant	In salads.	Di Novella et al. 2013

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Nasturtium officinale R. Br. BRASSICACEAE		Salerno	Cava de' Tirreni	Leaves	In salads, or as component of "*minestra maritata*".	Mautone et al. 2019
	Auriuli, Crescione	Salerno	Monti Picentini Regional Park	Young leaves, shoots, aerial part	In salads.	Savo et al. 2019
Nepeta cataria L. LAMIACEAE	Mentastro	Salerno	National Park of Cilento and Vallo di Diano	Aerial part dryed	Flavouring for food, especially goat's cheese.	Di Novella et al. 2013
	Mentastro	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio della Civitella, Perito, Orria), Castelnuovo Cilento	Aerial part	The decoction of the aerial parts cooled and bunches of grapes were put in it. Thus, the grape took a flavour that kept away the insects during the drying made to obtain the raisin.	u.d.
Oenanthe fistulosa L. APIACEAE	Raparunzoli	Salerno	Monti Picentini Regional Park	Roots, young leaves	Cooked vegetable, as snack.	Savo et al. 2019
Onobrychis alba (Waldst. et Kit.) Desv. subsp. *alba* FABACEAE	Lupinella	Napoli	Phlegrean Fields Regional Park	Seeds	Roasted seeds as a coffee substitute.	Motti et al. 2009
Onopordum illyricum L. s.l. ASTERACEAE	Cardone	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013
Opuntia ficus-indica (L.) Mill. CACTACEAE	Ficurenia	Salerno	National Park of Cilento and Vallo di Diano	Fruits, whole plant	Edible.	Di Novella et al. 2013
	Ficu d'india	Salerno	Monte Vesole and Ascea	Fruits	Fruits eaten fresh.	Scherrer et al. 2005
		Salerno	Ascea	Fruits	To make a liqueur.	Scherrer et al. 2005

	Fecurìnia	Salerno	Castel San Lorenzo	Fruits, peel	Fruit for human consumption. Peeled without thorns, dried in the sun and stored for the winter to be fried together with potatoes as a substitute for dried peppers.	Salerno and Guarrera 2008
Opuntia ficus-indica (L.) Mill. CACTACEAE	Ficurinie	Napoli	Vesuvio National Park	Fruits	Eaten raw.	Menale et al. 2016
	Figurine	Napoli	Aversa, Acerra	Young cladodes	Eaten raw or boiled in salads.	u.d.
	Areana	Salerno	San Mauro Cilento	Shoots	As flavouring of the Cilento pizza, that is prepared using mint and anchovies too.	u.d.
	Arètica	Salerno	Acerno	Flowers	Dried flower buds used as a spice.	u.d.
		Salerno	Montecorvino Rovella	Flowers	Dried flower buds used as a spice.	u.d.
Origanum vulgare L. s.l. LAMIACEAE	Arecheta	Benevento	Cirignano	Flowers	Dried flower buds used as a spice.	u.d.
	Aregana	Salerno	Castel san Lorenzo	Leaves	As flavouring.	Salerno and Guarrera 2008
	Harigana rossa	Napoli	National Park of Cilento and Vallo di Diano	Dried aerial part	As flavouring for food, especially goat's cheese.	Di Novella et al. 2013
	Regano	Avellino	Monteverde	Shoots	As flavouring of the "*pizza arreghenata*", a flat bread seasoned with salt and tomatoes too.	u.d.
Origanum vulgare L. subsp. *viridulum* (Martrin-Donos) Nyman LAMIACEAE	-	Napoli	Agro Nocerino Sarnese	Leaves	As flavouring for food.	Motti and Motti 2017

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	Oregano, la Regana, Oregono, Oreano, Areono, Pilievo, Areano, Origano, Aregana, Aregano, Arecana	Salerno	Monti Picentini Regional Park	Young leaves, aerial part		Savo et al. 2019
Origanum vulgare L. subsp. *viridulum* (Martrin-Donos) Nyman LAMIACEAE	Harigana janca	Salerno	National Park of Cilento and Vallo di Diano	Dried aerial part	As flavouring for food, especially goat's cheese.	Di Novella et al. 2013
	Arechete	Salerno	Amalfi Coast	Leaves	As flavouring for meat and vegetables especially tomatoes (*Solanum lycopersicum*), potatoes (*Solanum tuberosum*) and eggplants (*Solanum melogena*).	Savo 2010
Ornithogalum umbellatum L. ASPARAGACEAE	Aglirieddo zico	Salerno	National Park of Cilento and Vallo di Diano	Bulbs	In soups.	Di Novella et al. 2013
Pancratium maritimum L. AMARYLLIDACEAE	Giglio di mare, Porro	Napoli	Monteruscello	Bulbs	Used in salads as an onion and leek substitute.	u.d.
	Giglio di mare	Napoli	Phlegrean Fields Regional Park	Bulbs	Ingredient for salads as onion substitute.	Motti et al. 2009
Papaver rhoeas L. s.l. PAPAVERACEAE	-	Avellino	Baianese and Lauretana areas	Young plants	In omelettes, salads, cooked vegetables, soups. As a component of "minestra di campagna'.	De Rosa et al. 2008
	Papagne	Salerno	Monte Vesole e Ascea	Young plants	Eaten boiled and fried. They can be added as an ingredient to soup.	Scherrer et al. 2005
		Napoli	Ischia	Leaves	Component of "*mnesta salvagioia*".	Vallariello 2003
	Papagnu	Salerno	Castel San Lorenzo	Leaves	Used as a cooked vegetable.	Salerno and Guarrera 2008

Papaver rhoeas L. s.l. PAPAVERACEAE	Papagna, Papagno	Salerno	Monti Picentini Regional Park	Young basal leaves	In omelettes, salads, cooked vegetables, soups.	Savo et al. 2019
	Papagna	Napoli	Phlegrean Fields Regional Park	Seeds	Used in bean soup before they germinate.	Motti et al. 2009
		Napoli	Ercolano, Torre del Greco	Flowery tops	In soups and salads.	u.d.
	Papagno	Napoli	Pompei, Boscoreale, Terzigno	Tops	In salads.	u.d.
		Napoli	Acerra, Casalnuovo	Young leaves	In salads or in vegetable minestrone.	u.d.
Papaver rhoeas L. subsp. *rhoeas* PAPAVERACEAE	Papagn	Avellino	Partenio Regional Park	Whole plant	In salads.	Menale and Muoio 2014
Papaver setigerum DC. PAPAVERACEAE	Papagna	Napoli	Phlegrean Fields Regional Park	Seeds	Used in bean soup before they germinate.	Motti et al. 2009
Parietaria judaica L. URTICACEAE	-	Avellino	Baianese and Lauretana areas	Aerial parts	In soups.	De Rosa et al. 2008
	Erva de muro	Napoli	Acerra, Casalnuovo	Young levaves	In omelettes and soups.	u.d.
Petasites hybridus (L.) G. Gaertn., B. Mey., Scherb. s.l. ASTERACEAE	Lappazzi	Salerno	Monti Picentini Regional Park	Leaf stem	Used as a cooked vegetable.	Savo et al. 2019
Picris hieracioides L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young stems leaves, basal leaves	As component of "*minestra di radichelle*".	De Rosa et al. 2008
	Cicorione de ciuccio, Asprella, Cicoria	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, cooked vegetables, soups.	Savo et al. 2019
Picris hieracioides L. subsp. *hieracioides* ASTERACEAE	Asperella, Spredda	Salerno	Monte Vesole e Ascea	Leaves	As ingredient of "*minestra*".	Scherrer et al. 2005

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Picris hieracioides L. subsp. *hieracioides* ASTERACEAE	Cicoria selvatica	Salerno	Amalfi Coast	Basal leaves	In salads.	Savo 2010
Pimpinella anisoides Briganti APIACEAE	Cimmusella	Salerno	National Park of Cilento and Vallo di Diano	Seeds	As cookie flavouring.	Di Novella et al. 2013
Pinus pinea L. PINACEAE	Pigna	Napoli	Phlegrean Fields Regional Park	Seeds	As dessert.	Motti et al. 2009
	Pignoli	Salerno	Comunità Montana Gelbison-Cervati (Perito, Orria, Gioi, Salento, Castelnuovo)		In blood sausage.	u.d.
	Pinuoli		San Mauro Cilento		In cakes and blood sausage.	u.d.
		Caserta	Cellole, Piedimonte di Sessa Aurunca, Carano		In blood sausage.	u.d.
Pistacia lentiscus L. ANACARDIACEAE	Lentisco	Napoli	Piano di Sorrento	Leaves	Leaves of laurel, myrtle, mastic and rosemary burnt to make smoke that addressed on sausages worked both as a flavouring and as an adjuvant in storage.	u.d.
	Lestringo	Salerno	National Park of Cilento and Vallo di Diano	Fruits, seeds	Fruits preserved in salt and used to flavour meat. Oil obtained from the seeds by pressure.	La Palometa and Grieco 2003
Plantago lanceolata L. PLANTAGINACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs, in soups.	De Rosa et al. 2008
	Cinchenierv i	Salerno	Cava de' Tirreni	Leaves	Component of "*minestra maritata*".	Mautone et al. 2019
	Cinquenervi	Salerno	Monti Picentini Regional Park	Young leaves	Soups.	Savo et al. 2019

	Cinquenervi	Napoli	Acerra		In salads or in vegetable minestrone.	u.d.
Plantago lanceolata L. PLANTAGINACEAE	Lengua re cane	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Leaves	In soups.	u.d.
	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs, in soups.	De Rosa et al. 2008
	Cinchenierve, Centonierve	Napoli	Agro Nocerino Sarnese	Leaves	In soups.	Motti and Motti 2017
Plantago major L. PLANTAGINACEAE	Cinchenierve	Salerno	Cava de' Tirreni	Leaves	As component of "*minestra maritata*".	Mautone et al. 2019
	Centounerbe, Piantaggine, Cinquenervi	Salerno	Monti Picentini Regional Park	Young leaves	In soups.	Savo et al. 2019
	Piantaggine	Napoli	Acerra	Leaves	In salads or in vegetable minestrone.	u.d.
Polygonum aviculare L. POLYGONACEAE	Cientnureche	Napoli	Ercolano, Portici, Torre del Greco	Aerial parts	In the past, aerial parts used as food.	u.d.
	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs, in omelettes, preserved in vinegar. Often sun dried for winter use.	De Rosa et al. 2008
Portulaca oleracea L. PORTULACACEAE	Pucchiacchella, Erba vasciulella	Salerno	Monte Vesole e Ascea	Leaves	Eaten as salad.	Scherrer et al. 2005
	Erba vasciulella	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Bark	Aerial part or tender leaves used as a tasty complement to raw or cooked salads.	u.d.

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	Purchiacchiella	Salerno	Montecorvino Rovella	Whole plant	Eaten in mixed salads.	u.d.
	Pucchiacchielli	Avellino	Roccabascerana	Leaves	In salads raw or cooked.	u.d.
	Purchiacchieddo	Salerno	Sanza	Leaves	Fresh and tender leaves in salads with lettuce and tomatoes.	u.d.
	-	Salerno	Agro Nocerino Sarnese	Whole plant	In the past, consumed raw in the growing season and dried in winter (sometimes preserved in olive oil). Today used as a salad ingredient.	Motti and Motti 2017
	Purchjacca	Salerno	Castel San Lorenzo	Shoots	Soft shoots added to mixed salads.	Salerno and Guarrera 2008
	Purchiacchieddo	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In salads.	Di Novella et al. 2013
Portulaca oleracea L. PORTULACACEAE	Pucchiacchella, Erba vasciulella	Salerno	Cava de' Tirreni	Leaves	In salads.	Mautone et al. 2019
	Picchiacca, Picchiacchiella, Pucchiacchiella, Picchiacche, Pricchiacca, Pricchiacchiedda, Pricchiacca, Centofoglie, Pricchiacchieddi, Erba vasciulella, Pirchiacchiedda, Purcacchiedda, Erba chiatta, Purcacchielle, Erva chiatta, Purcacchielli, Prucchiacca, Pucchiacchielli, Centofrunelle	Salerno	Monti Picentini Regional Park	Aerial part, young leaves	In salads, cooked vegetables, soups.	Savo et al. 2019

	Precchiacca	Salerno	Comunità Montana Gelbison-Cervati (Perito, Orria, Ceraso, Novi, Cannalonga, Moio della Civitella), Castelnuovo Cilento	Leaves		u.d.
	Erva porchiacchella	Napoli	Casalnuovo, Acerra, Aversa, Pomigliano	Leaves and young stems	In salads.	u.d.
	Purcacciuoli	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania			u.d.
Portulaca oleracea L. PORTULACACEAE	Ever' pucchiacchella, Ever' vasciulella	Napoli	Ercolano, San Giovanni a Teduccio, Torre del Greco, San Giorgio a Cremano	Aerial parts		u.d.
	Ever' purchiacchiella, Ever' casciulella, Ever' vasciulell'	Napoli	Pompei, Boscoreale, Boscotrecase, Trecase, Terzigno		Aerial parts in salads or dried parts eaten fried with oil, salt and pepper.	u.d.
Poterium sanguisorba L. s.l. ROSACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2008
	Pimpinella	Avellino	Montecorvino Rovella	Leaves	In mixed salads.	u.d.
Poterium sanguisorba L. subsp. *balearicum* (Bourg. ex Nyman) Stace ROSACEAE	Pane 'e noce	Salerno	Amalfi Coast	Leaves	Raw in salads.	Savo 2010
Primula vulgaris Huds. s.l. PRIMULACEAE	-	Avellino	Baianese and Lauretana areas	Leaves, flowers	In salads mixed with other herbs. Flowers used in infusion.	De Rosa et al. 2008
	Piraino	Salerno	Sanza	Fruits	Harvested in October-November and left to ripe, when they reached a brown colour they were put in water and vinegar and preserved to prepare salads in winter.	u.d.
	'Siur é pane	Benevento	Cirignano	Flowers	Sucked.	u.d.

Primula vulgaris Huds. s.l. PRIMULACEAE	Viole di pane, Fiori di pane, Erba di S. Antonio, e' Primule, Fiore di S. Giuseppe, Lacrime della Madonna, Fiore di S. Antonio, Primula di S. Giuseppe, Primula gialla, Viola bianca	Salerno	Monti Picentini Regional Park	Flowers	Sucked.	Savo et al. 2019
Prunus spinosa L. s.l. ROSACEAE	Trigna (fruit)	Benevento	Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Fruits	Small drupes, "*trigne*", with extremely sour taste, are sought after by the boys.	u.d.
	Trigne, la Spina, Prugna selvaggia, Trigna, Ciccispini, Spino, Uvo spinoso, Ceraselle selvatiche, Cessauoi, Biancospino, Prunelle selvatiche	Salerno	Monti Picentini Regional Park		Eaten raw, to make jams.	Savo et al. 2019
	Pruno	Salerno	San Mauro Cilento		In jams or used to prepare a liqueur with sugar and alcoholic distillate.	u.d.
	Trigna, Spina trigna	Avellino	Monteverde		Eaten raw or used to prepare a liqueur.	u.d.
Pteridium aquilinum (L.) Kuhn s.l. DENNSTAEDTIACEAE	Felece	Salerno	Monti Picentini Regional Park	Young shoots	In soups.	Savo et al. 2019
Pyrus communis L. subsp. *pyraster* (L.) Ehrh. ROSACEAE	Piràino	Salerno	National Park of Cilento and Vallo di Diano	Unripe fruit	Harvested in October and preserved in vinegar; eaten in winter salads.	Di Novella et al. 2013
	-	Salerno	Amalfi Coast	Fruits	As dried fruit.	Savo 2010
Quercus ilex L. FAGACEAE	Cierro	Napoli	Acerra, Aversa	Fruits	In the past, minced fruits used as coffee substitute.	u.d.

	Roverella	Salerno	Monte Vesole e Ascea	Fruit	Flour of the acorns used to make bread.	Scherrer et al. 2005
	Cercula	Napoli	Acerra, Aversa	Fruit	In the past, minced fruits used as coffee substitute.	u.d.
Quercus pubescens Willd. s.l. FAGACEAE	Cerza	Salerno	San Mauro Cilento	Fruit	Roasted fruits used as coffee substitute. In the past, roasted fruits used as food.	u.d.
		Salerno	Sanza	Fruits and wood	During World War II, roasted fruits used as a coffee substitute.	u.d.
		Salerno	Castel San Lorenzo	Fruits	Dried acorns ground to make bread.	Salerno and Guarrera 2008
		Salerno	San Mauro Cilento	Fruits	Roasted fruits as coffee substitute.	u.d.
Raphanus raphanistrum L. s.l. BRASSICACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves, stems	In salads or cooked vegetables. Component of "minestra di radichelle". The basal part of the stem, the thicker one, is cut, peeled and eaten raw with plates of sausages.	De Rosa et al. 2008
	Rafano	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In soups.	Di Novella et al. 2013
	Ràrice	Salerno	Phlegrean Fields Regional Park	Shoots	Grazed young shoots as an ingredient for salads.	Motti et al. 2009
	Rapesta, Rapa selvatica, Rapesta bianca, Foja, Rapa selvaggia, Foglia vecchia	Salerno	Monti Picentini Regional Park	Roots, young leaves, stems	In salads, cooked vegetables, vegetable pie, soups.	Savo et al. 2019
	Rafano	Napoli	Agro Nocerino Sarnese	Roots	Fresh grated root on spaghetti.	Motti and Motti 2017
Rapistrum rugosum (L.) All. BRASSICACEAE	Lossena	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Leaves	In vegetable soups.	u.d.

Rapistrum rugosum (L.) All. BRASSICACEAE	Rapesta	Napoli	Ischia	Leaves	In the soup called "*mnesta salvagioia*".	Vallariello 2003
		Salerno	Monti Picentini Regional Park	Young leaves	In soups.	Savo et al. 2019
Reichardia picroides (L.) Roth ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young basal leaves	In salads or cooked vegetables.	De Rosa et al. 2008
	Paparastiello	Napoli	Ischia	Leaves	In the soup called "*mnesta salvagioia*".	Vallariello 2003
	Lattuchedda	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In the soup called "*minestra terrana*".	Di Novella et al. 2013
	Lattecielle	Salerno	Cava de' Tirreni	Leaves	In the soup called "*minestra maritata*".	Mautone et al. 2019
	Musso e' lepre, Caccialiepri, Scaccialiepri, Scaccialiepre, Scaccialepre	Salerno	Monti Picentini Regional Park	Basal leaves	In salads, cooked vegetables, vegetable pie, soups.	Savo et al. 2019
	Lattarola	Salerno	Amalfi Coast	Leaves	In the soup called "*minestra maritata*".	Savo 2010
	Caccialepre	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Young plants, leaves	In salads or as coffee substitute.	u.d.
	Scazzaliepr'	Napoli	Ercolano, Torre del Greco, San Giovanni a Teduccio	Aerial parts	In salads or soups.	u.d.
Reseda alba L. s.l. RESEDACEAE	Ruca, le Ruche, Cannavella	Salerno	Monti Picentini Regional Park	Basal leaves	Cooked vegetable, in soups.	Savo et al. 2019

	Acacia	Benevento	Cirignano	Flowers	In omelettes.	u.d.
	Caggi, Acacia, Gaggia	Salerno	Monti Picentini Regional Park	Flowers	In omelettes, salads and as a cooked vegetable.	Savo et al. 2019
Robinia pseudoacacia L. FABACEAE	Gazza	Napoli	Aversa, Pomigliano	Flowers	Fried in batter.	u.d.
	Spinacacia	Salerno	San Mauro Cilento	Flowers	Used to prepare pancakes or macerated in red wine to obtain the robinia wine.	u.d.
	Rosa canina, Spina cagazzara, Ruvaina, Rosa cagazzara, Spennapulici	Salerno	Monti Picentini Regional Park		Spice, fresh fruit, jam.	Savo et al. 2019
		Salerno	Comunità Montana Gelbison-Cervati (Novi Velia, Moio della Civitella, Cannalonga)	Accessory fruits	Exsiccated accessory fruit eaten raw.	u.d.
Rosa canina L. ROSACEAE	Rosa canina	Salerno	San Mauro Cilento		Used to obtain a jam or to prepare a cream (after pulp boiling, seeds removal and blending with sugar, two beaten yolks and marsala wine).	u.d.
		Napoli	Acerra		Used to obtain a jam.	u.d.
		Avellino	Monteverde	Petals	Used to decorate salads and as flavouring.	u.d.
Rubus caesius L. ROSACEAE	Frammisalo	Salerno	National Park of Cilento and Vallo di Diano	Fruits	To make jams.	Di Novella et al. 2013
	Rusto	Salerno	Cava de' Tirreni	Tender tops	In omelettes.	Mautone et al. 2019

Rubus caesius L. ROSACEAE	Musina, Framoge nere, Murulo di rovo, li Rui, Muruli, Muroli, Muroli niuri	Salerno	Monti Picentini Regional Park	Fruits	To prepare jams or cooked in alcohol, as fresh fruit.	Savo et al. 2019
	Rivitale, R'amore	Salerno	National Park of Cilento and Vallo di Diano		To prepare marmalades.	Di Novella et al. 2013
Rubus canescens DC. ROSACEAE	Mura di montagna	Salerno	Monti Picentini Regional Park	Fruits	To prepare marmalades, as fresh fruit.	Savo et al. 2019
Rubus hirtus Waldst. et Kit. (group) ROSACEAE	Mura di montagna, Musina di montagna	Salerno	Monti Picentini Regional Park	Fruits	Eatgen raw or to prepare jam.	Savo et al. 2019
Rubus idaeus L. ROSACEAE	-	Avellino	Baianese and Lauretana areas	Fruits, young shoots	Fruits eaten fresh, to prepare jams. The young shoots eaten like asparagus.	De Rosa et al. 2008
	Frammisalo	Salerno	National Park of Cilento and Vallo di Diano	Fruits	As drinks / dessert.	Di Novella et al. 2013
	Carmuciani, Framosge rosse, Carmuciano, Lampone, Framoge rosse, Muruli russi, Muruli rossi, Morula, Muroli rossi	Salerno	Monti Picentini Regional Park			Savo et al. 2019
Rubus ulmifolius Schott ROSACEAE	-	Avellino	Baianese and Lauretana areas	Fruits, young shoots	Fruits eaten fresh, to prepare jams. The young shoots eaten like asparagus.	De Rosa et al. 2008
	Ruveta (plant), Morena (fruit)	Salerno	Montecorvino Rovella	Fruits	Fruits eaten fresh.	u.d.
	Rivitale, Ràmore (fruit)	Salerno	Sanza	Fruits	Jams made with the fruits, which are picked and slipped one by one into a dry *Bromus* sp. plant.	u.d.
	More	Avellino	Roccabascerana	Fruits	Eaten fresh or used to make jams.	u.d.

	Ruvera	Salerno	Castel San Lorenzo	Fruits	Used or feeding: they were typically assembled, to be transported, by stabbing them into a barrel of *Dactylis* sp.	Salerno and Guarrera 2008
Rubus ulmifolius Schott ROSACEAE	Lamòre, Framosge nere, la Mura, le More, Amùra, Lamùra, la Mùre, re More, Ruveto, Ruvetto, Ruiti, Lamore, Borraine, Borraina, le Musine, Borràina, Borràine, Framoge nere, Murulo di spina, Muruli, Muroli niuri, Muroli neri, Muruli neri, Murulu, More selvagge, Muroli di spina	Salerno	Monti Picentini Regional Park	Fruits	Cooked fruits in alcohol, fresh fruit, in salads, to make jams, as snack, alcoholic beverage, in soups.	Savo et al. 2019
	More	Napoli	Acerra, Aversa, Pomigliano, Casalnuovo	Fruits	Used to prepare jams and slushes.	u.d.
		Napoli	Roccarainola, Polvica	Fruits	Used to prepare jams, slushes and syrups.	u.d.
Rumex acetosa All. POLYGONACEAE	Acetosa	Salerno	San Mauro Cilento	Young leaves	In salads.	u.d.
Rumex arifolius All. POLYGONACEAE	Cefescola, Lingua di cane, Facetola	Salerno	Monti Picentini Regional Park	Young leaves, stems	As snack.	Savo et al. 2019
Rumex crispus L. POLYGONACEAE	Lingua di cane, Lapazi	Salerno	Monti Picentini Regional Park	Young leaves, stems	As snack, cooked vegetable, in soups.	Savo et al. 2019
Rumex scutatus L. s.l. POLYGONACEAE	Lapazzo	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In salads and soups.	Di Novella et al. 2013

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	-	Avellino	Baianese and Lauretana areas	Young shoots	Eaten like asparagus.	De Rosa et al. 2008
	Pungitopo	Salerno	Monte Vesole e Ascea	Shoot	Young shoots eaten like asparagus or cooked in water and vinegar and then put in olive oil for conservation.	Scherrer et al. 2005
	Frusci	Salerno	Sanza	Young shoots	Eaten like asparagus.	Salerno and Guarrera 2008
	Pungitopo	Napoli	Agro Nocerino Sarnese	Shoots	In omelettes.	Motti and Motti 2017
	Frusci	Salerno	Castel San Lorenzo	Shoots	Young shoots eaten in omelettes.	Salerno and Guarrera 2008
Ruscus aculeatus L. ASPARAGACEAE	Scacciasurece	Salerno	Cava de' Tirreni	Aerial part	In salads or with eggs.	Mautone et al. 2019
	Pungitopo, Ciecasurici, Arusci, Avruscio	Salerno	Monti Picentini Regional Park		Vegetables cooked or marinated in oil, in omelettes.	Savo et al. 2019
	Pungizoccule	Salerno	San Mauro Cilento		Young shoots used like asparagus.	u.d.
	Pungitopo	Benevento	San Lupo, San Lorenzo Maggiore, Ponte, Casalduni, Pontelandolfo	Shoots	Young shoots eaten boiled as asparagus.	u.d.
	Frusci	Napoli	Pietrastornina		Cooked shoots in soups.	u.d.
	Pungitopo	Napoli	Aversa		Young shoots eaten cooked like asparagus.	u.d.
	Piscialietto	Caserta	Carinola, Casale di Carinola		Young shoots used as asparagus or eaten boiled.	u.d.
Ruta graveolens L. RUTACEAE	Ruta, Aruta, Ruta capuzza	Salerno	Monte Vesole e Ascea	Leaves	To prepare a liqueur.	Scherrer et al. 2005
	Ruta	Benevento	Pietraroja	Leaves	Today used to flavor grape brandy.	u.d.

Ruta graveolens L. RUTACEAE		Benevento	Pietraroja	Leaves	In small quantities, used to give an unusual aroma to fresh cheese, eggs and fish dishes.	u.d.
Ruta chalepensis L. RUTACEAE	Ruta	Salerno	Amalfi Coast	Branches	To aromatize the grappa and then used like digestive.	Savo 2010
		Salerno	San Mauro Cilento	Aerial parts	Crushed aerial parts eaten fried.	u.d.
		Napoli	Pompei, Boscoreale, Terzigno	Shoots	Used as flavouring of grappa.	u.d.
Salvia officinalis L. s.l. LAMIACEAE	Salva	Salerno	Monte Vesole e Ascea	Leaves	To flavour meat dishes.	Scherrer et al. 2005
	Sàlevia	Salerno	Castel San Lorenzo	Leaves	As flavouring.	Salerno and Guarrera 2008
	Addori ri costa, Sarvia	Salerno	National Park of Cilento and Vallo di Diano	Dried aerial parts	As flavouring, especially for goat's chees.	Di Novella R. et al
Salvia rosmarinus Schleid. LAMIACEAE	Rosamarina	Napoli	Piano di Sorrento	Leaves	Leaves of laurel, myrtle, mastic and rosemary, burnt to make smoke that addressed on sausages worked both as a flavouring and as an adjuvant in storage.	u.d.
		Salerno	Sanza		To flavour mainly meats.	u.d.
	Rosamarina	Benevento	Cirignano		As a flavouring in numerous dishes.	u.d.
	Rosmarina	Salerno	Castel San Lorenzo		As flavouring.	Salerno and Guarrera 2008
	Rosmarino	Napoli	Phlegrean Fields Regional Park		As meat flavouring.	Motti et al. 2009
	Rosmarina	Napoli	Vesuvio National Park		Eaten raw.	Menale et al. 2016
Sambucus nigra L. ADOXACEAE	Saùco	Salerno	Monte Vesole e Ascea	Flowers	Flowers dipped in egg and fried.	Scherrer et al. 2005

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	Saùco	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Flowers	In beverages.	u.d.
	Savùco	Salerno	Cave de' Tirreni	Fruits, leaves	The leaves eaten with eggs; the fruits used in the preparation of jams.	Mautone et al. 2019
	Savuco, Sauco, Sambuco, Pastaccera, Savuci, Savucio	Salerno	Monti Picentini Regional Park	Fruits, leaves	To make alcoholic and analcoholic drinks; consumed as everyday food.	Savo et al. 2019
Sambucus nigra L. ADOXACEAE	Sammuco	Napoli	Boscoreale, Boscotrecase, Ercolano, Massa di Somma, Ottaviano, Pollena Trocchia, San Giuseppe Vesuviano, San Sebastiano al Vesuvio, Sant'Anastasia, Somma Vesuviana, Terzigno, Torre del Greco and Trecase		To prepare marmalades.	Menale et al. 2016
	Savuco	Salerno	San Mauro Cilento	Flowers, Fruits	Fruits used to prepare a jam; flowers to prepare pancakes.	u.d.
	Saucio	Napoli	Acerra, Aversa		Fruits used to prepare jams and syrups.	u.d.
	Sammucio	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania		Fruits used to prepare a liqueur.	u.d.
	Sambuco	Avellino	Bisaccia		Fruits used to prepare jams.	u.d.

Sanguisorba officinalis L. ROSACEAE	Pane 'e noce	Salerno	Cava de' Tirreni	Leaves	In salads or in the "*minestra maritata*".	Mautone et al. 2019
Satureja montana L. subsp. *montana* LAMIACEAE	Timo	Salerno	Monte Vesole e Ascea	Leaves	As flavouring, with meat and artichokes.	Scherrer et al. 2005
	Harihanedda	Salerno	National Park of Cilento and Vallo di Diano	Dried aerial parts	As flavouring especially for goat's cheese.	Di Novella et al. 2013
	Scirvuglio	Salerno	Amalfi Coast	Branches	As flavouring especially for cooked vegetables.	Savo 2010
Scandix pecten-veneris L. APIACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves and shoots	In salads or soups mixed with other herbs.	De Rosa et al. 2008
Scolymus hispanicus L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Roots, ribs	The spine-deprived ribs used in salads or cooked vegetables.	De Rosa et al. 2008
Senecio vulgaris L. s.l. ASTERACEAE	Cardillo	Napoli	Ischia	Leaves	As a component of the soup called "*mnesta salvagioia*".	Vallariello 2003
Silene latifolia Poir. CARYOPHYLLACEAE	-	Avellino	Mugnano del Cardinale	Young shoots	In salads, omelettes and soups.	De Rosa et al. 2008
	Silene	Napoli	Pompei, Boscotrecase, Terzigno	Tops	In salads.	u.d.
Silene vulgaris (Moench) Garcke s.l. CARYOPHYLLACEAE	Garufulielli	Salerno	Montecorvino Rovella	Leaves, flowers	Leaves gathered in springs and used in soups. Flowers eaten in salads.	u.d.
Silybum marianum (L.) Gaertn. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young shoots	In salads.	De Rosa et al. 2008
	Cardone	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Shoots, leaves, heads	The tender shoots, harvested long before flowering, are edible, the young leaves and the heads still closed are eaten raw or cooked like artichokes whose taste they recall.	u.d.
		Salerno	Cava de' Tirreni	Flowering heads	Used in the "*minestra maritata*".	Mautone et

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	Cardo	Caserta	S. Gregorio Matese	Stems, shoots, young leaves	In soups.	u.d.
		Caserta	Corigliano, Li Paoli, Ponte, S. Andrea del Garigliano, Valogno, Fontanaradina	Tops, young shoots and leaves without thorns	Raw or cooked in salads.	u.d.
Silybum marianum (L.) Gaertn. ASTERACEAE	Cardone	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio della Civitella, Perito, Orria), Castelnuovo Cilento	Young leaves	In the past, young leaves without thorns used, together with *Cichorium intybus* and *Urtica dioica*, to prepare a dish obtained heating them and frying with potatoes.	u.d.
		Avellino	Monteverde	Receptacle	Receptacles without outer parts in soups or eaten boiled.	u.d.
Sinapis sp. BRASSICACEAE	Làssana	Salerno	Castel San Lorenzo	Leaves, tender shoots, fruits	Fruits eaten raw; leaves and tender shoots cooked as vegetables.	Salerno and Guarrera 2008
Sinapis alba L. s.l. BRASSICACEAE	Vuoccolo sirvaggio	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013
Sinapis arvensis L. s.l. BRASSICACEAE	Ravizzone	Salerno	Sanza	Flowering tops	Flowering tops used as wild broccoli in all recipes: boiled in salad or fried, even to season pasta.	u.d.
	Ravizzone, Rapèsta	Salerno	National Park of Cilento and Vallo di Diano	Top plants	In salads.	Di Novella et al. 2013
Sinapis pubescens L. s.l. BRASSICACEAE	Vuoccolo sirvaggio	Salerno	National Park of Cilento and Vallo di Diano	Leaves	In soups.	Di Novella et al. 2013
Sisymbrium officinale (L.) Scop. BRASSICACEAE	Rapistogno	Napoli	Acerra	Leaves	In salads, omelettes and soups or fried in the "*pancotto*".	u.d.
Sixalix atropurpurea (L.) Greuter et Burdet DIPSACACEAE	Vedovina	Salerno	Montecorvino Rovella	Young leaves	Young leaves eaten as a cooked vegetale.	u.d.

Sixalix atropurpurea (L.) Greuter et Burdet DIPSACACEAE	Vedovina	Salerno	Macchia village (Montecorvino Rovella)	Leaves before blooming	In Macchia village are eaten in salads.	u.d.
Sonchus sp. pl. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Roots	As coffee substitute.	De Rosa et al. 2007
	Sovòne, Sivone, Sevono, Svone, Seone, Cardilli, Carduncelli, Sevòne, Cardo beneritto, Cardo biniritto, Carduncelle, Sione, Siuni	Salerno	Monti Picentini Regional Park	Basal leaves, shoots, stems	Eaten in salads, soups, vegetable pie, as a cooked vegetable.	Savo et al. 2019
Sonchus arvensis L. s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2007
Sonchus asper (L.) Hill s.l. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2008
	Sivone	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	As ingredient of "*minestra terrana*".	Di Novella et al. 2013
	Cardone	Salerno	Amalfi Coast	Leaves	As ingredient of "*minestra terrana*".	Savo 2010
Sonchus oleraceus L. ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2008
	Cicoria	Salerno	Monte Vesole e Ascea	Leaves	As ingredient of "*minestra*". Other species of *Sonchus* sp. pl. also used for "minestra".	Scherrer et al. 2005
	Cardillo	Benevento	Apollosa, Cautano, Castelvetere in Val Fortore, Foiano Valfortore	Young shoots	The young shoots, even if slightly thorny, eaten raw in salads, or cooked in soups.	u.d.
	Trunzo	Napoli	Ischia	Leaves	As ingredient of the soup called "*mnesta salvagioia*".	Vallariello 2003

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	Vrasparelle, Stracciaccannarone	Benevento	Cirignano	Aerial part	As a substitute for spinach in pizzas and soups.	u.d.
	Cardillo, Savuni	Napoli	Agro Nocerino Sarnese	Leaves	As a substitute for spinach in pizzas and soups.	Motti and Motti 2017
	Sivone	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In the "*minestra terrana*".	Di Novella et al. 2013
Sonchus oleraceus L. ASTERACEAE	Cardillo	Napoli	Phlegrean Fields Regional Park	Leaves	As a substitute for spinach in pizzas and soups.	Motti et al. 2009
	Cardilli	Salerno	Amalfi Coast		In salads.	Savo 2010
	Cardillo	Napoli	Aversa, Acerra		In soups or salads.	u.d.
	Cardillo	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania, S. Andrea del Garigliano, Ponte, Corigliano, Valogno	Leaves	Eaten raw or cooked in salads.	u.d.
	-	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2008
Sonchus tenerrimus L. ASTERACEAE	Cardilli	Benevento	Cirignano	Herbacesous parts, leaves	Eaten in salads before flowering.	u.d.
		Avellino	Roccabascerana	Herbacesous parts, leaves	Eaten in salad before flowering; boiled with beans.	u.d.
	Cardillo, Savuni	Napoli	Agro Nocerino Sarnese	Leaves	As a substitute for spinach in pizzas and soups.	Motti and Motti 2017
	Cardilli	Salerno	Amalfi Coast	Leaves	In salads.	Savo 2010
Sorbus domestica L. ROSACEAE	Suòrvu	Salerno	Castel San Lorenzo	Fruits	As dessert.	Salerno and Guarrera 2008

Sorbus domestica L. ROSACEAE	Suorvo, Sòrole, Suorivo, Suorevo selvatico, Sorbo, Sòreva, Sòrve, Suòrelo	Salerno	Monti Picentini Regional Park	Fruits	As dessert.	Savo et al. 2019
	Sovera	Napoli	Vesuvio National Park			Menale et al. 2016
Smilax aspera L. SMILACACEAE	-	Avellino	Baianese and Lauretana areas	Young shoots	Eaten like asparagus, pickled in vinegar.	De Rosa et al. 2008
Stellaria media (L.) Vill. s.l. CARYOPHYLLACEAE	Mbruvuglina	Avellino	Baianese and Lauretana areas	Leaves	In salads mixed with other herbs.	De Rosa et al. 2008
	Centocchio	Salerno	Monti Picentini Regional Park	Aerial part	In salads.	Savo et al. 2019
	Centocchio	Napoli	Acerra	Aerial part	Raw or boiled.	u.d.
Sulla coronaria (L.) Medik. FABACEAE	Sulla	Salerno	Monte Vesole e Ascea	Leaves	Additional ingredient of "*minestra*".	Scherrer et al. 2005
	Sorda	Salerno	Castel San Lorenzo	Tender tops	Cooked as a vegetable.	Salerno and Guarrera 2008
Taraxacum sp. ASTERACEAE	Custanzella, Cicoria	Napoli	Agro Nocerino Sarnese	Leaves	In soups.	Motti and Motti 2017
	Cicoria selvatica	Salerno	Cava de' Tirreni	Leaves	In salads or cooked in the "*minestra maritata*".	Mautone et al. 2019
	Cicorione, Cicurione, Tarassaco, Soffione, Ragno purcello, Cicoria, Spaccapreti, Piscialietti, Radicchio, Cicurioni, Cicorioni, Scarola selvatica	Salerno	Monti Picentini Regional Park	Basal leaves	Eaten in salads, soups, vegetable pie, as a cooked vegetable.	Savo et al. 2019

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Taraxacum fulvum Raunk. ASTERACEAE	Cicurione	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In the "*minestra terrana*".	Di Novella et al. 2013
Taraxacum officinale Weber ex F.H.Wigg. [*Taraxacum* sect. *Taraxacum* aggregate] ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Leaves, flowers, roots	As a component of the "minestra cotta" with: *Anthriscus cerefolium*, *Borago officinalis, Plantago* sp. pl., *Urtica dioica*. Preparation of liqueurs. Rosted roots used as coffee substitute.	De Rosa et al. 2008
	Custanzella	Napoli	Piano di Sorrento	Leaves	In salads.	
	Cecuta	Salerno	Monte Vesole e Ascea	Leaves	In soups.	Scherrer et al. 2005
	Rugno, Cicoria selvaggia	Benevento	Castelvetere in Val Fortore	Roots, leaves	Prepared and consumed like chicory, but with a less bitter taste. The leaves also used in salads.	u.d.
	Cicurione	Salerno	National Park of Cilento and Vallo di Diano	Aerial part	In the "*minestra terrana*".	Di Novella et al. 2013
	Cicoria	Napoli	Phlegrean Fields Regional Park	Leaves	In soups.	Motti et al. 2009
	Cicoria	Salerno	Amalfi Coast	Leaves		Savo 2010
	Cicorie selvagge	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Novi Velia, Vallo della Lucania, Cannalonga), Castelnuovo Cilento	Leaves	In salads.	u.d.
		Napoli	Acerra, Aversa, Boscoreale, Boscotrecase, Casalnuovo, Pompei, Terzigno, Trecase	Leaves		u.d.

Taraxacum officinale Weber ex F.H.Wigg. [*Taraxacum* sect. *Taraxacum* aggregate] ASTERACEAE	Cicorie selvagge	Caserta	Sessa Aurunca, Roccamonfina, Carinola, Cellole, Conca della Campania	Leaves	Eaten raw in salads or cooked.	u.d.
		Salerno	San Mauro Cilento	Flowers	Used to prepare a jelly. 400 g of inflorescences are boiled together with cloves and two lemon cut into pieces. Then, the product is filtered and 800 g of sugar are added; at the end, the product is boiled another time.	u.d.
Taxus baccata L. TAXACEAE	Tasso	Salerno	Monti Picentini Regional Park	False fruit (seed cord)	Eaten as fresh fruit.	Savo et al. 2019
Thymus longicaulis subsp. *longicaulis* C. Presl LAMIACEAE	Timo	Salerno	Amalfi Coast	Leaves	To season meat.	Savo 2010
Thymus spinulosus Ten. LAMIACEAE	Serapullo	Benevento	Cautano, Foiano Valfortore	Flowering tops collected in June-August	Known to be used exclusively in a preparation called sanguinaccio, based on pork blood with dried fruit, sultanas and cooked wine.	u.d.
Thymus striatus Vahl. LAMIACEAE	Timo	Salerno	Amalfi Coast	Leaves	To season meat.	Savo 2010
Thymus serpyllum L. (group.) LAMIACEAE	Timo, Serapullo, Timo selvatico	Salerno	Monti Picentini Regional Park	Aerial part	Used as a spice.	Savo et al. 2019
Trifolium pratense L. s.l. FABACEAE	-	Avellino	Baianese and Lauretana areas	Whole plant	In salads, cooked vegetables.	De Rosa et al. 2007
Tussilago farfara L. ASTERACEAE	Ogne 'e cavallo	Salerno	Montecorvino Rovella	Aerial parts	In soups, omelettes.	u.d.
	Cùcole	Salerno	Monti Picentini Regional Park	Shoots	In soups.	Savo et al. 2019

Ulmus minor Miller s.l. ULMACEAE	Olmo	Salerno	Monti Picentini Regional Park	Fruits	Eaten raw	Savo et al. 2019
Urospermum dalechampii (L.) F.W.Schmidt ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves	As a cooked vegetable.	De Rosa et al. 2007
Urospermum picroides (L.) Scop. ex Schmidt ASTERACEAE	-	Avellino	Baianese and Lauretana areas	Young leaves	As a cooked vegetable.	De Rosa et al. 2008
	Ogna purcedda	Salerno	Castel di San Lorenzo	Leaves	Eaten boiled	Salerno and Guarrera, 2008
	Sivone grasso, Svone grasso, Sovone grasso, Seone, Sevone	Salerno	Monti Picentini Regional Park	Basal leaves	As a cooked vegetable.	Savo et al. 2019
Urtica dioica L. s.l. URTICACEAE	-	Avellino	Mugnano del Cardinale	Leaves, stems	As a cooked vegetable. As a component of the "minestra cotta" with: *Anthriscus cerefolium*, *Borago officinalis, Plantago* sp. pl., *Taraxacum officinale.*	De Rosa et al. 2008
	Verdicole, Cudicole	Salerno	Monte Vesole e Ascea	Young leaves	Boiled and fried, used to fill pizza bread, or as a cream on pasta. Fodder for turkeys (boiled, cut and mixed with flour).	Scherrer et al. 2005
	Ardìca	Benevento	Apollosa, Castelvetere in Val Fortore	Whole plant	Cooked in a little water and then seasoned with olive oil.	u.d.
	Ardicola	Salerno	National Park of Cilento and Vallo di Diano	Tops	Tops, boiled and reheated with butter or garlic, eaten like asparagus.	La Palometa and Grieco 2003
	Ardica	Salerno	Cava de' Tirreni	Aerial part	Boiled and eaten in salads or with pasta.	Mautone et al. 2019
	Urdic	Avellino	Partenio Regional Park	Aerial part	In salads.	Menale and Muoio 2014

	Urdica, Ordica, Ardica, Burdiche, Bordiche, Ordiga, Urtiche, Bordica	Salerno	Monti Picentini Regional Park	Young leaves, shoots	In omelettes, pasta, vegetable pie, in soups, cooked vegetables.	Savo et al. 2019
	Ardìc	Napoli	Phlegrean Fields Regional Park	Leaves	Boiled and fried with pasta.	Motti et al. 2009
Urtica dioica L. s.l. URTICACEAE	Ardica	Salerno	Comunità Montana Gelbison-Cervati (Ceraso, Vallo della Lucania, Novi, Cannalonga, Gioi, Salento, Moio della Civitella, Perito, Orria), Castelnuovo Cilento	Aerial parts	In the past, together with *Cichorium intybus* and *Silybum marianum*, used to prepare a dish obtained heating them and frying with potatoes.	u.d.
	Ortica	Avellino	Monteverde	Aerial parts	Eaten boiled	u.d.
	Lardica	Napoli	Pompei, Boscoreale, Boscotrecase, Trecase, Terzigno	Young leaves	In salads or to prepare pancakes.	u.d.
	Ardeca	Salerno	Agro Nocerino Sarnese	Young leaves	In pizzas, soups and spaghetti.	Motti and Motti 2017
	Ardìc	Napoli	Phlegrean Fields Regional Park		Boiled and eaten in salads or with pasta.	Motti et al. 2009
	Verdicula	Salerno	San Mauro Cilento		To prepare the nettle salad, obtained with samples boiled and dressed with olive oil.	u.d.
Urtica membranacea Poir. URTICACEAE	Ardica	Napoli	Acerra, Aversa, Pomigliano	Leaves	Young leaves in omelettes and soups.	u.d.
	Ardica campanara, Evr' pugnicosa	Napoli	Ercolano, Torre del Greco, Portici		Young leaves in salads and pancakes.	u.d.
	Lardica campanara	Napoli	Pompei, Boscoreale, Boscotrecase, Trecase, Terzigno		Young leaves in salads and pancakes.	u.d.
	Ardica	Salerno	Cava de' Tirreni	Aerial part	Boiled and eaten in salads or with pasta.	Mautone et al. 2019
Urtica urens L. URTICACEAE	Urdic	Avellino	Partenio Regional Park	Aerial part	In salads.	Menale and Muoio 2014

Valerianella locusta (L.) Laterr. VALERIANACEAE	-	Avellino	Baianese and Lauretana areas	Leaves	In salads.	De Rosa et al. 2008
Veronica beccabunga L. PLANTAGINACEAE	Beccabunga	Benevento	Apollosa, Cautano, Foiano Valfortore	Flowers, leaves collected from June to August	In mixed salads.	u.d.

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The brute that never was, life and death of Neanderthal man

Marina Melchionna[1], Alessandro Mondanaro[2], Silvia Castiglione[1] and Pasquale Raia[1]*

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***Correspondence:**
pasquale.raia@unina.it
https://orcid.org/0000-0002-4593-8006
Affiliations:
1 Department of Earth, Environmental and Resources Sciences. University of Naples Federico II, Naples, Italy.
2 Department of Earth Science. University of Florence, Florence, Italy.

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Abstract

The scientific views upon life and death of *Homo neanderthalensis*, the closest species to *Homo sapiens* ever lived, changed continuously through time. Once considered a form of brutish, unintelligent and savage hominin, Neanderthals are now rightfully seen as a highly social, clever and ecologically plastic species, whose behavior must have been much closer to modern humans than we thought before. Extensive gene exchange between the two species and convincing evidence of imitation by Neanderthals of *H. sapiens* practices and technologies bolster this view, suggesting the interactions between the two were possibly untroubled. This casts serious doubts on the conventional opinion that *H. sapiens* could have violently exterminated Neanderthals. In contrast, the much stronger than ever evidence that Neanderthals were not a cold-loving species, and an increased awareness of the effect of climate change on extinction in hominins, reinforce the idea that *H. sapiens* did not cause their demise.

Keyword: *Homo neanderthalensis*, *Homo sapiens*, Cave art, Paleolithic intentional burials, climate change

Riassunto

Le opinioni scientifiche sulla vita e la morte dell'*Homo neanderthalensis*, la specie più vicina all'*Homo sapiens* mai vissuta, sono cambiate continuamente nel tempo. Una

volta considerati una forma di ominini brutale, poco intelligente e selvaggio, i Neanderthal sono ora giustamente visti come una specie altamente sociale, intelligente ed ecologicamente plastica, il cui comportamento deve essere stato molto più vicino agli esseri umani moderni di quanto pensassimo prima. L'ampio scambio genico tra le due specie e le prove convincenti dell'imitazione da parte dei Neanderthal delle pratiche e delle tecnologie di *H. sapiens* rafforzano questa visione, suggerendo che le interazioni tra le due erano forse senza problemi. Ciò solleva seri dubbi sull'opinione convenzionale che *H. sapiens* avrebbe potuto sterminare violentemente i Neanderthal. Al contrario, le prove molto più forti che mai che i Neanderthal non fossero una specie amante del freddo e una maggiore consapevolezza dell'effetto del cambiamento climatico sull'estinzione degli ominini, rafforzano l'idea che *H. sapiens* non ha causato la loro scomparsa.

Parole chiave: *Homo neanderthalensis*, *Homo sapiens*, arte rupestre, sepolture intenzionali paleolitiche, cambiamento climatico

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Neanderthals, *Homo neanderthalensis*, were the closest among our relatives. Contrary to the conventional history of most other members of the genus *Homo*, Neanderthals lived away from the African continent, residing in the cooler lands of northern Old World, where the species first findings were surprisingly unearthed back in the XIXth century.

Early descriptions of Neanderthals provided a misguided rendering of the species, closer to a violent caveman brandishing a club than to us, and thus unceremoniously evading any recognition that they were, in fact, nothing less than the second most intelligent species on Earth. This rough treatment of our cousins probably went hand on hand with the sappy feeling aroused at thinking they were, after all, humans. The anatomist Herman Shaaffausen, in his first ever description of Neanderthal remains in 1857 had to feel this sentiment when he stigmatized the findings as belonging to a "barbarous and savage race". Thomas Huxley was not any more light-hearted at regarding the skull found in Neander valley as "the most pithecoid [i.e. ape-like] of known human skulls". The German pathologist Rudolph Virchow even went one step further, dismissing the idea that Neanderthals were on our bloodline altogether, and dubbing the remains as belonged to an unfortunate, heavily

pathological old *Homo sapiens* individual (Rosen 1977). These denials recall to mind Queen Victoria's mixed sense of disgust and kinship at visiting London zoo in 1842, when she asked to move a female orangutan away from her sight uttering the infamous "frightful, and painfully, and disagreeably human" words. Similarly familiar sound the repeated attempts to demote the finding of an extraordinarily small-brained dwarf species of *Homo* on Flores islands as a legitimate, recent member of our kind (Hershkovitz et al., 2007; Obendorf et al., 2008). In a curious twist of fate, *Homo floresiensis* was regarded as a pathological member of our own species, an idea that Virchow would have appreciated. Today paleoanthropologists look at a much brighter side of Neanderthals. The species is now recognized as highly social, intelligent, plastic and endowed with exquisitely human cognitive characteristics, from healthcare practices delivered to the sick to art production (Spikins et al., 2018).

The fossil record of Neanderthals includes several individuals fraught with injuries or bone fractures they managed to survive with the help of their peers. The healthcare practices concerned not only injured individuals but also those with long-term, non-communicable diseases. An adult male aged between 25 and 40, found at La Chapelle-Aux-Saints (France), was suffering from chronic periodontal disease, extensive tooth loss, severe osteoarthritis in lower cervical and upper thoracic vertebrae, moderate to severe degeneration of lower thoracic vertebrae, osteoarthritis in both shoulder joints, and a rib fracture in the mid-thoracic region, at the time of his death. Survival with so many different severe conditions must have required direct support during health crisis, hygiene maintenance, manipulation and feeding to an extent to "ensure that he was not left behind when the group moved camp" (Spikins et al., 2018). The skeleton of a male individual aged around forty found at La Ferrassie (France), shows minor periodontal pathology, with abscesses of the left mandible and resorption, minor osteoarthritic changes to the lower spine and right elbow joint, a healed fracture of the great trochanter of the right femur, and the presence of active systemic disease at the time of his death. Like the La Chapelle-Aux-Saints individual, this man must have received continuous assistance for years. In terms of healthcare and personal hygiene, the presence of interproximal grooves in the teeth supports the use of toothpicks, as suggested by Spikins et al. (2018). Also, a poplar present in a dental calculus of a Neanderthal from El Sidrón in Spain, with a dental abscess demonstrates the likely use of painkillers in the form of salicylic acid (Weyrich et al., 2017).

As argued by Spikins et al. (2018), "strong bonds provide a social buffer against individual shortfalls in resources, health or capacity to raise young and provide a distinct evolutionary advantage"; also, "for Neanderthals food sharing, hunting, childcare and healthcare are likely to have been inseparable elements of social relationships based on strong social bonds and willingness to take risks and give up time or resources to improve others'

survival". In this sense, the El Sidrón assemblage represents a perfect example of group-living in Neanderthals, with no less than thirteen different individuals, including seven adults, three adolescents, two juveniles and one infant, living together.

What emerges from the fossil record is that Neanderthals indubitably lived physically challenging lives but that was not too different from what modern hunter-gatherers are used to. What appears to be proven beyond doubt, is that Neanderthals' infant corpses received a lot of attention from the elders. Peculiar examples of this are found at La Ferrassie, in which two newborns were founded buried in oval depressions (Heim 1982), or the bodies founded at Sima de las Palomas (Spain), where a young Neanderthal woman and a child were possibly deposited, rather than casually found, with flexed knees and elbows, and the hands raised up beside the face (Walker et al., 2012). Additional evidence of similar burials was yielded at Vindija and Krapina (Croatia), Mezmaiskaya (Russia), Teshnik-Tash (Uzbekistan), Amud, Le Moustier and Roc de Marsal (France) and Dederiyeh (Siria, reviewed in Spikins et al., 2014). Peculiarly, flint scrapers at La Ferrassie, goat horns at Teshnik-Tash (Uzbekistan) and a red deer maxilla in Amud Cave (France) could have been intentionally associated to the burial. Of course, kids were paid great attention well before death by Neanderthals, as suggested by flints knapped by unexpert individuals at the Grotte du Renne at Arcy-sur-Cure (France; Bodu 1990), or the artistic artifact (a protofigurine representing a face) probably made as a toy for the kids at La Roche-Cotard (France; Marquet & Lorblanchet 2003). The reality and extent of Neanderthalian art is hotly debated. At Gorham's cave (Gibraltar) one of the cave walls is adorned with a criss-cross engraving showing geometric regularity, akin a similar finding at Blombos cave (South Africa) made by *H. sapiens* (Simón Vallejo et al., 2018). Even more impressive, and undeniably Neanderthalian, are the 'sculptures' of Bruniquel in France, two huge circles made with stalagmites bottoms. What is fascinating about Bruniquel is that Neanderthals appear to have selected pieces of stalagmites that had similar lengths, suggesting they cared the aesthetics of the final product (Jaubert et al., 2016). Pike et al. (2012) dated a stencil present in El Castillo cave in Spain, the famous Panel de las manos to find that the stencil of a hand could have an age of 40 ka, meaning it is mostly compatible with Neanderthals. Yet, debate about the age estimate of the radiometric method adopted by the authors is mounting (White et al., 2019). At Shanidar Cave in Iraq, one of the individuals was found in what appear as an intentional burial, surrounded by pollen of different flowering plants, suggesting flowers adorned the corpse of this individual as a burial ritual (Pomeroy et al., 2020).

Oscar Wilde once famously said that Art, all art, is quite useless. Making useless objects that take nonetheless days of work to complete, like a mask figurine made out of flint carving or moving hundreds of kilograms of solid rock in the form of stalagmites only to make circles are tasks individuals living a dire life, under unimaginably hard conditions, are only

afforded to do if they are, cognitively speaking, like us. And Neanderthals were more like us than the hand stencils or natural painkillers would suggest. Shockingly, they are within us. From 2010, is known beyond doubt that a variable number of Neanderthals genes (depending on which human ethnic group is sampled) is present in modern-day, non-African *Homo sapiens* (Green et al., 2010). This discovery, independently confirmed by several studies, indicates that Neanderthals and humans had frequent intercourses, quite an accomplishment for a "barbarous and savage race". And yet, these smart, adaptable individuals of our own kind, which were as good as to produce tar heating birch bark to attach points on spears (Roebroeks & Soressi 2016), use painkillers (Weyrich et al., 2017), change diet upon necessity, spanning from hunting to fishing and seafood consumption (Zilhão et al., 2020), were among the three human species that conquered the world by means of culture (Mondanaro et al., 2020) and whose brains where exceedingly large and asymmetric just like ours (Melchionna et al., 2020), did not manage to survive to the present day.

In the past, scientists were used to think Neanderthals fell victim to the rampant peopling of Europe by *H. sapiens*. This view constitutes an almost textbook example of competitive exclusion, with a superior competitor displacing the underdog. This old-fashioned idea, however, failed to pass reality check. On the one hand, gene flow between the two species suggests most encounters were not conflictual. The competitive exclusion idea probably rests on the undeclared assumption that we humans *must* have been the culprit, although there is not a single archaeological evidence of aggressive confrontation (e.g. Neanderthal skulls bearing unhealed wounds left by *H. sapiens* stone tools, Neanderthal bones butchered by *H. sapiens*). On the other hand, the most likely alternative to competition for explaining the extinction of Neanderthals, that is climate change, was habitually underplayed. Neanderthals were traditionally regarded as adapted to the cold. Their short limb extremities and large narial openings were thought to preserve heat loss and humidity (Holliday 1997; Steegmann et al., 2002). However, more recent studies have questioned the adaptive significance of these traits (Lacruz et al., 2019), and neither them, nor Neanderthals' advanced cognitive skills, made them capable to survive through the last glaciation (Rae et al., 2011; Benito et al., 2017; Melchionna et al., 2018). The observation that the presumed to be cold-adapted Neanderthals could not make it to the last glacial maximum makes climate change a serious candidate as the extinction driver. Melchionna et al. (2018) inferred climatic niches of *H. neanderthalensis* and *H. sapiens* trough Species Distribution Modelling (SDM), taking in consideration a time span that comprises the occurrences of both species that lived for a certain time (60 – 36 ka) in the same area. Their main targets were to understand whether the 'cold-loving' assumption about Neanderthals is correct, and if there were some superimpositions in the niches of the two species. They found that, although there was a clear overlap

between the two human species, the habitable habitat patches for Neanderthals crumbled in small and isolated areas just prior to its extinction, pushing the species into an extinction vortex. Indeed, climate change, rather than competition, seems to have been the main extinction driver for extinction in other *Homo* species as well (Raia et al., 2020).

After 400 kilo years of revered existence, *H. neanderthalensis* found its last stand in Europe some 40 ka (Higham et al., 2014), but its legacy, and even its genes, still live and thrive today, deep in our minds and bodies.

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Author contributions

All authors have contributed equally.

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