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The traditional food use of wild vegetables in Apulia (Italy) in the light of Italian ethnobotanical literature

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Abstract

In this work, we present a summary of an ethnobotanical research carried out in the whole Administrative Region of Apulia (southern Italy). The main topic of the investigation is the traditional knowledge about wild plants, focusing on their common names, on which parts were used in cooking and how they were used. The main aim was to establish a botanical knowledge about these culinary uses through a systematic identification of the species involved, directly in the field. In addition to this, we focused on the ecological aspects of these species and on their biological and chorological forms. Results suggest the existence of very strong ties between the local communities and this particular flora, without substantial differences between rural and urban areas or among different zones of the Apulia Region. On the other hand, in each area we found peculiar food uses, species, parts used, and recipes. The analysed wild plants still have a fundamental role in the local diet, which can predominantly be ascribed to the Mediterranean model. Moreover, we documented an increasing interest in the culinary uses of these species: in the Gargano area, for instance, more and more cultivations of *Salicornia perennans* Willd. subsp. *perennans* are underway thanks to the demand coming from restaurants. In total, we documented 214 taxa (58 families) and at least 19 of them are enduring components of the local diet. Nineteen species represent a high number, considering that the tertiary sector is nowadays predominant in Apulia (73.5 % of the local GDP, compared to 73.2 % in Italy as a whole). Furthermore, the total amount of wild species used as food is the highest in Italy, according to the Italian ethnobotanical literature. On the same basis, we were able to draft a national checklist of 539 taxa documenting the taxonomy of the wild plants involved in traditional food use in Italy, categorized by regions. In conclusion, this work shows that the available literature regarding the Italian territory provides only a partial representation of traditional food uses, even though they are widespread throughout the country. Consequently, this tradition remains to be thoroughly investigated.

Keywords
Ethnobotany, Wild Food Plants, Apulia, Italy

Introduction

The first major botanical work on the spontaneous Italian flora traditionally used for food purposes dates back to the 1980s (Aliotta 1987). For the first time, the spontaneous species that still had food use were described, with a focus on used parts and culinary preparations. Aliotta also listed the fruits and the spices (species with aromatic properties) people used. Only recently, a database has been published (Guarrera 2006b), describing the state of the art on folk uses (food use, too) of wild plants. The data is very heterogeneous and was collected in different years. Subsequently researches have been focusing on food uses thanks to which have a general overview of the species of food use characterizing the Italian tradition (Ghirardini et al. 2007, Caneva et al. 2013). In total, we acknowledge 828 edible units (Camangi et al. 2013) of this kind, which constitute more than 50 % of the ca. 1600 species reported for the whole European continent (Couplan 2009). This high number also includes fruits (even cultivated species) and plant parts used for flavouring preparations or for liquors. In the present work, we chose to consider only the spontaneous species and, in particular, those used as "vegetables", whose parts are harvested in large amounts (especially leaves) and used as fundamental ingredients in the main meals of a regular day. Therefore, we excluded fruits and aromatic plants, e.g., *Origanum heracleoticum* L., from our study. Also, the number of plants considered in the work by Camangi et al. (2013) does not fully account for inter- and intra-specific variability, because very often species belonging to the same genus or similar species were put together and, in some cases, only the genus was indicated. In conclusion, knowledge about food uses of plants is still restricted, even on a regional scale, despite thorough investigations have been conducted in central and northern Italy, namely in Piemonte (Mattirolo et al. 2001, Gibelli 2004, Pieroni and Giusti 2009), Toscana (Corsi and Pagni 1979, Pieroni 2000, Giusti and Pieroni 2009, Signorini et al. 2007, Camangi et al. 2007), and Lazio (Guarrera 1994, 2006b). A major comparative study about this tradition was also performed in southern Italy (Guarrera and Leporatti 2007) and some recent investigations about food use of wild plants were conducted in some areas of Basilicata (Cassandra and Pieroni 2015, Sansanelli et al. 2017) and in Sicilia (Aleo et al. 2013). Very recently, Regional data was released for Sardegna (Camarda et al. 2017) and Umbria (Ranfa and Bodesmo 2017).

Ethnobotanical research work in Apulia is still scarce and even less is known about food uses. What we know is due to very few studies (Corrain 1962, Picchi and Pieroni 2005, Guarrera 2006a, Leporatti and Guarrera 2007, Accogli and Marchiori 2009, Nardone et al. 2012) and, only recently, some of them have specifically considered food uses (Biscotti 2012, Biscotti and Pieroni 2015). Therefore, we acknowledged the strong need for an investigation about food uses of wild plants in the entire Region.

Materials and methods

Selected area

Apulia (Figure 1) is characterised by a predominantly flat territory (53.2 % lowlands, 43.5 % hills, 1.5 % mountains). The macrobioclimate is essentially Mediterranean (Rivas Martinez 1996, Pesaresi et al. 2014) throughout the Region, with the exception of the central part of Gargano, which has a temperate climate. The mountains (Murge, Serre Salentine, Gargano promontory) and the long coasts lead to different bioclimates, ranging from the Upper Thermomediterranean in Salento to the Lower Supra-temperate in Gargano (Biondi et al. 2008). Indeed, Apulia is a very interesting Region because of its biogeography, given that the Eastern Mediterranean flora and the peninsular flora meet here (Trotter 1913, Francini Corti 1966). From a vegetational point of view, the great potential of the Region is clearly represented by its holm oak (*Quercus ilex* L.) forests (Biondi et al. 2004). Morover, the Turkey oak (*Quercus cerris* L.) and European beech (*Fagus sylvatica* L.) forests that one finds in Gargano are quite unique (Biondi et al. 2008).

The tertiary sector is nowadays predominant in Apulia (73.5 % of the local GDP, compared to 73.2 % for Italy as a whole), followed by the secondary industry (14.4 % of the local GDP compared to 12.2 % for southern Italy and 18.5 % for the whole country) (IPRES 2016). Tourism is relevant too: in 2015, the number of tourists visiting the Region was more than 3 million, with people coming from Germany, UK, France, and predominantly Russia (Agenzia Regionale per il Turismo, 2015). According to a study by UVAL-UVER-ISTAT (2012) the quality of life is not homogeneous , especially in terms of services, like public transport, education, and so on. In fact, the so-called "advanced" Apulia can be found only in a few areas, e.g., the Tavoliere delle Puglie area (Foggia), the Barletta-Trani area, the coast going from Bari to Brindisi, the Valle d'Itria area, and the surroundings of Lecce and Taranto. So-called belt-municipalities (Terra di Bari, the near-Murgia belt and the Lecce and Taranto areas) are common here. Moreover, one can distinguish intermediate municipalities and outlying districts (Monti Dauni, Murge, southern Salento). Finally there are territories defined as "ultra-outlying", such as the Gargano area. Based on these data, the predominant - and probably hidden - composition of the Region consists of small villages, increasingly subjected to a marginalization process characterised by demographic decline, high unemployment rate, and so on. A crucial role is played by the distance between these villages and the nearby cities, in which the tertiary industry is mainly localised. Interestingly, Apulia is still strongly dependent on agriculture and is even leader in this field thanks to some of its local products. Consequently, the communities living here, even in the cities, still reveal some aspects of the rural way of life.

Field study

In our investigations, we explored the entire Regional territory over a period of six years (2011–2017) examining 15 different communities, here defined as learning areas, at

Figure 1. Study area: Apulia region (Southern Italy).

the same time. They are representative of the eight economic-territorial systems of the region (Figure 2) as defined by the aforementioned UVAL-UVER-ISTAT (2012) study. The municipalities included in each of the learning areas and their territorial systems are listed in the supplementary Suppl. material 1: Table S1. On average, 30 individuals were interviewed for each area and up to 450 people constituted the entire sample falling within the following age groups: 60 % aged 50–90, 25 % 40–49, and 15 % 20–39. As for gender, women constitute 59 % of the sample. They are professionals, public employees, retired people, peasants, caterers, local experts, and common consumers. Several were local botanists and researchers. The interviews were carried out according to the ethnobotanical research methods (Camarda et al. 2005; Signorini et al. 2013). Thanks to these testimonies we were able to identify the sites where the wild plants were harvested. Finally, in same sites, we conducted floristic relevés in order to understand the ecological dynamics in which the plants are involved and to assess the degree of availability of the species.

The plant species that the informers told us about were identified according to Pignatti (1982). As for the nomenclature, we followed Bartolucci et al. (2018) and Galasso et al. (2018). Finally, samples of some of the species are now preserved in the *Herbarium Anconitanum* ANC (Marche Polytechnic University).

We analysed all the species that are traditionally used for culinary purposes, including those which are no longer used, but that can still be easily found in the literature and in

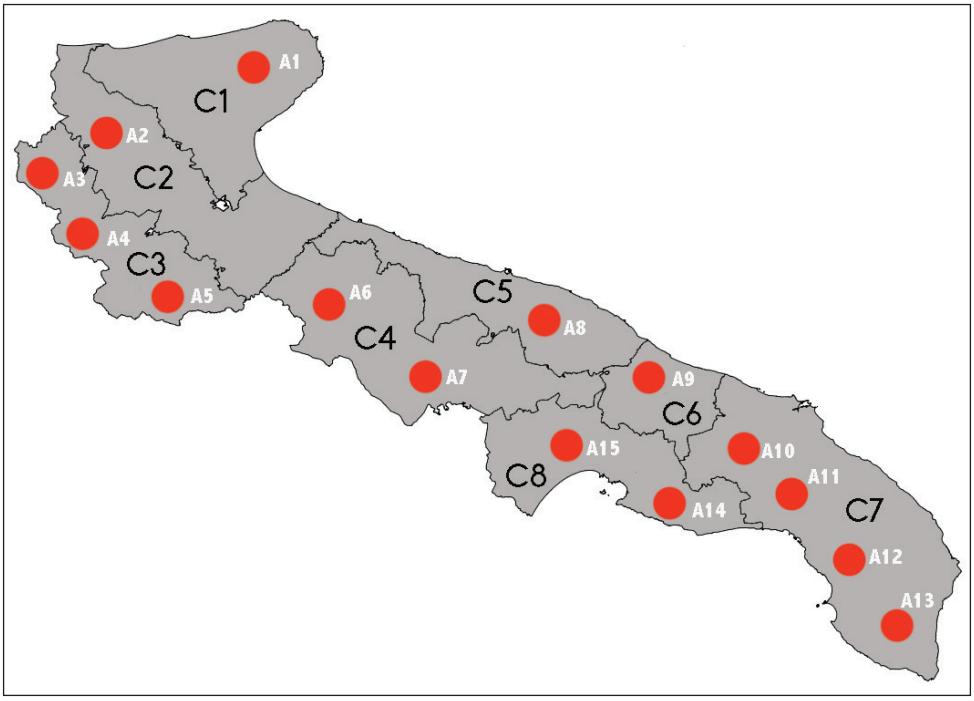

Figure 2. In the background the Apulian districts: Gargano (**C1**), Tavoliere delle Puglia (**C2**), Dauni Mountains for the province of Foggia (**C3**); Land of Bari murgiana (**C4**) and Terra di Bari (**C5**) for the province of Barletta-Andria-Trani and Bari; Valle d'Itria (**C6**) and Salento for the province of Brindisi and Lecce (**C7**); Ionic tarantine arch for the province of Taranto (**C8**). In the foreground red areas the study areas (15) for each district.

oral testimonies. The recorded species are listed in the supplementary Suppl. material 1: Table S2, which has been structured following ethnobotanical criteria, as previously used in research on Apulia (Biscotti and Pieroni 2015): local names, used parts, traditional culinary uses, frequency of citation [VC – very common: quoted by 40 % (n = 180) of the informants or more; C – common: quoted by 10–39 % (n = 45-179) of the informants; R – rare: quoted by less than 10 % (n = 1–44) of the informants; A – disused].

For a deeper understanding of the findings, we consulted the ethnobotanical bibliography that considered food uses in Italy. Apart from the database of Guarrera (2006b), the fundamental literature has been: Abruzzo (Manzi 1987, 1999, Idolo et al. 2010); Basilicata (Giusti et al. 2002, Pieroni et al. 2005, Guarrera et al. 2006, Cassandra and Pieroni 2015); Calabria (Passalacqua et al. 2006, Nebel et al. 2006); Campania (Scherrer et al. 2005, De Natale et al. 2009, Salerno and Guarrera 2008, Motti et al. 2009, Guarino et al. 2008); Emilia-Romagna (Sansanelli et al. 2014); Friuli Venezia Giulia (Paoletti et al. 1995, Dreon and Paoletti 2009, Cassandra and Pieroni 2015); Lazio (Guarrera 1994); Liguria (Bisio and Minuto 1999, Maccioni et al. 2004); Molise (Menale et al. 2006, di Tizio et al. 2012); Piemonte (Mattirolo et al. 2001, Gibelli 2004, Pieroni and Giusti 2009); Puglia (Corrain 1962, Picchi and Pieroni 2005, Guarrera 2006a, Leporatti and

Guarrera 2007, Accogli and Marchiori 2009, Nardone et al. 2012, Biscotti and Pieroni, 2015); Sardegna (Lancioni et al. 2007, Signorini et al. 2009, Camarda et al. 2017); Sicilia (Lentini and Venza 2007, Arcidiacono et al. 2010, Aleo et al. 2013); Toscana (Corsi and Pagni 1979, Pieroni 2000, Camangi et al. 2007, Signorini et al. 2007, Giusti and Pieroni 2009); Umbria (Ranfa et al. 2013; Ranfa and Bodesmo 2017); Veneto (Zuin 2010). We drew up a checklist (Suppl. material 1: Table S3) showing all the species found in the literature with their family (Peruzzi 2010), biological form, chorotype (Pignatti 1982) and the Regions in which they are used as food. The abbreviations used for the names of the Regions are: ABR (Abruzzo), BAS (Basilicata), CAL (Calabria), CAM (Campania), EMR (Emilia-Romagna), FVG (Friuli Venezia Giulia), LAZ (Lazio), LIG (Liguria), LOM (Lombardia), MAR (Marche), MOL (Molise), PIE (Piemonte), PUG (Puglia), SAR (Sardegna), SIC (Sicilia), TOS (Toscana), TAA (Trentino-Alto Adige), UMB (Umbria), VDA (Aosta Valley), VEN (Veneto) (Conti et al. 2005). As for the nomenclatural controversies, they were resolved according to The Plant List (http://www.theplantlist).

Data analysis

Based on data listed in the supplementary Suppl. material 1: Tables S2 and S3 we assembled two datasets with presence/absence data of 214 taxa × 8 districts (Apulian data) and 539 taxa × 19 regions (Italian data), respectively. We then obtained a dissimilarity matrix for each dataset by applying the function *vegdist* of the *vegan* package (Oksanen et al. 2015), method *jac*, in the open source software R (R Development Core Team 2015) and finally we conducted a cluster analysis with the function *hclust*, method *complete linkage* of the same package. The groups were visually seen with the *rect.hclust* function (k = 6). Finally, we used Venn diagrams to give a visual representation of the similarities.

Results

The species traditionally used in Apulia can be classified in 214 taxa, 201 specific and 13 subspecific (Suppl. material 1: Table S2), 42 of which are only used in this Region. Some of these 42 species belong to the genera *Allium* (*A. atroviolaceum* Boiss., *A. pendulinum* Ten.), *Crepis* (*C. apula* (Fiori) Babc., *C. rubra* L., *C. zacintha* (L.) Babc.), *Carduus* (*C. chrysacanthus* Ten., *C. nutans* subsp. *micropterus* (Borbás) Hayek, *C. nutans* subsp. *scabrisquamus* Arènes). Other species are typical of temperate forests (*Pulmonaria vallarsae* subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi). Some others belong to the complex genus *Taraxacum* (*T.* sect. *Erythrosperma* (H.Lindb.) Dahlst., *T.* sect. *Obovata* Soest, *T.* sect. *Scariosa* Hand.-Mazz.). Overall, we documented the use of species belonging to 58 families. Seventy-nine of our taxa are Asteraceae, closely followed by Brassicaceae and Apiaceae. These two families include several species commonly referred to as wild fennels, wild broccoli raabs, and wild celeries.

From a chorological point of view, most of the species are Steno-Mediterranean (26 %) and Euri-mediterranean (23 %). Strikingly, we found 67 species used only in one learning area. Seventy-four taxa are widely known throughout the Region, as expressed by their Frequency of Citation, and at least 19 of them are used in all the districts. Therefore, each community has followed very different paths in the process of using plants for food while the few species used everywhere [*Asparagus acutifolius*, *Diplotaxis tenuifolia* (L.) DC., *Muscari comosum* (L.) Mill., *Papaver rhoeas* L., *Helminthotheca echioides* (L.) Holub, *Scolymus hispanicus* Desf., *Sonchus asper* (L.) Hill, *Urospermum picroides* (L.) F.W.Schmidt] can now be acknowledged as the most characteristic food species for the Apulian tradition. Moreover, it is on a culinary level that biocultural differences proved to be stronger: what really differentiates the communities, in fact, is the role of the food taxa, e.g., whether it is used in association with pasta, with meat or with bread. We found many unique preparations here, such as the use of wild greens as ingredients of eel-based [*Taraxacum* sect. *Obovata*, *T.* sect. *Erythrosperma*] or lake fish-based [*Sonchus maritimus* L., *Tripolium pannonicum* (Jacq.) Dobrocz. s.l.] soups.

Culinary uses are many (around 20) and varied, as further proof of the great experimentation conducted in the search for raw materials and new recipes by the people inhabiting this land. Most commonly, they boil mixtures of plants, either alone or with stale bread ("pancotti"), and then dress them with abundant olive oil. In Monti Dauni (near Foggia), these mixtures are accompanied by fried bacon. The association of some of the recorded species [e.g., *Sonchus asper*, *Diplotaxis erucoides* (L.) DC., *Urospermum picroides*, *Foeniculum vulgare Mill.* subsp. *piperitum* (Ucria) Coutinho, *Scolymus hispanicus*] with homemade pasta is remarkable. We can now say that this fundamental association is very likely the basis of Apulian cooking. Indeed, one of the most characteristic dishes here is a type of pasta ("orecchiette") with broccoli raab.

Meat is widely used in recipes with wild plants too: for example, young leaves of *Eryngium campestre* L. are cooked with lamb. Furthermore, people use leaf stalks of *Sylibum marianum* (L.) Gaertn. in a veal stew, bulbs of *Muscari comosum* in lamb or goat casseroles, and leaves of *Urospermum dalechampii* (L.) F.W.Schmidt with sheep (local name of the recipe: "u callaridde"). Legumes are part of several recipes as well: fava beans, for instance, are cooked with *Sonchus asper* or *Urospermum picroides*. Dried beans, instead, are found in recipes having leaves of *Taraxacum* sp.

Finally, we documented a very common use of boiled *Salicornia fruticosa* L. and *Salicornia perennans* Willd. subsp. *perennans* either alone or as side dish in fish recipes. Recently, interest towards *Salicornia* sp. (salicornie, in Italian) has risen dramatically, especially in the Gargano area. We recorded other relevant uses of plants in fried recipes and omelettes. Wild greens are also stir-fried with olive oil and chilli, or roasted. For instance, shoots of *Smyrnium olusatrum* L. or young shoots of *Orobanche crenata* Forssk. are fried alone, while leaves of *Cichorium intybus* L. are fried with garlic and onion. On the contrary, leaves and young aerial parts of *Dioscorea communis* (L.) Caddick & Wilkin and *Asparagus acutifolius*, and bulbs of *Muscari comosum* are main ingredients of omelettes. Leaves of *Papaver rhoeas* and *Rumex acetosa* L. are stir-fried with

olive oil and chilli in Salento (local name of the recipe: "Paparina infuocata"). Tubers of *Asphodelus ramosus* L. or cloves of *Oxalis pes-caprae* L. are substitutes for potatoes in casseroles and roasts. Bulbs of *Allium ampeloprasum* L. are roasted, either directly or in hot ashes. Wild plants are commonly used as ingredients for salads or eaten raw as a snack with bread [leaves of *Helosciadium nodiflorum* (L.) W.D.J.Koch*, Allium ampeloprasum, Cerinthe major* L., *Diplotaxis tenuifolia, Diplotaxis viminea* (L.) DC., *Podospermum lacinatum* (L.) DC. subsp. *decumbens* (Guss.) Gemeinholzer & Greuter, *Portulaca oleracea* L., *Reichardia picroides* (L.) Roth*, Rorippa sylvestris* (L.) Besser*, Sonchus asper, Smyrnium olusatrum, Poterium sanguisorba* L., *Seseli tortuosum* L., *Dioscorea communis*]. Leaves of medicinal plants (*Ruscus aculeatus* L.*, Dioscorea communis*), even those containing toxic compounds, are ingredients of soups and fried recipes (mostly they are stir-fried with olive oil and chilli). For example, young shoots of *Clematis vitalba* L. and *C. flammula* L. are used as food in the areas of Foggia and Bari and inthose of Lecce and Taranto, respectively.

From our literature survey, we report as unique the use of eating the stem marrow of *Silybum marianum* raw with salt, as usually done with celery. Several recipes listed here are fundamental to Apulian cooking and very often they are consumed during religious holidays, to which the local communities are still strongly tied. In general, the custom of using wild plants as food remains alive and it is very common to see wild plant-harvesters selling their "products" on the roadsides and in the local markets, mostly in the Foggia area, but also around Bari and Brindisi. These vendors are called "terrazzani" (Capozzi 2004) in Foggia and San Severo and mostly they sell *Asparagus officinalis* L.*, Salicornia fruticosa* L., *Salicornia perennans* Willd. subsp. *perennans, Scolymus hispanicus, Orobanche crenata, Sonchus* sp., and *Muscari comosum*.

According to the informers we interviewed, consumers' fear of a residual presence of pesticides and other chemicals used in agriculture (flatlands around Foggia, Bari, Barletta, and Brindisi) is now a major factor in the reported lowering of wild plant harvesting. We also observed a reduction in the number of wild plants caused by the modernization of cropping patterns. Several wild species have found "refuge" in urban habitats, therefore becoming a fundamental part of the urban flora. However, it is still common to see (Gargano, Monti Dauni, Murge, Salento) people harvesting wild plants along the roadside and in wheat fields.

In Apulia, dialect names for plants are diverse, and can vary between neighbouring communities. Strikingly, 19 different local names were recorded for *Borago officinalis* L.: borrascine, burrasciana, burraccèlle, burraccedde, burrascina, burraccia, burracchia, burrascene, borracce, burracce, ferrascene, murraine, pezze de iarde, sucamele, verrascene, vorraine, vurraine, vurrascene, and verrascene, and 18 for *Muscari comosum*: ampascioni, bambasciale, bembascioele, cipudduzze, embasciole, jampasiune, lampascione, lampasciune, lambasciune, lambagione, lambascione, pampasciune, lembascione, pampascione, pampasciulu, pampascene, vambasciule and vampasciuli.

In our literature survey, we found a large number of species used for food throughout Italian Regions. However, only four (Table 1) are used everywhere: *Portulaca oleracea, Silybum marianum, Borago officinalis*, and *Cichorium intybus*. *Papaver rhoeas, Son-*

Table 1. Species with higher frequency in Italian regions.

Scientific name	Regional frequency
Borago officinalis L.	20
Cichorium intybus L.	20
Portulaca oleracea L.	20
Silybum marianum (L.) Gaertn.	20
Papaver rhoeas L.	19
Sonchus oleraceus L.	19
Taraxacum F.H.Wigg. sect. *Taraxacum*	18
Urtica dioica L.	18
Asparagus acutifolius L.	17
Capsella bursa-pastoris (L.) Medik.	15
Clematis vitalba L.	15
Humulus lupulus L.	15

chus oleraceus, and *Asparagus acutifolius* are used in 19, 18, and 17 Regions, respectively. Based on their frequency, *Silene vulgaris*, *Valerianella locusta,* and *Nasturtium officinale* R.Br. are representative of the tradition of northern Italy. Less frequent, but still typical, are *Chenopodium album* L. s.l., *Humulus lupulus* L., *Primula vulgaris* Huds., and *Salvia pratensis* L. Instead, *Capsella bursa-pastoris* (L.) Medik*., Chondrilla juncea* L., *Clematis vitalba, Cynara cardunculus* L. subsp. *cardunculus*, *Foeniculum vulgare* subsp. *piperitum*, *Reichardia picroides*, *Ruscus aculeatus*, *Rumex acetosa*, and *Urospermum dalechampii* are representative of central and southern Italy (species listed in decreasing order of frequency).

We noted that 241 taxa (44 % of the total) are used, each one, in just one Region, as a further proof of the extremely diversified culinary uses of wild plants in Italy. The number of taxa for each Region is shown in Fig. 3. Some species are non-native (e.g., *Agave* sp., *Robinia pseudoacacia* L.), while most belong to the Italian flora. Among the latter, species representative of the Italian phytogeographical diversity are: *Allium atroviolaceum* Boiss. (Apulia); *A. neapolitanum* Cirillo (Umbria); *A. ascalonicum* L. (Friuli Venezia Giulia); the genus *Lathyrus*, e.g., *L. articulatus* L., *L. ochrus* (L.) DC., *L. odoratus* L., and *L. sylvestris* L., in Sicily; *Ranunculus bulbosus* L., *R. lanuginosus* L., and *R. sardous* Crantz in Abruzzo, Sardegna, and Toscana, respectively; Iridaceae (*Moraea sisyrinchium* (L.) Ker Gawl.) in Basilicata; finally, species of the Violaceae, such as *Viola alba* Besser subsp. *dehnhardtii* (Ten.) W.Becker in Toscana, *V. mirabilis* L. in Friuli Venezia Giulia, and *V. reichenbachiana* Jordan ex Boreau in Liguria.

We also observed several peculiarities in terms of species and culinary uses: for instance, in Friuli Venezia Giulia *Equisetum arvense* L. and *E. telmateia* Ehrh. are used as components of mixtures. Leaves of *Asplenium ruta-muraria* L. are cooked with corn flour and eaten accompanied by milk. Interestingly, leaves of *Ficaria verna* Huds. (a toxic species) are eaten raw in salads (Dreon and Paoletti 2009) and the same occurs with *Lactuca virosa* L. in Basilicata (Sansanelli et al. 2017). In Umbria, *Rhagadiolus stellatus* rhizomes are also eaten (Ranfa and Bodesmo 2017). Instead, Sicilians tradi-

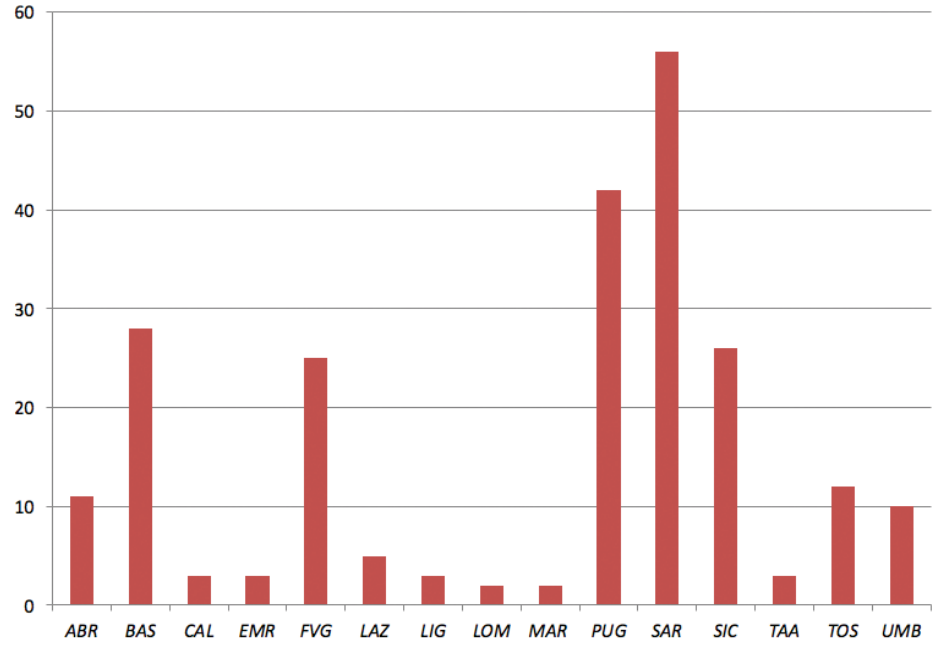

Figure 3. Number of exclusive wild taxa used as food for each region.

tionally roast bulbs and rhizomes of *Oxalis pes-caprae* (local names: castagnole and pinnuneddi, respectively) and boil leaves of *Lycium europaeum* L. (Arcidiacono et al. 2010). In Molise, leaves of *Urtica dioica* L. are boiled and eaten with ricotta cheese (di Tizio et al. 2012). In Basilicata, they grill roots of *Daucus carota* subsp. *carota* (Pieroni et al. 2005). The same is true for the stems of *Hermodactylus tuberosus* (L.) Salisb. in Sicily (Lentini and Venza 2007) and for *Asphodeline lutea* (L.) Rchb. and *A. liburnica* (Scop.) Rchb. in Apulia (Biscotti 2012). Also peculiar of the Italian tradition is the use of wild greens eaten raw with bread, often the lunch of local farmers. In fact, wild plants are commonly used in salads, according to the Italian "insalatiera" tradition (Firpo 1974); some species are basic components, such as *Portulaca oleracea*, while others are unique in the ethnobotanical literature, e.g., roots of *Onopordum illyricum* L., leaves of *Lactuca viminea* (L.) C.Presl, *Reseda alba* L. (Nebel et al. 2006), *Campanula rapunculus* L. (Ranfa and Bodesmo 2017), and *Podospermum laciniatum* subsp. *decumbens* (Biscotti 2012) and shoots of *Limbarda crithmoides* (L.) Dumort. s.l. (Scherrer et al. 2005).

Discussion

The flora traditionally used for food purposes in Puglia on the chorological level, is consistent with the flora of the region (Marchiori et al. 2000). At family level compared with the national data, interestingly, while 58 families in total are found in Italy,

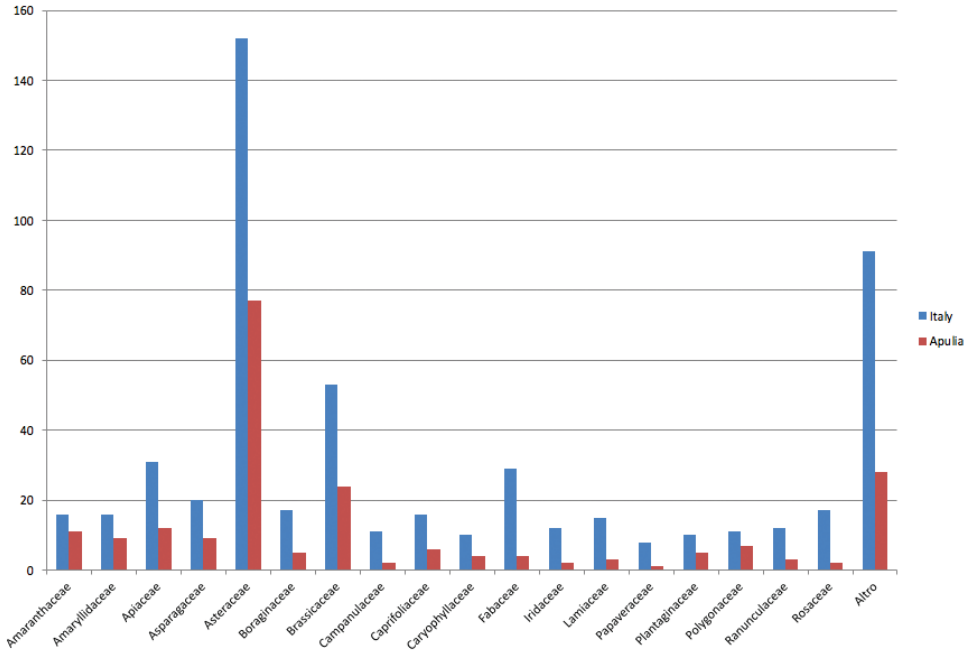

Figure 4. Comparison among families of wild species used in Italy (blue) and in Apulia (red) by number.

as many as 55 are found only in Apulia (Fig. 4). In Sardegna (223 documented species) this number decreases to 42 (Camarda et al. 2017) and includes fruit and aromatic plants. In Umbria (Ranfa and Bodesmo 2017), the documented species are 100 and the families 23.

Compared with other regions, Apulia shows a higher percentage of geophytes (Fig. 5), and shows a much more diversified culinary tradition, even though its territory is quite homogeneous in geographical terms.

Groups C1 to C8 include districts belonging to different geographical areas. It is only in the group on the right (C1, C2, C3) that we have districts of the same area (Foggia) (Fig. 6), very likely because of the common historical and economic backgrounds. In fact, wheat and sheep farming have always characterised the communities inhabiting these areas, from Gargano to Monti Dauni.

The wild plants are usually harvested in grasslands and arid scrubs that once were forests and then pastures, as we personally noticed by accompanying the informers. Nowadays, these areas frequently exhibit the features of grasslands of *Asphodelus ramosus* (= *Asphodelus microcarpus* Salzm. et Viv.); recently they have been included in the new *Charybdido pancratii-Asphodeletea ramosi* class (Biondi et al. 2016). Our floristic relevés revealed the presence of a considerable number of perennial plants (*Muscari comosum*, *Cichorium intybus*) and shrubs (*Asparagus acutifolius*, *Dioscorea communis*). Fires occurring in these areas often block their natural dynamic processes while favouring the growth of edible species. For instance, after a fire, *Asparagus acutifolius* can usually be

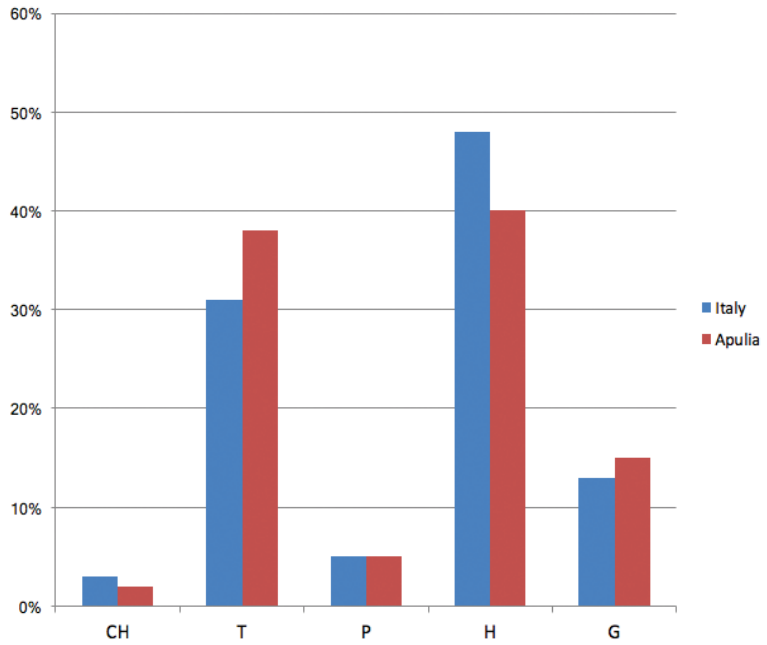

Figure 5. Comparison of the biological forms of wild species used in Italy (left) and in Apulia (right), expressed as percentage. **T** therophyte **G** geophyte **H** hemicryptophyte **CH** chamephyte **P** phanerophyte

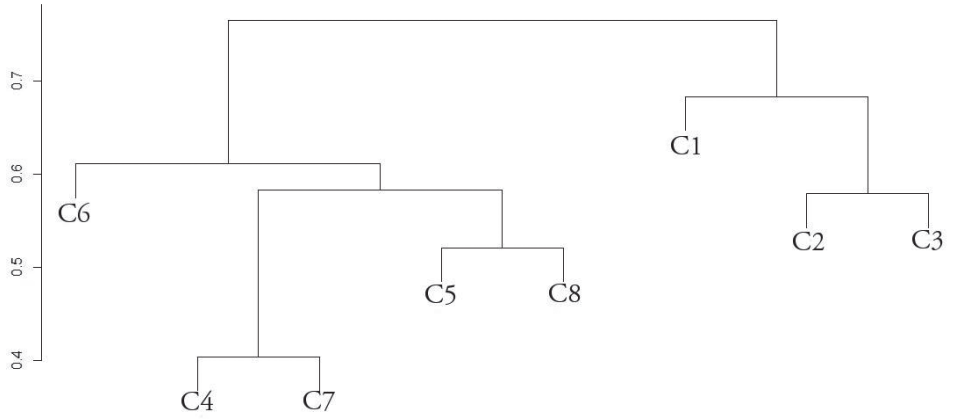

Figure 6. Cluster analysis of spontaneous species used in the eight districts of Puglia **C1** Gargano **C2** Tavoliere delle Puglie **C3** Monti Dauni **C4** Terra di Bari Murgiana **C5** Terra di Bari premurgiana **C6** Valle d'Itria **C7** Salento **C8** Arco ionico tarantino.

found. Wild plants are typically harvested in territories involved in traditional cropping patterns, which are still present in Gargano, Murgia, and Salento. In fact, these harvesting sites are rich in edible species, especially annuals and biennials (*Sonchus* sp., *Crepis* sp., *Urospermum* sp., *Cichorium intybus*). Traditional cropping patterns are, however,

gradually disappearing and, if abandoned, give way to dynamic processes of transformation towards shrubs and then forests. Eventually, such changes cause a strong reduction in edible species. Even though these natural systems are nowadays only a small fraction of the Region as a whole, people still collect wild plants from forests; in fact, Apulia has, among the Italian Regions, the lowest ratio (8 %) between forests and total land area (Regione Puglia 2005).

People who still harvest and eat such plants are primarily the elderly. In our interviews, though, we documented a rising interest for these plants also among the 40- to 60-year olds. There is no interest at all, instead, amongst younger people (< 25) to such an extent that this knowledge could very likely be lost in the future, as already noted in the European ethnobotanical literature (Tardìo et al. 2006, Della 2006, Hadjichambis 2008, Schunko and Vogl 2010, Łuczaj 2012, Caneva et al. 2013, Cassandra and Pieroni 2015, Dolina et al. 2016, Raivo and Sõukand 2016). Therefore, education, either in or outside schools, is needed to preserve it. This particular knowledge is also intimately connected with local dialects, which, in fact, are less and less spoken. Indeed, local languages are critical to understand the biocultural diversity of the local communities, deeply rooted in plant uses. In addition to this, some of these dialects show linguistic influences (Franco-provencals and Griko) that are fundamental to ethnobotanical research. It is noteworthy that the Franco-provencal community living in Monti Dauni is the only one of its kind in central and southern Italy (De Salvio 1908, Valente 1972, Lopane 2014).

Worthy of mention is the existence of the "terrazzani", who are representatives of communities made of very poor people that make ends meet by harvesting wild natural products (fruits, wild greens, mushrooms, snails, and bushmeat).

In our interviews, we documented a gradual lowering in the number of species used as food: people no longer eat 30 of them, but do remember eating them in the past. Ten species are not even remembered by the interviewees, but are clearly documented in literature (Baselice 1812, Bruni 1857, Corrain 1962, Lecciso 1983, Pece 2005). Still, if we consider that, on average, the number of food taxa is quite high here and that the Region has a predominant tertiary sector, the Traditional Ecological Knowledge (TEK) (Heckler 2012) in Apulia is still at a reasonably high level. Indeed, the present study shows that people in Apulia are familiar with and use up to 214 taxa, only 37.9% of the 571 taxa defined as potentially edible (Bianco et al. 2009) in the Apulian flora, namely 2,544 species (Bartolucci et al 2018).

Nowadays, consumers consider wild plants as supplementary components in recipes that also contain cultivated plants, as already pointed out in the ethnobotanical literature of the Mediterranean area (Hadjicambis et al. 2008). In Apulia, however, wild and cultivated plants in the common sense are not distinguished from one another: they are the same, at least from a cultural point of view (Baselice 1812). In fact, both are called "fogghjiè" in local dialects. Thus, in Apulia, wild vegetables have represented and still represent a fundamental part of the Mediterranean diet.

Here, these species have always been part of the local diet (Baselice 1813) and nowadays the large demand coming particularly from the catering sector has stimulated e.g. the installation of several Salicornia cultivations in Gargano (Urbano et al. 2017).

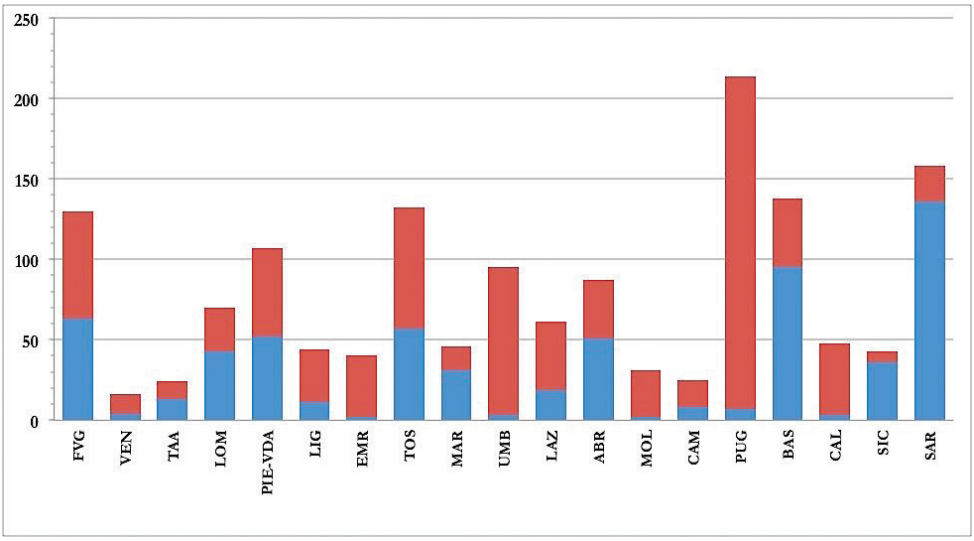

Figure 7. Number of wild species used in Italian regions: in blue the taxa in Guarrera (2006b) are shown; red bars show data from the present work, based on several recent analyses of Italian Regions (2006–2017).

The domestication of this species has great economic prospects and, from an agronomical point of view, it is strategic for the use of high-salinity soils.

It is worth mentioning that the food use of *Clematis vitalba* has been previously reported in several Regions of northern Italy (Dreon and Paoletti 2009), central Italy (Pieroni 2000, Lentini and Venza 2007; Ranfa and Bodesmo 2017), and in Sicily (Lentini and Venza 2007). It has recently been documented also in the communities of the Croatian coast (Dolina et al. 2016). Therefore, the fact that we report it also in Apulia shows that communities did not eat only edible plants but also parts of toxic plants, e.g., shoots of *Clematis* sp. containing less protoanemonin, a compound irritating skin and gastrointestinal mucosa (Chawla et al. 2012).

It is noteworthy that the largest gap between previous and current ethnobotanical knowledge is, among Italian regions, for Apulia (Fig. 7). Our investigation, conducted on the whole Regional territory, could have been a crucial factor and studies of this kind are, therefore, strongly recommended for the other Italian Regions. The importance of the presented update for some species is striking: for instance, several authors documented the use of *Silybum marianum* in all Italian Regions, as opposed to the work of Guarrera (2006b) who recorded it only in Basilicata, Lazio, Lombardia, and Sardegna. The same is true for *Reichardia picroides* (Puglia, Sardegna) and *Portulaca oleracea*, which were previously reported only in Lazio, Friuli Venezia Giulia, and Sardegna, but recently shown to be used as food throughout Italy (Bosi et al. 2009). Leaves of *Crepis* sp. turn out now to be cooked in soups all over Italy and not just in northern parts of the country. Furthermore, food use of *Hyoseris radiata* L. was documented only in Liguria and Trentino Alto Adige, while we now also report it in Marche, Toscana, Sicilia, Sardegna, Umbria, and Puglia. Finally, *Reichardia picroides* should be considered

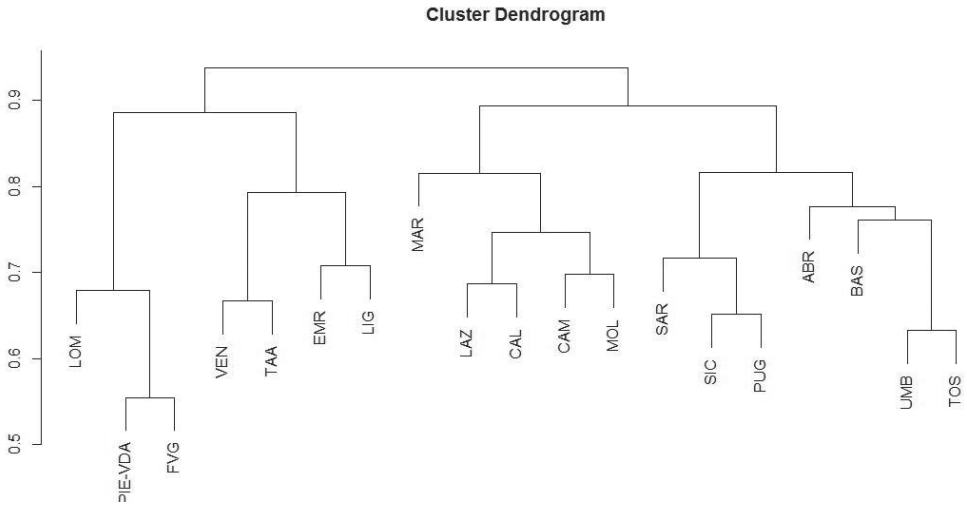

Figure 8. Hierarchical cluster analysis dendrogram of species on a Regional basis.

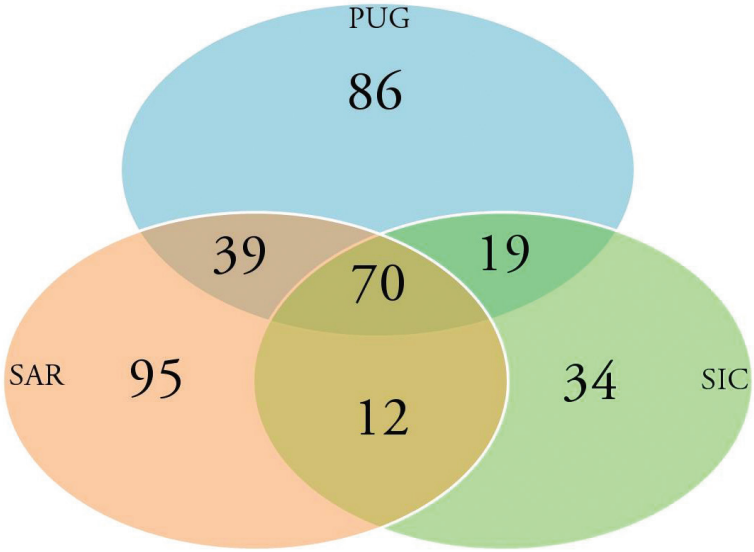

Figure 9. Venn diagram with food taxa used in Apulia, Sicilia and Sardegna.

as one of the most typical food species of southern Italy, while in older reports its use was documented solely in Liguria and Marche.

Among Italian regions, Piemonte, Friuli Venezia Giulia, and Aosta in northern Italy and Puglia, Sicilia, and Sardegna in southern Italy are homogeneous (Fig. 8). As further evidence, the similarities in the latter group are represented in the Venn diagram (Fig. 9). The causes of these similarities are not easy to explain and may represent a starting point for future research.

Table 2. Distribution of food taxa in Italian macro-regions.

Macro-regions	N° taxa (%)
northern Italy	204 (37.2)
central Italy	193 (35.2)
southern Italy	398 (72.7)

Finally, the total count of 828 food units for Italy may be doubtful because of the lack of updated investigations on a national scale. In our opinion, this number is merely an approximation. According to our methodology, wild plants used as food would then be 539 taxa (only 300 according to Guarrera 2006b), 23 of which at subspecific rank (e.g., *Crepis vesicaria* L. subsp. *taraxacifolia* (Thuill.) Thell.). It is, therefore, important to note that popular knowledge can provide a deep understanding of the rich taxonomical diversity of the flora of each territory.

Table 2 shows the resulting taxa (539) divided by macroregion; the highest number is found in southern Italy. As opposed to what was previously reported (Caneva et al. 2013), the Asteraceae are predominant in every macroregion (northern Italy = 22 %, central Italy = 31 %, southern Italy = 29 %). The percentage of Brassicaceae, instead, is higher in southern Italy (11 %) than in the other areas. Moreover, only 6 % of the food taxa used in northern Italy is made up of Rosaceae. Thus, this family ranks third, right after the Brassicaceae (8 %), while it is nearly irrelevant in southern Italy (2 %). To sum up, the Rosaceae prevail in northern Italy and Asteraceae/Brassicaceae in southern Italy, if one includes fruit species and parts of aromatic plants.

Conclusions

Our investigation highlights the fact that culinary use of wild plants has still a strong tradition in Apulia not only in the rural population, but it is widespread all over the territory. Moreover, the use of some species and the respective culinary preparations characterise each area, thereby representing a fundamental part of the local gastronomy. We also observed that a common knowledge about these uses does not exist: in fact, only 19 of the 214 food taxa examined are used in all eight districts. In addition, wild greens are sold as common vegetables in several towns; they are as important as cultivated ones in constituting the Mediterranean diet that characterises this Region, thanks to a tradition that has historically been giving value to these products. In our opinion, a better knowledge about food use of wild species can only be gained through a systematic analysis, such as the one reported here.

Our results point to the existence of a rich and diversified tradition in Italy, as expressed in the numerous culinary preparations. The species having a proper use as food in the various Italian Regions can be grouped in 539 taxa, excluding fruits and aromatic plants. Ethnobotanical research is increasingly becoming fundamental to explore the TEK, also expressed by the local names of plants. This field of study is crucial

if we want to preserve the dialects that people in Italy are progressively forgetting and, accordingly, the associated knowledge about food use of wild vegetables.

The results of this investigation conducted in Apulia can prove that food use of plants in Italy has been only partially documented:

1. several territories still have to be thoroughly explored in this sense (e.g., areas in the Alps and Apennines, rural and suburban areas);
2. further investigations on a regional scale are needed;
3. there is a need to update and verify the existent literature, as well as to uniform the methods of investigations in order to obtain more homogeneous data.

Notwithstanding, a rich literature about the cultural, gastronomic, economic, and agronomic value of wild vegetables is nowadays available. However, little has been done to exploit their potentialities. Several authors of ethnobotanical studies have been calling for new initiatives to preserve and promote these uses. Therefore, the successful domestication of "salicornie" in the Gargano area and its commercial success is of great interest.

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Supplementary material 1

Tables S1, S2, S3

Authors: Nello Biscotti, Daniele Bonsanto, Gennaro Del Viscio

Data type: Document PDF

Explanation note: Table S1 (Learning areas divided by territorial district), Table S2 (Wild vegetables gathered and consumed in Apulia region) and Table S3 (Wild food plants of popular use in Italy by regions (Checklist)).

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COMMENTARY

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Was Charles Darwin right in his explanation of the 'abominable mystery'?

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Abstract

The site and time of origin of angiosperms are still debated. The co-occurrence of many of the early branching lineages of flowering plants in a region somewhere between Australia and the SW Pacific islands suggests a possible Gondwanan origin of angiosperms. The recent recognition of Zealandia, a 94% submerged continent in the east of Australia, could explain the discrepancy between molecular clocks and fossil records about the age of angiosperms, supporting the old Darwinian hypothesis of a "lost continent" to explain the "abominable mystery" regarding the origin and rapid radiation of flowering plants.

Keywords

angiosperm origin, Darwin, abominable mystery, Zealandia, palaeogeography

Introduction

Charles Darwin's "abominable mystery", as reported in the correspondence with Joseph Hooker, Gaston de Saporta and Oswald Heer between 1875 and 1881 (Darwin and Seward 1903), has ended up representing all the unresolved problems regarding the origin and early evolution of angiosperms. Actually, Darwin was not directly interested in the angiosperm fossils, identification of the ancestor of flowering plants, character homology or the evolutionary history of flowering plants, all subjects that since that time

have worried generations of botanists (Friedman 2009). Instead, Darwin was plagued by the sudden origin and fast radiation of angiosperms all around the world in the mid-Cretaceous, an event that was in contrast with his belief of a gradual, slow evolution. To give an explanation to this problem, Darwin speculated about an early, pre-Cretaceous birth and differentiation of flowering plants in a 'lost continent', which was submerged after angiosperm radiation all around the world: "*plants of this great division must have been largely developed in some isolated area, whence owing to geographical changes, they at last succeeded in escaping, and spread quickly over the world*". (letter to O. Heer, 8 March 1875; see Darwin and Seward 1903: 204) or, again, "*I have sometimes fancied that development might have slowly gone for an immense period in some isolated continent or large island, perhaps near the South Pole.*" (letter to J.D. Hooker, 12 August 1881; see Darwin and Seward 1903: 26).

Even if more fossil and molecular data are now available, as yet, it is not possible to determine the site of origin of the angiosperms (Briggs and Walters 2016). In the past, contrasting views have been developed in this regard, placing the site of origin in the Arctic region (Seward 1927), in alpine biomes of northern latitudes (Stebbins 1974), in SE-Asia (Takhtajan 1969), in E-Asia (Sun et al. 1998; Sun et al. 2001), at high boreal latitudes (Hochuli and Feist-Burkhardt 2004), or in unrelated scattered areas from multiple seed plant lineages (see the polyphyletic-polychronic-polytopic hypothesis by Wu et al. 2002). Overall, there is no consensus on the location(s) of angiosperm origin.

However, if we consider the geographic distribution of the 26 early branching angiosperm families (i.e. 'Archaeangiospermae' sensu Stuessy 2010): ANA grade, Magnoliids and Chloranthaceae (see also APG IV 2016), all of them show a distribution including, at least for tiny areas, Gondwanan territories. Overall, 21 early branching families (81%) are found in SW Pacific Gondwanan areas, i.e. New Guinea, E Australia, Fiji, New Zealand, or New Caledonia, with Amborellaceae, Austrobaileyaceae, and Degeneriaceae endemic to these areas (Fig. 1). Moreover, the worldwide maximum concentration of archaeangiosperm families (about 60%) falls in small portions of the NE Australian coast and Papua Nuova Guinea (Fig. 1).

Although current ranges of these families may significantly differ from their past distributions, taken together these data suggest a possible SE Gondwanan origin of the angiosperms. A more general Gondwanan origin was previously hypothesised also by Cronquist (1988), Retallack and Dilcher (1981) and MacDonald (2003). The presence of early divergent lineages (Amborellaceae, Atherospermataceae, Chloranthaceae, and Winteraceae) in New Caledonia, an island re-emerged from Zealandia only ca. 37 million years ago (Ma) after a period of inundation (Cluzuel and Chiron 1998), is not in contrast with this view. There is increasing evidence that the present New Caledonian biota is the product of late Cenozoic immigration events by means of long-distance dispersal from nearby territories (e.g., E Australia, New Zealand, New Guinea). Also *Amborella trichopoda,* the only extant representative of Amborellaceae, became extinct elsewhere after New Caledonia colonization (Pillon 2012; Grandcolas et al. 2014; Nattier et al. 2017).

Luyendyk (1995) first proposed the name Zealandia for a collection of continental fragments between the Australian and Pacific plates (Smith and Sandwell 1997; Stagpoole 2002). In the last two decades, the progressive accumulation of bathymetric, geological,

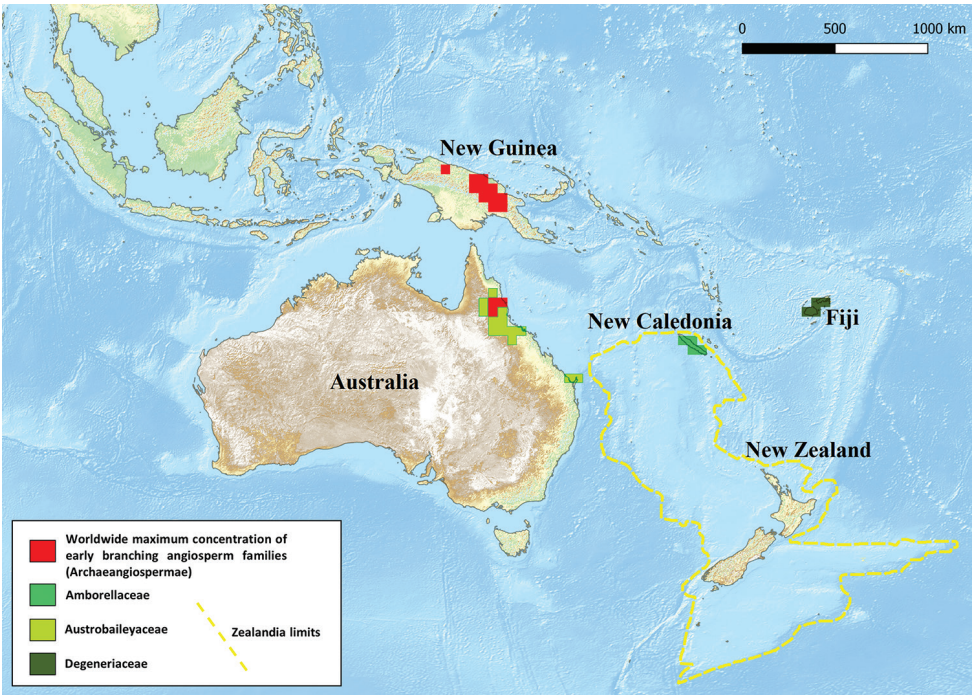

Figure 1. Worldwide maximum concentration of early branching families. Red cells highlight the worldwide highest concentration (15/26, about 60%) of 'Archaeangiospermae' sensu Stuessy (2010). Cells in different tones of green highlight three families (Amborellaceae, Austrobaileyaceae, Degeneriaceae) endemic to New Caledonia, NE Australia, and Fiji, respectively. Zealandia continent (yellow dashed line) is drawn according to Mortimer et al. (2017). The distribution of Archaeangiosperm families was obtained from Angiosperm Phylogeny Website (Stevens 2001 onwards), then georeferenced and superimposed through raster analyses in GIS environment, by means of R software (R Core Team 2017).

and geophysical data, has led Mortimer et al. (2017) to define Zealandia not as a collection of partly submerged continental fragments, but a coherent 4.9 M km^2 continent (Fig. 1), that was formerly part of Gondwana. After its separation from Gondwana (85–130 Ma from Antarctica, 60–85 Ma from Australia; Lewis et al. 2006), Zealandia was 94 % submerged during the late Cretaceous (60–85 Ma; Goldberg et al. 2008).

There is a striking coincidence between the geological evidence of this continent that disappeared in the late Cretaceous and the distribution, around or inside the limits of Zealandia, of many early branching angiosperm families (Fig.1). The age estimates of the divergence of crown group angiosperms using molecular clock data vary considerably, between 140 and 240 Ma or earlier (Martin et al. 1989a,b; Soltis and Soltis 2004; Moore et al. 2007; Bell et al. 2010; Silvestro et al. 2014; Foster et al. 2017). The reconstruction of the genome of the most recent common angiosperm ancestor suggests an age of 214 Ma for its appearance (Murat et al. 2017). By contrast, reliable angiosperm fossil records older than 130–140 Ma have been not found so far (Doyle 2012; Foster et al. 2017, Herendeen et al. 2017). Even though the lack of fossil records before the early Cretaceous suggested to several scholars that angiosperms must have undergone

extremely fast evolution early in their history, Cascales-Miñana et al. (2016) argued that for 100 million years of their evolutionary history angiosperms remained relatively rare, maybe growing in habitats poorly represented in the fossil records. Zealandia was quite a large portion of Gondwana, mostly submerged during the late-Cretaceous (60–85 Ma; Goldberg et al. 2008). This area could have been the cradle of the ancestor and of the early evolution of the main angiosperm lineages during Triassic-Jurassic periods.

Putting the pieces together, our hypothesis is that the flowering plant ancestor could have appeared in the 'lost continent' Zealandia some 200 million years ago or earlier, perhaps from Paleozoic-Mesozoic seed ferns (Taylor and Taylor 2009) after a whole genome duplication event (*Amborella* Genome Project 2013) and/or rapid genome downsizing (Simonin and Roddy 2018), slowly differentiating the main angiosperm lineages (Archaeangiosperms, Monocots and Eudicots) for millions of years. Then, these already established lineages could have spread outside Zealandia, starting from the early Cretaceous, in a rapid worldwide radiation, before its submersion in the late Cretaceous.

In a recent work (Sauquet et al. 2017), the ancestral angiosperm flower was reconstructed. According to these authors, this ancestral flower was bisexual, showing undifferentiated, whorled tepals and stamens with three elements per whorl. This combination of features is not observed in any extant angiosperm, including the earliest-divergent lineages (e.g., ANA grade). If the ancestral angiosperm flower model and our hypothesis are right, we expect that palaeobotanical investigations in the submerged Zealandia region may allow to find (micro)-fossil records showing these putatively ancestral features. Possibly, Darwin's intriguing speculation on the appearance and early evolution of angiosperms in a 'lost continent' was correct.

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RESEARCH ARTICLE

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Notulae to the Italian flora of algae, bryophytes, fungi and lichens: 5

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Abstract
In this contribution, new data concerning bryophytes, fungi, and lichens of the Italian flora are presented. It includes new records and confirmations for the bryophyte genera *Diplophyllum* and *Ptychostomum*, the fungal genera *Arrhenia*, *Gymnosporangium,* and *Sporidesmium* and the lichen genera *Arthonia*, *Coenogonium*, *Flavoplaca*, *Gyalolechia*, *Parmotrema*, *Peltigera*, *Pterygiopsis*, *Squamarina*, *Tornabea,* and *Waynea*.

Keywords
Ascomycota, Basidiomycota, Bryidae, Jungermanniidae, floristic data

How to contribute

The text of the records should be submitted electronically to: Cecilia Totti (c.totti@univpm.it) for algae, Annalena Cogoni (cogoni@unica.it) for bryophytes, Alfredo Vizzini (alfredo.vizzini@unito.it) for fungi, Sonia Ravera (sonia.ravera@unimol.it) for lichens.

Floristic records

BRYOPHYTES

Errata corrige. *Paludella squarrosa* (Hedw.) Brid. (Meesiaceae), erroneously reported as new for Trentino-Alto Adige in Ravera et al. (2017), is confirmed to occur in this region, but new only for the mentioned site.

Diplophyllum obtusifolium (Hook.) Dumort. (Scapaniaceae)

+ **FRV**: Alta Carnia, (Udine), on moist soil, (UTM WGS84 33T 359573.5156682), ca. 1632 m, 19 October 2014, *F. Sguazzin, L. Boemo, A. Boemo* (Bryophytorum Herbarium F. Sguazzin). – Species confirmed for the flora of Friuli Venezia Giulia.

Diplophyllum obtusifolium is a montane-arctic-circumpolar liverwort species (Dierßen 2001). It was found together with *Sphagnum palustre* L., a surprising finding because usually it is a pioneer species colonizing soils banks and track sides (Lockhart et al. 2012). According to Aleffi et al. (2008), the presence in Italy of *D. obtusifolium* is restricted to a number of northern localities with the only exception of Abruzzo. Its occurrence in Lazio and Marche has not been confirmed over the last 50 years. The herbarium specimen collected by Rossetti and kept in the Herbarium of the University of Pisa (PI) for Toscana (leg. Rossetti, August 1891, Forno Volasco, Apuan Alps) actually refers to *Diplophyllum obtusatum* (R.M.Schust.) R.M.Schust. (Aleffi et al. 2008). After 114 years since the first report of the species, the present finding is a confirmation for Friuli Venezia Giulia (Bizzozzero 1885, Loitlesberger 1905, Glowacki 1908). This species seems rare in the Mediterranean basin, being recorded only for

Bosnia-Herzegovina, Bulgaria, Serbia, Spain, France, and Italy (Ros et al. 2007). It was reported from Portugal by Ros et al. (2007), based on a record taken from phytosociological relevés from the Serra da Estrela. After a revision of the material, this record was correctly re-attributed to *Diplophyllum taxifolium* (Wahlenb.) Dumort. (Ellis et al. 2012). With reference to its global distribution, *D. obtusifolium* occurs throughout the western part of North America, and is also widespread in Asia, Europe, and eastern North America. According to Hodgetts (2015), it is considered Endangered (EN) in Hungary and Netherlands, Near Threatened (NT) in Luxemburg, Ireland and Italy, Vulnerable (VU) in Germany.

S. Poponessi, F. Sguazzin, M. Aleffi

Ptychostomum subneodamense (Kindberg) J.R.Spence (Bryaceae)

+ **TAA**: Kirchbergtal, south of Santa Gertrude (Bolzano) on the right bank of the Kirchbergbach, among the stones and the low vegetation of the stream (UTM WGS84 32T 643004.5147513), 1735 m, 27 June 2017, *F. Sguazzin* (Bryophytorum Herbarium F. Sguazzin). – Species confirmed for the flora of Trentino-Alto Adige.

The old name *Bryum subneodamense* Kindb., which was recorded for Italy by Cortini Pedrotti (2001), was considered a synonym of *Ptychostomum pseudotriquetrum* (Hedw.) J.R.Spence & H.P.Ramsay by Ros et al. (2013), but later Spence (2013 and in FNA 2014) claimed that *P. subneodamense* is a distinct species. *Ptychostomum subneodamense* is a temperate-arctic-circumpolar species; in Europe, it is regionally threatened (Dierβen 2001). Formerly, this species was known only for Valle d'Aosta (Vaccari 1913, sub *Bryum neodamense* Itzigs. var. *ovatum* Lindb. & Arr.), Veneto (Venturi 1899, sub *Bryum neodamense* Itzigs. var. *ovatum* Lindb.) and Trentino-Alto Adige (Geheeb 1883, sub *Bryum ovatum* Jur.; Venturi 1899, sub *Bryum neodamense* Itzigs. var. *ovatum* Lindb.). Moreover, Holyoak and Hedenäs (2006) mention a herbarium specimen of *Bryum subneodamense* Kindberg collected nearby Gorizia (Friuli Venezia Giulia) by Loitlesberger (March 1903, S) and reviewed by Podpěra (1942). Therefore, our record represents the confirmation of the occurrence in Italy of this rare species after 115 years from its last report.

F. Sguazzin

FUNGI

Arrhenia spathulata (Fr.) Redhead (Hygrophoraceae)

+ **CAL:** Bosco di Mavigliano, Montalto Uffugo (Cosenza), on the moss *Pleurochaete squarrosa* (Brid.) Lindb. (UTM WGS84: 33S 604782.4360104), 200 m, 25 February 2017, *D. Puntillo* (CLU No. 56); Imbutillo, Curinga (Catanzaro) on the moss *P. squarrosa* (UTM WGS84 33S 606081.4298323) 1 m, 24 November 2017, *D. Puntillo* (CLU No. 72). – Species new for the flora of Calabria.

This species is recognizable for its spatuliform, petaliform to flabelliform (fan-shaped) basidiome, for its little raised anastomatized and spaced veins, for the short and lateral stipe and for the flexible and wavy margin. *Arrhenia spathulata* grows on soil with *P. squarrosa* or other mosses. It was known so far from Piemonte (Pollini 1824), Trentino-Alto Adige (Marisa et al. 1986), Toscana (Barluzzi et al. 1996, Perini et al. 1999), Marche (Maletti 2016), Lazio (Granito and Lunghini 2011), Campania (Violante et al. 2002), Sicilia (Signorello and Napoli 1994, Lantieri 2006, Lantieri et al. 2009), Lombardia, Veneto, Emilia-Romagna, and Puglia (Onofri et al. 2005).

D. Puntillo

Gymnosporangium clavariiforme (Wulfen) DC. (Pucciniaceae)

+ **CAL**: Piano di Novacco, Saracena (Cosenza), on twigs of *Juniperus communis* L. (UTM WGS84: 33S 589506.4406265), 1305 m, 24 May 2014, *D. Puntillo* (CLU No. 69). – Species new species for the flora of Calabria.

This species is a heteroecious rust, growing on *Juniperus* as primary host. During spring, it produces a set of orange tentacle-like spore tubes (tetial stage) with a jelly-like consistency when wet. The secondary host is *Crataegus*, where *G. clavariiforme* produces yellowish depressions on the leaves (spermogonial and aecial stage). The species is widespread in Austria, Belgium, Dalmatia, Finland, Germany, Great Britain, and Hungary (De Toni 1888). In Italy, it has been recorded from Val d'Aosta (Traverso 1912), Trentino-Alto Adige (Hellrigl 2010), and Friuli Venezia Giulia (Tomasi 2014).

D. Puntillo

Sporidesmium bacidiicola Alstrup (Sporidesmiaceae)

+ **SIC**: Monte Egitto, Bronte (Catania), western slope of the Etna, in an ancient *Quercus congesta* forest, on bark, parasitic on *Physcia tenella* (Scop.) DC. (UTM WGS84: 33S 493690.4179961), 1550 m, 6 October 2017, leg. *D. Cataldo*, det. *W. v. Brackel* (Herb. Brackel 7990). – Species new for the flora of Italy (Sicilia).

The genus *Sporidesmium* consists of fungi with a mycelium lacking hyphopodia, brown macronematous conidiophores and solitary, euseptate, brown to subhyaline conidia, developing terminally and holoblastic. Most of the species are saprotrophic or parasites of vascular plants and fungi. Only two species are lichenicolous: *Sporidesmium lichenicola* Iturr., D.Hawksw. & J.L.Crane, living on *Leptogium* (Iturriaga et al. 2008), and *S. bacidiicola*, described from Denmark on *Bacidia rubella* (Hoffm.) A.Massal. (Alstrup 1991). Later, it was found growing also on *Fellhaneropsis vezdae* (Coppins & P.James) Sérus. & Coppins and on *Physcia adscendens* H.Olivier and was known until now only from Denmark, Poland, and Germany (Alstrup and Olech 1996, Czyżewska and Kukwa 2009, Alstrup et al. 2013, von Brackel 2014). This species is characterized by effuse colonies, an immersed mycelium, erect, brown, septate,

proliferating conidiophores, integrated conidiogenous cells, and brown, narrowly ellipsoid, 5–9(–12)-septate conidia.

D. Cataldo, W. v. Brackel

LICHENS

Arthonia granosa B. de Lesd. (Arthoniaceae)

+ **CAM**: Centola (Salerno), on *Quercus suber* L. (UTM WGS84: 32T 526512.4434694), 290 m, 25 February 2011, *G. Brunialti, V. Genovesi, S. Ravera*. – Species new for the flora of Campania.

It is a rare Mediterranean-Atlantic species, doubtfully lichenized, often collected on cork oak (e.g., Fos 1998, Ravera 2002, Rizzi et al. 2011, Boutabia et al. 2015). It is a characteristic lichen of the *Arthonietum granosae* Giralt & Gómez-Bolea 1987, an epiphytic community restricted to coastal stations with humid maritime winds. *Arthonia granosa* can be distinguished from other superficially similar *Arthonia* species by the white pruina on the round to oblong apothecia, hymenium I+ wine coloured and 1-septate guttulate spores 18–30 × 8–13 µm. In Italy, the species has been reported from Lazio, Sardegna, Puglia (Nimis 2016) and Sicilia (Ottonello et al. 2011). Due to its rarity, it is included in the Italian red list of epiphytic lichens under the "Vulnerable" category (Nascimbene et al. 2013).

S. Ravera

Coenogonium luteum (Dicks.) Kalb & Lücking (Coenogoniaceae)

+ **TOS**: Marina di Castagneto Carducci (Livorno), on *Juniperus macrocarpa* Sm. (UTM WGS84: 32T 624680.4784765), 8 m, 24 November 2017, *L. Di Nuzzo, E. Bianchi, R. Benesperi*. – Species confirmed for the flora of Toscana.

Coenogonium luteum is a crustose pantropical lichen with orange to pink apothecia and green thallus. Its distribution includes both hemispheres; in Italy, it is a mostly Tyrrhenian species (Nimis 2016). It occurs in shaded situations and, due to its rarity, it is included in the Italian red list of epiphytic lichens under the "Least Concern" category (Nascimbene et al. 2013).

L. Di Nuzzo, E. Bianchi, R. Benesperi

Flavoplaca limonia (Nimis & Poelt) Arup, Frödén & Søchting (Teloschistaceae)

+ **FVG**: Castle of San Giusto (Trieste), near the entrance on inclined surfaces of calciferous sandstone (UTM WGS84: 32N 871998.5066124), 80 m, 25 January 2016, *P.L. Nimis* (TSB No. 47501). – Species new for the flora of Friuli Venezia Giulia.

It is a species of the *F. citrina*-complex, characterised by large soredia/blastidia, a *limonia*-type of soralium, a pale yellow thallus, and a thick apothecial margin often covered by blastidia. *Flavoplaca limonia* is found on calcareous rocks or on base-rich, hard, siliceous cliffs in dry and in sun-exposed to shaded and damp situations, but also on twigs of maritime shrubs or on soil, below the montane belt. This species, described from calcareous cliffs along the coast of the Island of Marettimo, Sicilia (Nimis et al. 1994), proved to be quite widespread in southern Europe (see, e.g., Vondrák et al. 2009). Its hitherto known Italian distribution was limited to coastal localities of Puglia, Sicilia, and Sardegna, and an inland locality in Veneto (Nimis 2016), but the species is certainly more widespread, since in the past it was generally identified as "*Caloplaca citrina*".

P.L. Nimis

Gyalolechia fulgida (Nyl.) Søchting, Frödén & Arup (Teloschistaceae)

+ **PIE**: Gremiasco (Alessandria), surroundings of the Osservatorio Astronomico Cà del Monte, on south-facing sandstone outcrops (UTM WGS84: 32T 506270.4962306), 682–687 m, 9 December 2016, *G. Gheza* (Herb. Gheza); Monte Vallassa (Alessandria), on a southeast-facing sandstone outcrop in the woods (UTM WGS84: 32T 507119.4962675), 725 m, 9 December 2016, *G. Gheza* (Herb. Gheza). – Species new for the flora of Piemonte.
+ **LOM**: surroundings of Agriturismo Guardamonte, Bagnaria (Pavia), on a southeast-facing sandstone rock face (UTM WGS84: 32T 507608.4962932), 720 m, 10 August 2016, *G. Gheza* (Herb. Gheza). – Species new for the flora of Lombardia.

Gyalolechia fulgida is a Mediterranean species found mainly on calcareous rocks in the Mediterranean belt (Nimis 2016). It was previously known for northern Italy only in one site in Liguria (Valcuvia Passadore et al. 2000). The three new sites recorded here, extending the Italian range of the species to Piemonte and Lombardia, are actually very close, being located on two mountainsides with the thermo-xeric character of a mountain placed along the boundary between Val Curone (Alessandria) and Val Staffora (Pavia). In these sites, *G. fulgida* was found together with the lichens *Placidium* sp., *Squamarina cartilaginea* (With.) P.James, *Squamarina stella-petraea* Poelt and with the moss *Grimmia* sp., in more or less sheltered concavities of sandstone outcrops, both on the thin soil layer over weathered sandstone and on the very rock.

G. Gheza

Parmotrema hypoleucinum (J. Steiner) Hale (Parmeliaceae)

+ **CAM**: Isola di Vivara, Procida (Napoli), on twigs of *Erica arborea* L. and *Olea europaea* L. (UTM WGS84: 33T 415034.4510875), 13 October 2008, *C. D'Antonio* (TSB No. 47500). – Species new for the flora of Campania.

This is a pantropical-pantemperate species with a Mediterranean-Atlantic distribution in Europe, found on twigs of trees and shrubs in undisturbed Mediterranean

maquis vegetation along the coasts, which can be easily distinguished from all other *Parmotrema*-species occurring in Italy by the white lower surface. It is a characteristic lichen of a rare and endangered epiphytic community, which is most frequent on undisturbed, coastal sand dunes, the *Parmotremetum reticulati-hypoleucini* Nimis & Schiavon (1986). Its distribution in Italy is predominantly Tyrrhenian, the species having been reported from Toscana, Lazio, Sardegna, Puglia, Basilicata and Calabria (Nimis 2016). The species is generally very rare and is, therefore, included in the Italian red list of epiphytic lichens as "Near-threatened" (Nascimbene et al. 2013). It is certainly declining, due to increasing touristic exploitation of coastal environments. The new record fills a gap in its distribution along the Tyrrhenian coasts of the Italian Peninsula.

P.L. Nimis, C. D'Antonio

Peltigera monticola Vitik. (Peltigeraceae)

+ **PIE**: Oropa (Biella), near the Santuario, on soil (UTM WGS84: 32T 420405.5053261), 1150 m, summer 1905, leg. *L. Micheletti* det. *D. Isocrono, E. Matteucci, S.E. Favero-Longo* (TO n. 3412); Crissolo (Torino), Pian del Re, near Fiorenza Lake, (UTM WGS84: 32T 348927.4951186), 2150 m, 10 September 2012, on serpentinite outcrops *D. Isocrono, E. Matteucci, S.E. Favero-Longo* (TO n. 2118). – Species new for the flora of Piemonte.

Peltigera monticola is a terricolous species, first described by Vitikainen (Vitikainen 1994), belonging to the large *Peltigera canina* group, a species complex that includes taxa that are sometimes difficult to identify (Miadlikowska et al. 2003) and, for this reason, often misunderstood. It is considered rare in Italy, where it has been reported for the Eastern Alps and Sardinia (Nimis 2016). The records reported here are the first for the Italian Western Alps. The first record from Piemonte is available through a herbarium specimen collected by Luigi Micheletti near Oropa and previously identified as *Peltigera canina* (L.) Willd.

D. Isocrono, E. Matteucci, S.E. Favero-Longo

Pterygiopsis affinis (A.Massal.) Henssen (Lichinaceae)

+ **MAR**: Gole della Rossa, Fabriano (Ancona), on calcareous rock (UTM WGS84: 33T 338355.4810338), 200 m, 3 November 2017, *L. Morosini*. – Species new for the flora of Marche.

+ **UMB**: Monte di Pale, Foligno (Perugia), near the Eremo di Santa Maria Giacobbe on calcareous rock (UTM WGS84: 33T 318298.4761664), 520 m, 30 August 2017, *L. Morosini*. – Species new for the flora of Umbria.

+ **BAS**: Parco dei Monaci (Matera), along Gravina stream on calcareous rock (UTM WGS84: 33T 639479.4496784), 130 m, 10 June 2016, *M. Tretiach, S. Ongaro*; Parco dei Monaci (Matera), along the Gravina stream on calcareous rock (UTM WGS84: 33T 640142.4495777), 125 m, 10 June 2016, *M. Tretiach, S. Ongaro*; Province of

Matera, on a calcareous rock wall (UTM WGS84: 33T 640199.4496976), 195 m, 10 June 2016, *M. Tretiach, S. Ongaro*; Contrada Murgia Timone (Matera), on calcareous rock (UTM WGS84: 33T 636965.4502634), 380 m, 10 June 2016, *M. Tretiach, S. Ongaro*. – Species new for the flora of Basilicata.

Pterygiopsis affinis is the only species of the genus *Pterygiopsis* known to occur in Italy. The genus is part of the family Lichinaceae, which includes several genera, with varied morphology and different photobionts. Some genera are particularly difficult to identify, and their taxonomic position is debatable. *Pterygiopsis affinis* is a crustose lichen with a placodioid, effigurate thallus, from bluish black to dark grey. Apothecia are lecanorine, with proper margin and red disc. Asci are multi-spored, with hyaline, sub-globose to broadly ellipsoid ascospores, ca. 6–12 × 3–6 µm. The photobiont is a chroococcoid, unicellular cyanobacterium (*Gloeocapsa*), with a yellowish mucilaginous cell envelope. *Pterygiopsis affinis* is a rare epilithic lichen, tolerating high solar radiation and prolonged drought. It grows on south-exposed rocks, often along seepage tracks. In Italy, *P. affinis* occurs from the Alpine regions to Puglia and Sardegna, but owing to lack of knowledge in several Regions (Nimis 2016), its frequency has been certainly underestimated.

S. Ongaro, L. Morosini, S. Martellos, M. Tretiach

Squamarina stella-petraea Poelt (Squamarinaceae)

+ **PIE**: Gremiasco (Alessandria), surroundings of the Osservatorio Astronomico Cà del Monte, on south-facing sandstone outcrops (UTM WGS84: 32T 506270.4962306), 682–687 m, 9 December 2016, *G. Gheza* (Herb. Gheza). – Species confirmed for the flora of Piemonte.

+ **LOM**: surroundings of Agriturismo Guardamonte, Bagnaria (Pavia), on a southeast-facing sandstone rock face (UTM WGS84: 32T 507608.4962932), 720 m, 10 August 2016, *G. Gheza* (Herb. Gheza). – Species new for the flora of Lombardia.

Squamarina stella-petraea is a Mediterranean species found mainly on calcareous rocks in the Mediterranean belt (Nimis 2016). It can be quite easily distinguished from other saxicolous *Squamarina* because of its rosulate white thallus, areolate in the middle and lobed at the margin. It was previously known for northern Italy only in one site in Piemonte (Nimis 2016) and one in Liguria (Valcuvia Passadore et al. 2000). The two new sites recorded here, extending to Lombardia the Italian range of the species, are located on two mountainsides of Monte Vallassa with thermo-xeric character. Here, *S. stella-petraea* was found together with *Squamarina cartilaginea* (With.) P.James, *Romjularia lurida* (Ach.) Timdal, and *Gyalolechia fulgida* (Nyl.) Søchting, Frödén & Arup in more or less sheltered concavities of sandstone outcrops. It was found with well-developed rosulate thalli, but also coalesced with *S. cartilaginea*.

G. Gheza

Tornabea scutellifera (With.) J.R. Laundon (Physciaceae)

+ **TOS**: Marina di Castagneto Carducci (Livorno), on *Juniperus macrocarpa* Sm. (UTM WGS84: 32T 624591.4785396), 6 m, 10 July 2017, *L. Di Nuzzo, E. Bianchi, R. Benesperi*; Marina di Castagneto Carducci (Livorno), on *J. macrocarpa* (UTM WGS84: 32T 624680.4784765), 8 m, 24 November 2017, *L. Di Nuzzo, E. Bianchi, R. Benesperi*. – Species confirmed for the flora of Toscana.

Tornabea scutellifera is a fruticose epiphytic macrolichen strictly associated with semiarid and warm situations with frequent periods of high air humidity (Nimis and Tretiach 1997). It is included in the Italian red list of epiphytic lichens under the "Least Concern" category (Nascimbene et al. 2013). There are no recent records in the literature for Toscana (Micheli 1729; Savi 1825; Baglietto 1871; Saccardo 1894).

L. Di Nuzzo, E. Bianchi, R. Benesperi

Waynea giraltiae van den Boom (Ramalinaceae)

+ **SIC**: Monte Egitto, Bronte (Catania), western slope of the Etna, in an ancient *Quercus congesta* forest, on bark (UTM WGS84: 33S 493690.4179961), 1550 m, 6 October 2017, leg. *D. Cataldo*, det. *W. v. Brackel* (Herb. Brackel 7197). – Species new for the flora of Italy (Sicilia).

Waynea giraltiae was recently described from Portugal; it was known until now only from the Iberian Peninsula (Portugal and Spain), growing in the lowland on the bark of *Quercus rotundifolia* Lam. (van den Boom 2010). This species is characterized by a squamulose to granulose thallus with thick-walled, hyaline, septate hairs, a well-defined upper cortex, marginate, greyish to blackish apothecia, asci *Bacidia*-type and hyaline, fusiform, (1–)3-septate ascospores, 12–18 × 2–2.5 µm. Sterile specimens may be mistaken for *Agonimia opuntiella* (Buschardt & Poelt) Vězda, but this species lacks the thick hyaline upper cortex, the hairs are composed of several hyphae and the upper surface is papillate. Sterile *Physconia servitii* (Nádv.) Poelt has a similar appearance, but also in this species, the hairs are composed of several strands of hyphae and the thallus is whitish-grey instead of greenish.

D. Cataldo, W. V. Brackel

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RESEARCH ARTICLE

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Notulae to the Italian alien vascular flora: 5

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Abstract

In this contribution, new data concerning the distribution of vascular flora alien to Italy are presented. It includes new records, and confirmations for Italy or for Italian administrative regions of taxa in the genera *Albizia*, *Anredera*, *Bougainvillea*, *Cardamine*, *Cenchrus*, *Cephalaria*, *Ceratochloa*, *Cytisus*, *Datura*, *Delosperma*, *Euonymus*, *Freesia*, *Hylotelephium*, *Lantana*, *Musa*, *Physalis*, *Rotala*, *Styphnolobium*, *Trachycarpus*, and *Tradescantia*. Nomenclature and distribution updates, published elsewhere, and corrections are provided as supplementary material.

Keywords

Alien species, floristic data, Italy, nomenclature

How to contribute

The text for the new records should be submitted electronically to Chiara Nepi (chiara.nepi@unifi.it). The corresponding specimen along with its scan or photograph has to be sent to FI Herbarium: Sezione di Botanica Filippo Parlatore del Museo di Storia Naturale, Via G. La Pira 4, 50121 Firenze (Italy). Those texts concerning nomenclatural novelties (typifications only for accepted names), status changes, exclusions, and confirmations should be submitted electronically to: Gabriele Galasso (gabriele.galasso@comune.milano.it). Each text should be within 2,000 characters (spaces included).

Floristic records

Albizia julibrissin Durazz. (Fabaceae)

+ (CAS) **CAL**: Montegiordano (Cosenza), fraz. Montegiordano Marina, massicciata ferroviaria presso Via Canale G. Garibaldi (WGS84: 40.031813°N; 16.600047°E), massicciata ferroviaria, ca. 10 m, 21 August 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Calabria.

A young specimen of the species grows on pebbly ground at the railway roadbed crossing the village's suburban area near an overpass. It originated from the seeds produced by some trees cultivated along a neighboring road. The native range of *Albizia julibrissin* includes southern Caucasus, Iran, Pakistan, India, Nepal, Bangladesh, Sri Lanka, Myanmar, China, Korea, Japan, Ethiopia, Eritrea, and Somalia. The species was introduced in Italy for ornamental purposes in 1745 (Targioni Tozzetti 1896) and it is currently widely planted as ornamental in parks and gardens around the world.

N. Olivieri

Anredera cordifolia (Ten.) Steenis (Basellaceae)

+ (CAS) **MAR**: Cupra Marittima (Ascoli Piceno), presso la stazione ferroviaria (WGS84: 43.023750°N; 13.860402°E), incolto, ca. 6 m, 3 August 2017, *N. Olivieri* (FI). – Casual alien species confirmed for the flora of Marche.

At Cupra Marittima, this species grows on sandy soil at the edge of a small neglected area, along with *Broussonetia papyrifera* (L.) Vent. and *Ailanthus altissima* (Mill.) Swingle. The species was no longer recorded in the Marche after 1950 (Galasso et al. 2018). According to Viegi et al. (2004), reporting Brilli-Cattarini's personal communications, *Anredera cordifolia* was previously observed in Ancona in 1945, and in Pesaro in 1939.

N. Olivieri

Bougainvillea spectabilis Willd. (Nyctaginaceae)

+ (CAS) **ABR**: Pescara (Pescara), presso Viale V. Pepe (WGS84: 42.458347°N; 14.231300°E), bordo di marciapiede, ca. 3 m, NE, 9 August 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

A young plant has developed on the inner edge of a sidewalk at the base of the perimetral wall of a private home in the urban area of Pescara. The location is partially shaded and at a short distance from the Adriatic Sea, but it is sheltered from sea winds by the buildings. In Italy, *Boungavillea spectabilis* is also reported as a casual alien in Sardegna (Bacchetta et al. 2009, Galasso et al. 2018).

N. Olivieri

Cardamine occulta Hornem. (Brassicaceae)

+ (CAS) **LAZ**: Roma (Roma), lungo Via del Biscione (WGS84: 41.895524°N; 12.472969°E), aiuola, 18 m, 28 October 2017, *A. Stinca* (FI, PORUN). – Casual alien species new for the flora of Lazio.

In Italy, *Cardamine occulta* is recorded for Piemonte, Lombardia, Trentino-Alto Adige, Veneto, Friuli Venezia Giulia, Emilia-Romagna, Toscana, Campania, and Sardegna (Galasso et al. 2018). According to Stinca et al. (2017), this species has been largely spread by nurseries and soil transportation.

A. Stinca, G. Chianese

Cenchrus setaceus (Forssk.) Morrone (Poaceae)

+ (CAS) **TOS**: Piombino (Livorno), fraz. Baratti (WGS84: 42.998797°N; 10.516870°E), margine stradale, 8 m, 21 October 2017, *T. Fiaschi* (FI). – Casual alien species new for the flora of Toscana.

The occurrence of this species in Toscana does not seem to be linked to direct human cultivation. Seeds of *Cenchrus setaceus* are known to have a very efficient wind dispersal strategy. However, given that the nearest known populations occur a few hundred kilometres away from Baratti, wind is not the most likely vector. The species is included in the list of Invasive Alien Species of Union Concern (Commission Implementing Regulation EU 2016/1141) and was found in three separate nuclei 10 m apart, in a parking area of a renowned tourist location, where seeds could have been introduced *via* pet fur or car mats. According to Galasso et al. (2018), it occurs in Lazio, Puglia, Calabria, Sicilia, and Sardegna.

G. Bonari, T. Fiaschi, R. Guarino

Cephalaria syriaca (L.) Schrad. (Dipsacaceae)

+ (NAT) **LAZ**: Roma (Roma), Scalo ferroviario Ostiense (WGS84: 41.871550°N; 12.488699°E ± 700 m), ca. 20 m, 28 May 1954, *A. Cacciato* (RO); Tarquinia (Viterbo), loc. Pian di Spille, zona militare (WGS84: 42.255734°N; 11.678989°E), incolto erboso al margine di campo coltivato a fieno greco, 4 m, 17 April 2017, *A. Scoppola* (FI, UTV no. 35200); Monte Romano (Viterbo), valle del Fiume Mignone (WGS84: 42.251059°N; 11.877385°E), margine di campi lungo strada sterrata in luogo arido, 109 m, 20 April 2017, *A. Scoppola, L. Cancellieri* (UTV no. 35202, *Herb. L. Cancellieri*). – Naturalized alien species confirmed for the flora of Lazio.

Cephalaria syriaca belongs to the Mediterranean-Turanian element, growing as a weed in cereal fields and waste places (Matthews 1972). It is not listed for Lazio by Anzalone et al. (2010), while Lucchese (2017) records the species for this administrative region, but without providing information on recent records or herbarium specimens. Accordingly, it has been excluded from the confirmed regional alien flora (Galasso et al. 2018). It is not reported in the flora of the Pian di Spille coast (Iocchi and Bartolucci 2008). However, it was reported by Cacciato (1955) in the Ostiense railway station in Roma, an area deeply transformed due to the urban development of the last decades. This ancient discovery is attested by a 1954 herbarium specimen preserved in RO. However, this record was ignored by Lucchese (2017). In the two new localities, *C. syriaca* occurs with a conspicuous number of fertile individuals, spread at the edge of cultivated fields and waste places.

L. Cancellieri, A. Scoppola

Ceratochloa cathartica (Vahl) Herter (Poaceae)

+ (NAT) **PUG**: Bari (Bari), foce del Torrente Lamasinata (WGS84: 41.134654°N; 16.827638°E), prateria umida su substrato sabbioso, 1 m, 30 September 2017, *R. Labadessa* (FI); Bari (Bari), Torrente Lamasinata (WGS84: 41.134647°N;

16.827632°E), prati umidi su sabbia, 1 m, 30 September 2017, *R. Labadessa* (BI no. 40486, no. 40487). – Naturalized alien species new for the flora of Puglia.

Ceratochloa cathartica is an alien plant from South America, whose European distribution ranges from Portugal to Ukraine, and from Great Britain to Italy (Ryves et al. 1996). This species was probably introduced as fodder in Europe, where it may be found as naturalized in the warmer regions (Ryves et al. 1996). Several individuals were found within an area of about two hectares, in a wet sandy meadow dominated by annual and perennial grass species.

R. Labadessa, L. Forte

Cytisus striatus (Hill) Rothm. (Fabaceae)

+ (NAT) **ITALIA** (**LIG**): Noli (Savona), fraz. Tosse, fra la SP8 e l'Autostrada dei Fiori A10 (WGS84: 44.227616°N; 8.393363°E), macchia mediterranea, 177 m, 20 June 2017, leg. *L. Minuto*, det. *C. Turcato* (FI, GE). – Naturalized alien species new for the flora of Italy (Liguria).

Cytisus striatus is native to Morocco, Portugal, and Spain. It has been introduced into a number of northwestern European countries (England, Scotland, Wales, and France), and in the Americas (California and Oregon in the U.S.A., and Argentina), where it is considered to be an invasive shrub. A large population, identified following the key published by Frodin and Heywood (1968), was detected growing on the motorway embankment. Other plants were observed along the Autostrada A10 from Albenga to Savona Vado, and along the Autostrada A12 near Sestri Levante (loc. Rocche di Sant'Anna).

C. Turcato, L. Minuto

Datura wrightii Regel (Solanaceae)

+ (CAS) **LAZ**: Bracciano (Roma), fraz. Vigna di Valle, Museo Storico dell'Aeronautica Militare, presso l'Aeroporto di Vigna di Valle (WGS84: 42.085366°N; 12.218396°E), suolo sabbioso presso il lago, 158 m, 16 July 2017, *S. Buono* (FI, UTV). – Casual alien species new for the flora of Lazio.

Datura wrightii is a perennial plant native to the southwestern United States and Mexico. In southern Europe, it was widely confused with the closely related species *D. inoxia* Mill. (Verloove 2008). Reports of the occurrence of this species as casual or naturalized alien in some Italian regions are very recent (Banfi and Galasso 2010, Verloove et al. 2010, Ardenghi et al. 2011, Del Guacchio 2011, Cerutti and Motta 2012, D'Aleo and Bonanno 2016, Galasso et al. 2018). A single individual was observed growing on sandy soil near Lake Bracciano, along with other alien species as *Abutilon theophrasti* Medik., *Ludwigia peploides* (Kunth) P.H.Raven subsp. *montevidensis*

(Spreng.) P.H.Raven, *Pavonia hastata* Cav. (see also Galasso et al. 2017), and *Physalis peruviana* L. (see beyond in this contribution). The plant regularly developed a high number of flowers and fruits from July to December 2017.

S. Buono, S. Magrini, A. Scoppola

Delosperma cooperi (Hook.f.) L.Bolus (Aizoaceae)

+ (CAS) **EMR**: Castel San Giovanni (Piacenza), Via Fratelli Bandiera (SP10R), angolo con Via Bottarone (WGS84: 45.06085°N; 9.43153°E), ciglio stradale, con *Setaria italica* subsp. *viridis* e *Lactuca sativa* subsp. *serriola*, 75 m, 3 September 2017, *N. Ardenghi*, *S. Mossini* (FI). – Casual alien species new for the flora of Emilia-Romagna.

A single flowering individual was found in the growing site.

N.M.G. Ardenghi, S. Mossini

Euonymus japonicus Thunb. (Celastraceae)

+ (CAS) **ABR**: Pescara (Pescara), aiuola lungo Viale T. Patini (WGS84: 42.452488°N; 14.241713°E), epifita su stipite di *Phoenix canariensis*, ca. 4 m, 29 October 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

A young individual of this species grows as an epiphyte among the stumps of the cut leafy rachis of a *Phoenix canariensis* H.Wildpret, at about 1.5 m from the ground. The settlement site is located in a coastal, partially shaded, suburban area, not far from the Adriatic Sea. In the surrounding gardens, *Euonymus japonicus* is cultivated as ornamental and the recorded plant may have originated from seeds dispersed by ornithochory.

N. Olivieri

Freesia alba (G.L.Mey.) Gumbl. (Iridaceae)

+ (CAS) **ABR**: San Vito Chietino (Chieti), fraz. Marina di San Vito (WGS84: 42.307275°N; 14.446527°E), prato presso giardino privato, ca. 20 m, 29 October 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

A young individual of the species has developed in a meadow near a private garden where the species is cultivated. It grows on sandy-pelitic soil, dry in summer. The locality is close to the Adriatic Sea, and has a Mediterranean climate, but it is exposed to damp atmospheric currents coming from the sea. *Freesia alba* and its horticultural hybrids with *F. corymbosa* N.E.Br. and *F. leichtlinii* Klatt, erroneously attributed to *F. refracta* (Jacq.) Klatt (Goldblatt and Manning 2008, Galasso et al. 2018), are bulbous plants of South African origin cultivated as ornamentals, even outdoors and in the ground along the Abruzzo coasts.

N. Olivieri

Hylotelephium spectabile (Boreau) H.Ohba (Crassulaceae)

+ (CAS) **MAR**: Pesaro (Pesaro e Urbino), Viale della Liberazione, Mura roveresche (WGS84: 43.90999°N; 12.90483°E), parete in mattoni, con *Capparis orientalis*, *Parietaria judaica*, *Convolvulus sepium*, 28 August 2017, *N. Ardenghi, S. Mossini* (FI). – Casual alien species new for the flora of Marche.

Two individuals (one of which with ripening fruits) were observed on the ancient city walls of Pesaro, probably originating from the dissemination of cultivated plants in the nearby dwellings.

N.M.G. Ardenghi, S. Mossini

Lantana camara L. subsp. *aculeata* (L.) R.W.Sanders (Verbenaceae)

+ (CAS) **PUG**: Ugento (Lecce), fraz. Torre San Giovanni, lungo un canale artificiale presso la costa ionica (WGS84: 39.875752°N; 18.146011°E), vegetazione disturbata lungo un canale, ca. 4 m, 24 August 2017, *N. Olivieri* (FI). – Casual alien subspecies new for the flora of Puglia.

Some individuals grow near an artificial channel along with *Phragmites australis* (Cav.) Trin. ex Steud. subsp. *australis* in a flat coastal area, on a red soil with good water availability, characterized by disturbed vegetation and partially shaded by some *Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*. The previous report for Puglia (Olivieri 2012) of *Lantana camara* L. for the same area of Ugento has to be referred to the same taxon recorded here. *L. camara* subsp. *aculeata* is widely cultivated for ornamental purposes and naturalized in the tropics and subtropics; in Italy it is reported in Abruzzo, Molise, Basilicata, Calabria, Sicilia, and Sardegna (Galasso et al. 2018).

N. Olivieri

Lantana depressa Small (Verbenaceae)

+ (CAS) **PUG**: Taranto (Taranto), presso la stazione ferroviaria (WGS84: 40.484680°N; 17.223055°E), incolto, ca. 17 m, S, 23 August 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Puglia.

One individual of the species grows at the base of the steps leading to an old abandoned building near the railway embankment, not far from the railway station. It has developed inside a fissure at the base of the rise of a partially eroded concrete step, in a context of ruderal vegetation dominated by *Dittrichia viscosa* (L.) Greuter subsp. *viscosa*. *Lantana depressa* is native to southern Florida and has also been reported in Sicilia (Galasso et al. 2018). According to Sanders (2012), the individual belongs to *L. depressa* var. *depressa*, originally widespread along the limestone outcrop of the Miami Rock Ridge.

N. Olivieri

Musa basjoo Siebold & Zucc. ex Iinuma (Musaceae)

+ (NAT) **TOS**: Montignoso (Massa-Carrara), fraz. Cinquale, sommità dell'argine di un canale in destra del Fiume Versilia, in prossimità di una villetta residenziale (WGS84: 43.986072°N; 10.161817°E), argine di canale, 2 m, 19 July 2017, *L. Lastrucci, L. Lazzaro* (FI). – Naturalized alien species new for the flora of Toscana.

In the site of collection, the species is present with several individuals, of different ages. The population appears to have originated by vigorous resprout from pruning residues. Indeed, the species is widely cultivated in the gardens of the residential areas near the canals surrounding Lake Porta. Several localized stands of this species have also been observed in other sites of the Massa-Carrara and Lucca provinces.

L. Lastrucci, G. Ferretti, L. Lazzaro

Physalis peruviana L. (Solanaceae)

+ (CAS) **LAZ**: Bracciano (Roma), fraz. Vigna di Valle, Museo Storico dell'Aeronautica Militare, presso l'Aeroporto di Vigna di Valle, in riva al lago (WGS84: 42.085373°N; 12.218674°E), riva di lago, 157 m, 28 July 2017, *S. Buono* (FI, UTV). – Casual alien species new for the flora of Lazio.

Physalis peruviana is a herbaceous perennial species, which has been very widely introduced across the world from South America as a cultivated plant for its fruit, as a medicinal plant, and as an ornamental (CABI 2018). It is reported as a casual alien in several administrative regions, especially in northern Italy, and as naturalized in Sicilia (Galasso et al. 2018). It is classified as an invasive plant at the global level (Global Invasive Species Database 2018). Some individuals of this species grow on sandy soil near Lake Bracciano, along with *Abutilon theophrasti* Medik, *Datura wrightii* Regel (see a previous record in this contribution), *Ludwigia peploides* (Kunth) P.H.Raven subsp. *montevidensis* (Spreng.) P.H.Raven, *Pavonia hastata* Cav. (see also Galasso et al. 2017), *Portulaca oleracea* L., *Solanum nigrum* L., and other alien species. The plants regularly develop flowers and fruits.

S. Buono, S. Magrini, A. Scoppola

Rotala ramosior (L.) Koehne (Lythraceae)

+ (NAT) **EMR**: Colorno (Parma), golena del Po presso la fraz. Sacca (WGS84: 44.976183°N; 10.383083°E), fanghi di lanca, 25 m, 20 August 2017, *M. Adorni* (FI). – Naturalized alien species new for the flora of Emilia-Romagna.

In Galasso et al. (2018), *Rotala ramosior* is reported only for Piemonte, Lombardia, where the species grows in rice fields (Banfi and Galasso 2010), and for Veneto along the River Po (Masin and Scortegagna 2012). The population from Sacca, con-

sisting of several dozens of plants growing on muddy and damp soil, was also reported in the Acta Plantarum Forum (http://www.floraitaliae.actaplantarum.org/viewtopic.php?t=98599).

M. Adorni

Styphnolobium japonicum (L.) Schott (Fabaceae)

+ (CAS) **PUG**: Foggia (Foggia), Villa Comunale - Parco Karol Wojtyla (WGS84: 41.555366°N; 15.186515°E), ca. 64 m, 19 August 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Puglia.

Some young individuals of the species grow along the perimetral wall of the Villa Comunale, near Via Galliani, on a calcareous alluvial vertisol subjected to partial desiccation of the herbaceous vegetation in summer, partially shaded by *Styphnolobium japonicum* and *Pinus halepensis* Mill. subsp. *halepensis*.

N. Olivieri

Trachycarpus fortunei (Hook.) H.Wendl. (Arecaceae)

+ (CAS) **MAR**: Pesaro (Pesaro e Urbino), Viale C. Battisti (WGS84: 43.91577°N; 12.91205°E), aiuola con *Acer pseudoplatanus* coltivato, 4 m, un individuo, 28 August 2017, *N. Ardenghi, S. Mossini* (FI). – Casual alien species new for the flora of Marche.

A single, aged individual was found in a public flowerbed, probably grown from seeds originated from cultivated plants in the surroundig public and private gardens.

N.M.G. Ardenghi, S. Mossini

Tradescantia fluminensis Vell. (Commelinaceae)

+ (CAS) **MAR**: Pesaro (Pesaro e Urbino), Viale della Liberazione, Mura roveresche (WGS84: 43.90999°N; 12.90483°E), parete in mattoni, con *Capparis orientalis*, *Parietaria judaica*, *Convolvulus sepium*, 28 August 2017, *N. Ardenghi, S. Mossini* (FI). – Casual alien species new for the flora of Marche.

A group of plants, without flowers or fruits, was found on the ancient city walls of Pesaro, probably deriving from the dissemination of cultivated plants in the surrounding dwellings.

N.M.G. Ardenghi, S. Mossini

Nomenclature and distribution updates from other literature sources

Nomenclature, status, and distribution updates according to Béguinot (1903), Devesa (2007), Kilian et al. (2009+), Göktürk and Sümbül (2014), Liu et al. (2017), Banfi (2018), Güzel et al. (2018), and Martini and Viciani (2018), and corrections to Galasso et al. (2018) are provided in Supplementary material 1.

G. Galasso

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Supplementary material 1

Supplementary data

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Data type: species data

Explanation note: 1. Nomenclature updates; 2. Status/Note updates; 3 Distribution updates; 4. Synonyms, misapplied or included names.

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RESEARCH ARTICLE

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Contribution to the floristic knowledge of the head of the Po Valley (Piedmont, north Italy)

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Abstract

In 2014, the annual field trip of the working group for Floristics, Systematics, and Evolution of the Italian Botanical Society was held in Piemonte (northern Italy), at the head of the Po Valley. This valley, at whose extremity is located the Monviso (3,841 m a.s.l.), belongs to the Cottian Alps about which very little is known from a floristic point of view. An inventory of the taxa of vascular plants collected during the field trip is reported here. The research led to the identification of 3,546 *exsiccata*, kept in nine public and nine private collections. A total of 669 taxa belonging to 79 plant families were recorded. Six taxa resulted endemic to Italy and three exclusive to Piemonte, while only nine alien species were detected; six taxa are new and five confirmed for the regional flora.

Keywords

Cottian Alps, regional flora, new floristic records, vascular flora

Introduction

This contribution is part of the activities promoted by the working group for Floristics, Systematics, and Evolution of the Italian Botanical Society, which, since 2003, has given particular emphasis to territorial research aimed at floristic censuses, jointly conducted by botanists from different Administrative Regions. One of the main goals of the working group is to increase knowledge about the vascular flora of poorly known areas. Only three expeditions have been carried out so far in central and northern Italy, two in Liguria (Peccenini et al. 2007, 2010) and one in Toscana (Peruzzi et al. 2011).

In this paper, we present the results of a field trip held in 2014 in Piemonte (northern Italy), organized by Daniela Bouvet, Annalaura Pistarino and Adriano Soldano. The aim of the trip was to increase our floristic knowledge of the Po Valley on the Piemonte side of the Cottian Alps. The area that has been poorly studied from floristic and vegetational points of view (Bouvet et al. 2005), and the valley is considered an "area with intermediate floristic knowledge".

Study area

The area covered by the excursion is located in Piemonte at the head of the Po River basin; from an administrative point of view, it falls within the Cuneo province, in the municipalities of Ostana, Oncino and Crissolo and in a small part of Paesana (Fig. 1).

The Po Valley is geographically located between the Pellice Valley to the north and the Varaita Valley to the south and southwest, and borders to the west with the Guil Valley along the Italian-French cross-border waterfront ridge. The valley runs from southeast to northwest from the plain to Paesana and irregularly east-west in the middle-upper part; it is over 30 km long. The altitude ranges from 400 m a.s.l. at Revello-Martiniana Po to 3,841 m a.s.l. at the top of the Monviso, which surmounts the surrounding peaks by about 500 m (Suppl. material 1: 1).

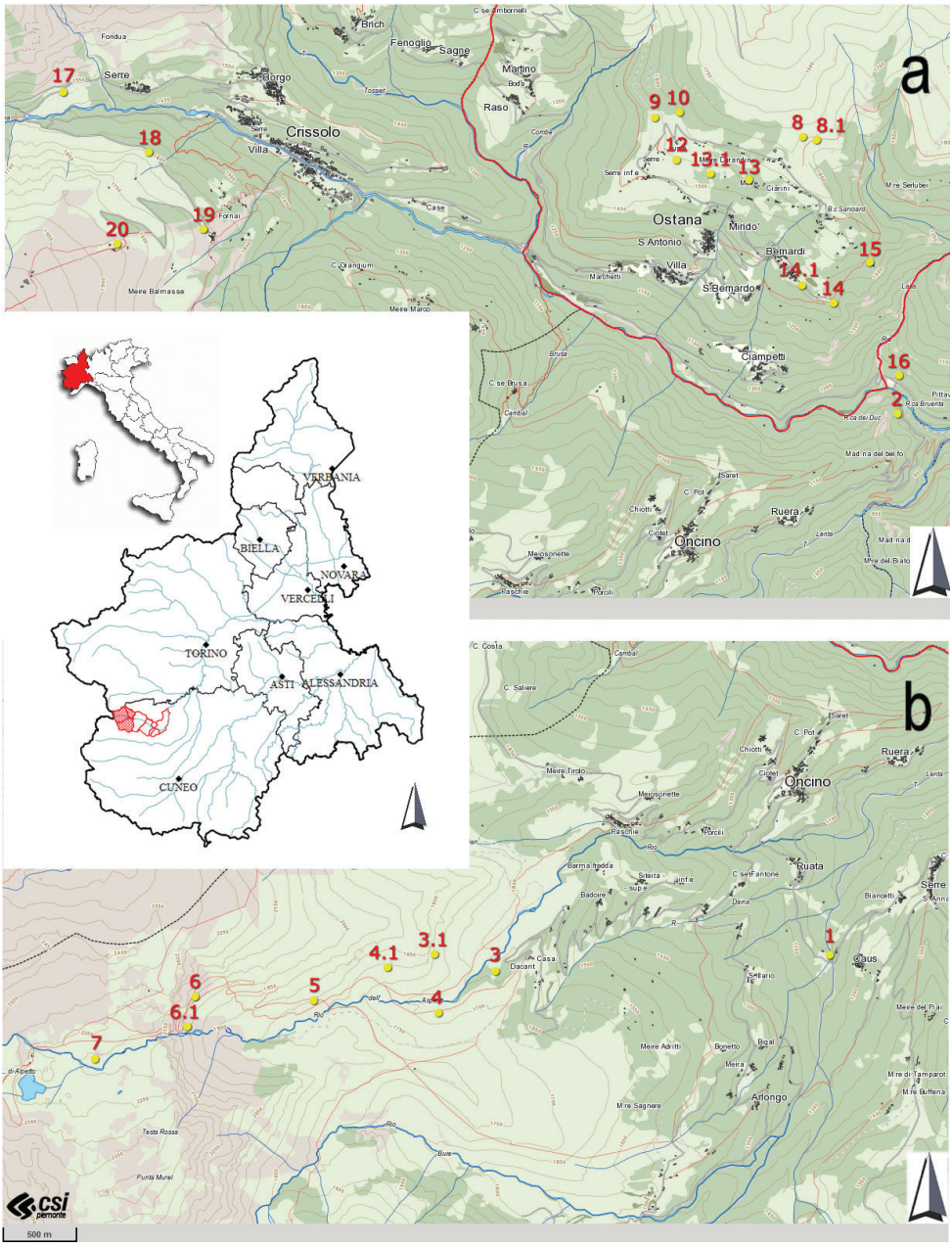

Figure 1. Area where the annual field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society took place and topographic maps (scale 1:20,000) with collecting sites (number and yellow dots). For detailed data of each site, see Suppl. material 1: 5. **a** July, 9 (site n. 2), July, 11 (from site n. 8 to n. 16), July, 12 (from site n. 17 to n. 20) **b** July, 9 (site n. 1) and July, 10 (from site n. 3 to n. 7). From: GeoPortale Piemonte (Regione Piemonte – http://www.geoportale.piemonte.it/).

The Po Valley is one of the historic cross-border trade routes. It was used in the Middle Ages, although less than the Varaita Valley; it connected the Marchesato of Saluzzo with the Château Queyras (in the Guil Valley, currently in the Département Hautes-Alpes), through the road from Revello, Sanfront and Paesana, where it joined the one from Barge, thereby connecting this area with the Pinerolese area and the domains of Savoy. In the past, the ancient pedestrian pass of the Po Valley was the Colle delle Traversette (2,950 m a.s.l.); the first alpine tunnel, the "Hole of the Viso" (2,882 m a.s.l.), a tunnel less than 100 m in length, was excavated in 1479–80 in order to allow trade with France.

The orography of the valley narrows upstream of Paesana, becoming steep and closed in the municipalities of Ostana, Oncino and Crissolo and widening in correspondence with the glacial plains of Pian della Regina and Pian del Re at the base of the Monviso. The natural and social environment is characterized by a remarkable heterogeneity, with settlements organized in small historically important mountainous hamlets, located between the valley floor and the lower mountain slopes. As in many western alpine valleys, the following phenomena occur:

– widespread abandonment and depopulation of the head of the valley, with small, more populated villages (e.g., Crissolo, Ostana, Oncino), and episodic congestion due mostly to summer tourism;
– abandonment of marginal areas (grassland-pastures) or impervious areas unsuitable for pasture, therefore with spontaneous re-naturalization through tree and shrub invasion and, at high altitudes, *via* herbaceous and suffruticose alpine formations, with a greater degree of wildness, but lower pabular value;
– abandonment of anthropogenic forests (chestnut) and progressive advancement of the senescence and forest instability phases;
– interventions on watercourses, especially on the Po River, with the creation of artificial banks and weirs at the head of the valley, mostly resulting in a loss of wildness.

The Western Alps are characterized by a high degree of geological complexity (Compagnoni and Sandrone 1981). In particular, the investigated area is located at the point of contact between two well-differentiated areas: at the head of the Po Valley near Ostana-Oncino, considering an imaginary north-south line from Villanova to Ostana, the Dora-Maira Massif to the east and the Piemonte Zone of calcschists with ophiolites to the west are placed side by side (Suppl. material 1: 2).

The Dora-Maira Massif is characterized by metamorphic rocks, of both eruptive and sedimentary origin, involved in alpine orogenesis. The most common lithological types are gneiss and micaschists and, in subordinate quantities, quartzites, marbles and amphibolites.

The Piemonte Zone consists of heterogeneous metamorphic rocks of sedimentary and eruptive origin, where three different sequences are distinguished by lithological composition: a predominantly triassic carbonate sequence, a jurassic carbonate-argillaceous sequence (calcschists) and a set of rocks linked to deep magmatic events

(ophiolites). The landscape of the calcschistous areas, due to the poor resistance of these rocks to atmospheric agents, is characterized by basically soft shapes, as opposed to the steep relief of green stones and limestone-dolomite walls.

The rocks of the Dora-Maira Massif and of the Piemonte Zone emerge in the area with discontinuities: in fact, they are often covered with incoherent materials, resulting from their mechanical removal and their chemical alteration on the surface environment. In cartography they are, generally, referred to as quaternary overlay, which includes morainic soils, alluvial and conoid deposits, debris and debris cones, and eluvio-colluvial overlay.

From a climatic point of view, based on annual rainfall distribution, the head of the Po Valley is characterized by a continental pluviometric regime with the lowest rainfall being in winter. Pluviometric data for the Paesana municipality tend to a prealpine regime, with a main rainfall peak in spring and a secondary one in autumn; data for the Crissolo municipality suggest a subalpine regime, with a main rainfall peak in autumn and a secondary one in spring. Average annual temperature and precipitation values correspond to Thornthwaite's humid climate for the municipality of Paesana (altitude 614 m) and to perhumid for the municipalities of Oncino (1,220 m), Ostana (1,250 m) and Crissolo (1,318 m) (Suppl. material 1: 3).

Part of the study area (e.g., the Alpetto Valley) is included in the "Parco naturale regionale del Monviso" (Monviso Regional Park) and in the ZSC "Gruppo del Monviso e Bosco dell'Alevé" (IT1160058), in continuity with the Parc Naturel Régional du Queyras on the French side. In 2013, the Monviso has become a MaB Reserve of UNESCO.

According to "Habitat Directive" 92/43/EEC, the biotopes of particular interest from a botanical standpoint, are the Pian del Re peat bog (included in the Special Natural Reserve of the Parco del Monviso), which retains peculiar glacial wrecks (Priority habitats 7240 *Alpine pioneer formations of *Caricion bicoloris-atrofuscae* and 7230 Alkaline fens), and the maple-lime-ash forests in the Oncino Valley (Priority Habitat 9180 **Tilio-Acerion* forests of slopes, screes and ravines).

There is no overall study that assembles the floristic studies conducted over the centuries in the Po Valley. Some punctual contributions have been published, mostly for high-altitude flora or for findings of interesting species, or for the conservation of protected areas.

Material and methods

During the four days of research (July 9–12, 2014), 34 participants to the field trip, accompanied by three foresters of the Monviso Regional Park (Suppl. material 1: 4) collected samples in 20 sites corresponding to biotopes considered significant for the head of the Po Valley. For each collecting site the reference number for the floristic list, collection date, toponyms with a short description, altitude, main habitats, cartographic coordinates (using UTM projection, ED50 geodetic system) and number of *exsiccata*

collected for each site are indicated (Suppl. material 1: 5). These collecting localities are related to litotypes of the substrates in Suppl. material 1: 2 and to a topographic map with a detail of 1:20,000 in Fig. 1.

In analogy with the working method already experienced in previous trips, the identification of *exsiccata* was carried out firstly individually by the collectors; then the most critical samples were revised by botanists present at a two-day meeting held on 23 and 24 February 2015 at the Department of Life Sciences and Systems Biology of the University of Turin. Specimens with no satisfactory identification yet were re-examined by some participants.

The floristic list was produced with the contribution of almost all participants to the field trip; some critical genera required the support of specialists: Ardenghi N.M.G. (*Festuca*, *Schedonorus*), Buccheri M., Casolo V. and Martini F. (*Achillea*), Cecchi L. (*Pulmonaria*), Domina G. (*Orobanche*), Dotti L. and Isaja A. (*Herminium*, *Nigritella*), Festi F. and Fröhner S.E. (*Alchemilla*), Gallo L. (*Hylotelephium*, *Sedum*, *Sempervivum*), Gottschlich G. (*Hieracium*, *Pilosella*), Marchetti D. (*Asplenium*, *Cystopteris*, *Dryopteris*), Martignoni M. (*Euphrasia*), Martinetto E. (*Cyperaceae*), Paiero P. (*Salix*), Polidori J.-L. (*Gentiana*), Scoppola A. (*Viola*), Selvaggi A. (*Juncus*, *Luzula*), Vogt R. (*Leucanthemum*) and Zaccara P. (*Pinguicula*).

Each systematic unit in the list is supported by at least one herbarium sample stored in either a public or private collection (Suppl. material 1: 6). Nomenclature and taxa delimitation followed the updated version of the Checklist of Italian Flora (Bartolucci et al. 2018, Galasso et al. 2018), except for varieties and hybrids (not considered in the above-mentioned Checklist).

In the floristic list (Suppl. material 1: 7), the systematic order and taxonomic circumscription of the families follow Bartolucci et al. (2018) and Galasso et al. (2018). Taxa are ordered alphabetically within each family. For each unit, synonyms used as accepted names in Conti et al. (2005, 2007) are indicated in square brackets. The reference number of the collecting site (Suppl. material 1: 5) and, in brackets, the herbarium collections in which the samples are kept, are reported below; when they belong to public collections, they are indicated with their acronym according to Thiers (2017), if part of a private collections with a code indicated in Suppl. material 1: 6.

The letter "E" preceding the scientific name indicates an endemic taxon for Italy (following Bartolucci et al. 2018); the letter "e" refers to few "exclusive" taxa, i.e., taxa that within Italy are only present in Piemonte, but are also present in neighbouring countries (France and/or Switzerland) (according to Bartolucci et al. 2018 and Aeschimann et al. 2004). The letter "A" indicates an alien unit; it is followed by the regional status: "NAT" for a naturalized species, "INV" for an invasive one (according to Bartolucci et al. 2018 and Galasso et al. 2018). The floristic novelties for the regional flora, according to Bartolucci et al. (2018) are marked with asterisks (** = new unit, * = confirmed unit, previously "Doubtful" or "Not Confirmed"). For some units that were particularly critical, a systematic, taxonomic and/or nomenclatural note has been included.

Results

During the field trip, almost 3700 samples of vascular plants were collected. The specimens identified at the species level are 3546. Amongst these, 594 specimens were collected in the first half-day of the excursion, 1691 in the second day, 957 in the third day and 304 in the fourth half-day. The site with the largest number of samples collected is by far No. 3 (443) (see the number of *exsiccata* for each site in Suppl. material 1: 5).

The specimens included in the floristic list belong to 669 taxa and 79 plant families (see Suppl. material 1: 7), including three varieties (*Thymus pulegioides* L. var. *pulegioides*, *Thymus pulegioides* var. *vestitus* [Lange] Jalas, *Laserpitium gallicum* subsp. *gallicum* var. *angustifolium* [L.] Lange) and one hybrid (*Carex lepidocarpa* Tausch × *Carex demissa* Hornem.).

Six taxa are endemic to Italy (indicated with "E" in Suppl. material 1: 7):

Sedum alsinifolium All.
Alchemilla vaccariana Buser
Dianthus furcatus subsp. *lereschii* (Burnat) Pignatti
Pulmonaria vallarsae subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi
Melampyrum italicum (Beauverd) Soó
Campanula elatines L.

Amongst these, two species are only present in Piemonte (*Campanula elatines* L. and *Sedum alsinifolium* All.), one only in Piemonte and Val d'Aosta (*Alchemilla vaccariana* Buser) and one only in Piemonte and Val d'Aosta and doubtfully in Liguria (*Dianthus furcatus* subsp. *lereschii* [Burnat] Pignatti).

Three taxa are exclusive to Piemonte, i.e., present in no other Administrative Region of Italy, but present in neighbouring countries (indicated with "e" in Suppl. material 1: 7):

Pulsatilla alpina subsp. *cottianaea* (Beauverd) D.M.Moser (endemic to the Western Alps, present in Piemonte and France), *Gentiana rostanii* Verl. (endemic to the Western Alps, present in Piemonte and France), *Hieracium piliferum* subsp. *subnivale* (Gren. & Godr.) Zahn (endemic to south-west Europe, present in Piemonte and France).

Only nine alien species were found.

Four of them are considered invasive in Piemonte (indicated with "A INV" in Suppl. material 1: 7): *Juncus tenuis* Willd., *Robinia pseudacacia* L., *Erigeron annuus* (L.) Desf. and *Galinsoga quadriradiata* Ruiz & Pav.

Five are considered naturalized (indicated with "A NAT" in Suppl. material 1: 7): *Papaver argemone* L. subsp. *argemone*, *Oxalis stricta* L., *Digitalis purpurea* L. (spontaneous in Calabria and Sardegna), *Veronica persica* Poir. and *Matricaria discoidea* DC.

Six taxa are floristic novelties for the regional flora of Piemonte (indicated with "**" in Suppl. material 1: 7):

Melica transsilvanica subsp. *klokovii* Tzvelev
Saxifraga cuneifolia subsp. *robusta* D.A.Webb

Alchemilla transiens (Buser) Buser
Salix waldsteiniana Willd.
Tilia platyphyllos subsp. *cordifolia* (Besser) C.K.Schneid.
Taraxacum panalpinum Soest

Three taxa were considered "doubtful" in Piemonte and are thus confirmed (indicated with "*" in Suppl. material 1: 7):

Helictochloa praeusta subsp. *pseudoviolacea* (Dalla Torre) H.Scholz
Cuscuta planiflora Ten.
Picris hieracioides L. subsp. *umbellata* (Schrank) Ces.

The finding of two species, for which the specimens collected in the Po Valley are the first since over 50 years, confirms the presence of the entity in Piemonte (indicated with "*" in Suppl. material 1: 7):

Centaurea scabiosa subsp. *alpestris* (Hegetschw.) Nyman
Leucanthemum ircutianum DC. s.l.

A significant number of collected taxa are included in Red Lists (the category of risk is indicated in brackets):

– seven species are included in the Red List of Piemonte (Conti et al. 1997):

Carex fimbriata Schkuhr (LR, also included in the Italian Red List)
Aquilegia alpina L. (LR)
Sedum alsinifolium All. (LR)
Malva moschata L. (LR)
Noccaea sylvia (Gaudin) F.K.Mey. (LR, also included in the Italian Red List)
Drosera rotundifolia L. (VU)
Cerastium lineare All. (LR, also included in the Italian Red List)

– eight taxa are included in the IUCN Red List of the Italian Flora (Rossi et al. 2013):

Huperzia selago (L.) Bernh. ex Schrank & Mart. subsp. *selago* (Least Concern)
Lycopodium clavatum L. (Least Concern)
Selaginella helvetica (L.) Spring (Least Concern)
Selaginella selaginoides (L.) Schrank & Mart. (Least Concern)
Herminium monorchis (L.) R.Br. (Endangered)
Aquilegia alpina L. (Least Concern)
Gentiana lutea L. subsp. *lutea* (Near Threatened)
Arnica montana L. subsp. *montana* (Least Concern).

A number of units were not identified at a detailed level: one taxon was identified at the section level (*Taraxacum* sect. *Alpina* G.E.Haglund), 20 species were identified *sensu lato* (*Viola calcarata* L., *Buphthalmum salicifolium* L., *Hieracium bifidum* Hornem., *H. dasytrichum* Arv.-Touv., *H. dentatum* Hoppe, *H. glaucinum* Jord., *H. lachenalii* Suter, *H. murorum* L., *H. obscuratum* Murr, *H. pilosum* Froel., *H. ramosissimum* Hegetschw., *H. scorzonerifolium* Vill., *H. tenuiflorum* Arv.-Touv., *H. valdepilosum* Vill., *H. villosum* Jacq., *Leucanthemum coronopifolium* Vill., *Leucanthemum ircutianum* DC., *Pilosella lactucella* [Wallr.] P.D.Sell & C.West, *P. piloselloides* [Vill.] Soják, *Scabiosa columbaria* L.).

Eight taxa were not identified with certainty and, therefore, are not included in the floristic list (*Festuca plonkae* Foggi & Signorini, *Alchemilla chirophylla* Buser, *A. incisa* Buser, *Urtica dioica* L. subsp. *pubescens* [Ledeb.] Domin, *Hypericum ×desetangsii* Lamotte, *Erysimum jugicola* Jord., *Pinguicula reichenbachiana* Schindl., *Leucanthemum heterophyllum* [Willd.] DC.).

Discussion

The 669 taxa found in the study area represent ca. 17% of the flora of Piemonte (4015 taxa, according to Bartolucci et al. 2018 and Galasso et al. 2018); they were found over an area that represents only 0.4% of the Regional area (the Crissolo, Oncino and Ostana municipalities occupy a surface area of 113 km^2, out of the 25,387 km^2 of the total).

Endemics (six) amount to almost 0.9% of the taxa observed and to 3.8% of the endemic species present in Piemonte (158, according to Bartolucci et al. 2018).

The percentage of alien species is very low (1.3%), compared with the percentage (12.8%) reported by Galasso et al. (2018), probably due to the altitude of the collection sites (always above 900 m) and to the relative low rate of anthropization of the habitats explored. This low percentage reveals that the area includes environments with a high degree of wildness.

Overall, there are six new taxa for the flora of Piemonte and five confirmations of doubtful or not confirmed taxa.

The high number of species detected, even in a few days of collection and in a small number of sites, suggests that the diversity of the flora in this area is remarkable and deserves further research. In particular, the Alpetto Valley and the surroundings of Ostana were unknown from a floristic point of view. The collected data also contribute to drafting the naturalistic plan of the "Parco del Monviso" and provide useful data for monitoring habitats and species of European interest (as required by Habitat Directive 92/43/EEC).

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Supplementary material 1

Supplementary data

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Data type: Word .doc file

Explanation note:

1. Monviso and the head of Po Valley.

2. Collection sites displayed on the Geological map of Italy (scale 1:100,000). For detailed code of each site see Suppl. material 1: 5.

3.1. Temperature and rainfall data for the weather station of Paesana (1,265 m a.s.l.) in the period 1993–2017.

3.2. Temperature and rainfall data for the weather station of Crissolo (1,342 m a.s.l.) in the period 2012–2017.

3.3. Snowfall data for the weather stations of Paesana (1,265 m a.s.l.) and Pian Giasset (2,150 m a.s.l.) in the period 2002–2017.

4. The 34 participants to the field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society from 9 to 12 July 2014.

5. List of collecting sites, with reference number, date of collection, placename with short description, altitude, main habitats, cartographic coordinates (expressed using UTM projection, ED50 geodetic system, zone 32T), number of *exsiccata* collected for each site. For detailed topographic map see figure 1.

6. Public *herbaria* and private collections in which the *exsiccata* collected are kept. Acronyms of public collections refer to Thiers (2017); in the column on the right number of *exsiccata* kept in each collection.

7. Floristic list of taxa observed at the head of the Po Valley (Piemonte, province of Cuneo) with reference number of collecting site and *herbaria* collections (in brackets). For detailed code of each site and *herbaria* see Suppl. material 1: 5, 6.

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RESEARCH ARTICLE

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Notulae to the Italian native vascular flora: 5

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Abstract

In this contribution, new data concerning the distribution of native vascular flora in Italy are presented. It includes new records and confirmations to the Italian administrative regions for taxa in the genera *Allium*, *Arabis*, *Campanula*, *Centaurea*, *Chaerophyllum*, *Crocus*, *Dactylis*, *Dianthus*, *Festuca*, *Galanthus*, *Helianthemum*, *Lysimachia*, *Milium*, *Pteris*, and *Quercus*. Nomenclature and distribution updates, published elsewhere, and corrections are provided as supplementary material.

Keywords

Floristic data, Italy, nomenclature

How to contribute

The text for the new records should be submitted electronically to Chiara Nepi (chiara.nepi@unifi.it). The corresponding specimens along with its scan or photograph have to be sent to FI Herbarium: Sezione di Botanica "Filippo Parlatore" del Museo di Storia Naturale, Via G. La Pira 4, 50121 Firenze (Italy). Those texts concerning nomenclatural novelties (typifications only for accepted names), status changes, exclusions, and confirmations should be submitted electronically to: Fabrizio Bartolucci (fabrizio.bartolucci@gmail.com). Each text should be within 2,000 characters (spaces included).

Floristic records

Allium schoenoprasum L. subsp. *schoenoprasum* (Amaryllidaceae)

+ **SAR:** Villagrande Strisaili (Ogliastra), Rio Bau Mela, rocce del torrente, sx orografica a monte del ponte. (WGS84: 40.016700°N; 09.251693°E) 870 m s.l.m., 17 June 2016, *G. Calvia, G. Mereu, A. Tatti* (FI). – Species new for the flora of Sardegna.

This species has a boreal distribution and, in Italy, it is known for all the northern administrative regions, Lazio and Abruzzo, but not yet for Sardegna (Bartolucci et al. 2018). The species is widespread in Corsica, according to Jeanmonod and Gamisans (2013). The Sardinian population reported here was first found in June 2013 (herbarium specimen preserved in Berchidda, Herb. Calvia) and was observed again in 2016, in a small area along a stream in the eastern basal sector of the Gennargentu.

G. Calvia, G. Mereu

Arabis planisiliqua (Pers.) Rchb. (Brassicaceae)

+ **ABR:** Serramonacesca (Pescara), Castel Menardo (WGS84: 42.240007°N; 14.086163°E), pascoli, 400 m, 18 May 2002, *F. Conti, D. Tinti* (APP No. 14786, FI); Capestrano (L'Aquila), Vallone di S. Giacomo (WGS84: 42.266167°N; 13.821541°E), *Quercus ilex* and *Q. pubescens* wood, 550 m, 20 May 2005, *C. Oberprieler et al.* (APP No. 15085); Valle Castellana (Teramo), M.ti Gemelli al M. dei Fiori presso Sant'Angelo in Volturino (WGS84: 42.771212°N; 13.581027°E), pendii rupestri, 1200-1465, 24 April 2000, *F. Conti*, *D. Tinti*, *L. Gubellini*, *A. Alessandrini* (APP No. 18778). – Species new for the flora of Abruzzo.

In Italy, the species is recorded only for Liguria and Sardegna, while it is not been recently confirmed for Toscana (Bartolucci et al. 2018).

F. Conti, F. Bartolucci

Campanula isophylla Moretti (Campanulaceae)

+ (CAS) **ABR:** Castelli (Teramo), muraglione in blocchi di roccia calcarea situato lungo il margine stradale all'interno dell'abitato (WGS84: 42.488558°N; 13.711749°E), ca. 497 m, 24 September 2017, *N. Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

The site in which the species was discovered is an urban area. The individual has probably grown from seeds produced by plants cultivated for ornamental purposes on private balconies. *Campanula isophylla* is an Italian endemic, native to Liguria (Bartolucci et al. 2018), but widely cultivated for ornamental purposes.

N. Olivieri

Centaurea centauroides L. (Asteraceae)

+ **CAL:** Albidona (Cosenza), Serra del Glaccaro, lungo la strada SP 153, incolti a margine strada (WGS84: 39.906101°N; 16.514156°E), 480 m, 21 June 2017, *L. Bernardo, D. Gargano, N.G. Passalacqua* (FI, CLU). – Species new for the flora of Calabria.

This species is endemic to southern Italy (Peruzzi et al. 2014, 2015); it is known for Molise, Campania, Basilicata, and Puglia (Del Guacchio 2010, Bartolucci et al. 2018). To date, the locality reported here represents the southern limit of the species' range.

L. Bernardo, D. Gargano. N.G. Passalacqua

Chaerophyllum nodosum (L.) Crantz (Apiaceae)

+ **PUG:** Monti dell'Arena, Cagnano (Foggia), 15 March 1893, *U. Martelli*, (FI 52277, sub *Physocaulis nodosus* Tausch); Murgie di Gravina, nel "Pulicchio", ai "Fronti di Gravina" (Bari), 12 August 1897, *A. Palanza* (BI 45750-45751); San Giovanni Rotondo (Foggia), Valle Masselli (WGS84: 41.67159°N; 15.79295°E), 482 m s.l.m., lecceta, 31 May 2008, Leg. et Det. *F. Mantino* (BI 40527); Castellaneta (Taranto), Monte S.

Trinità (WGS84: 40.627034°N; 16.858954°E), 410 m s.l.m., boscaglia a Leccio, 9 December 2008, Leg. *F. Carruggio*, Det. *F. Carruggio & G. Pazienza* (BI 40528); Gravina in Puglia (Bari), Pulicchio di Gravina (WGS84: 40.90396388°N; 16.42280277°E), 487 m s.l.m., rimboschimento a Pino d'Aleppo, 7 September 2017, Leg. et Det. *G. Pazienza*, (BI 40531-40532). – Species confirmed for the flora of Puglia.

Chaerophyllum nodosum is reported as doubtfully present in Puglia (Bartolucci et al. 2018). An ongoing study on the Alfonso Palanza Herbarium preserved in BI allowed to trace two 19th century specimens collected in Gravina in Puglia (Bari). Another historical collection by U. Martelli from Cagnano Varano (Gargano) can be found in FI (sub *Physocaulis nodosus* Tausch). Furthermore, this species was indicated for Ginosa in the Arco Jonico (Tenore 1831) and for Monte Sacro, in the Gargano promontory again (Rigo 1877, sub *Physocaulus nodosus* Tausch). The new records confirm the presence of this species in all the Apulian areas for which the species was recorded in the past.

G. Pazienza, F. Carruggio, V. Cavallaro, F. Mantino, L. Forte

Crocus neglectus Peruzzi & Carta (Iridaceae)

+ **LAZ:** Configni (Rieti), M. Cosce versante NO-N (WGS84: 42.431248°N, 12.614087°E), pascolo, suolo calcareo, 820 m, 19 February 2017, *F. Falcinelli* (FI); Leonessa (Rieti), M. La Cerasa versante NO (WGS84 42.560348°N; 13.093250°E), pascolo, suolo calcareo, 1520 m, 23 April 2017, *F. Falcinelli* (PI No. 010235). – Species new for the flora of Lazio.

The presence of *Crocus neglectus* was not yet reported for Lazio (Bartolucci et al. 2018). The localities published here are close to the boundary with Umbria, where the species was recently found (Bartolucci et al. 2017).

Falcinelli F., Roma-Marzio F., Peruzzi L.

Dactylis glomerata L. subsp. *hackelii* (Asch. & Graebn.) Cif. & Giacom. (Poaceae)

+ **CAM:** Anacapri (Napoli), Punta Campetiello (WGS84: 40.549047°N; 14.198525°E), rupe calcarea marittima, 10 m, SW, 26 August 2015, *A. Stinca, M. Ravo* (FI, PORUN); Anacapri (Napoli), Punta di Miglio (WGS84: 40.557127°N; 14.198239°E), rupe calcarea marittima, 10 m, N, 26 August 2015, *A. Stinca, M. Ravo* (PORUN); Capri (Napoli), Bagni di Tiberio (WGS84: 40.559380°N; 14.229349°E), rupe calcarea marittima, 2 m, N, 8 August 2015, *A. Stinca, M. Ravo* (PORUN); Capri (Napoli), tra Marina Grande e Punta Vivara (WGS84: 40.556711°N; 14.237138°E), pendio rupestre marittimo, 3 m, NNE, 8 August 2015, *A. Stinca, M. Ravo* (PORUN); Capri (Napoli), Punta Tragara (WGS84: 40.543408°N; 14.251923°E), rupe calcarea marittima, 5 m, SW, 9 August 2015, *A. Stinca, M. Ravo* (PORUN). – Subspecies new for the flora of Campania.

In Italy, *Dactylis glomerata* subsp. *hackelii* was, so far, recorded only for Toscana, Lazio, Puglia, and Sicilia (Bartolucci et al. 2018).

A. Stinca, G. Chianese

Dianthus carthusianorum L. subsp. *tenorei* (Lacaita) Pignatti (Caryophyllaceae)

+ **PUG:** Corato (Bari), Necropoli di San Magno, prateria xerica su substrato calcareo (WGS84: 41.020401°N; 16.212041°E), 478 m, 3 June 2017, *G. Buccomino* (FI). – Subspecies new for the flora of Puglia.

This is an Italian endemic subspecies, reported by Bartolucci et al. (2018) for central and southern Italy excluding Puglia and the islands. The population reported here consists of a small number of individuals. This taxon has also been observed in the "Trullo di Sotto" locality (Poggiorsini, Bari), in the calcareous steppe grasslands related to vegetation of trans-Adriatic and north-Adriatic Carso areas (Forte et al. 2005). Both sites are included in the "Alta Murgia" National Park and the "Murgia Alta" SCIs-SPAs IT9120007 under EU Directive 92/43/CEE.

G. Buccomino

Festuca trichophylla (Ducros ex Gaudin) K.Richt. subsp. *asperifolia* (St.-Yves) Al-Bermani (Poaceae)

+ **LAZ:** Micigliano (Rieti), Monti Reatini, Fonte Campo Marino (WGS84: 42.44698°N; 13.04959°E), brometo a *Bromopsis erecta*, con *Brachypodium rupestre* e *Lotus herbaceus*, argille, 910 m, E, 18 June 2015, Leg. *E. Del Vico*, *L. Facioni,* Det. *N.M.G. Ardenghi* (FI); Rieti (Rieti), Monti Reatini, Monte Lugnano (WGS84: 42.44231°N; 12.96242°E), prateria a *Brachypodium rupestre*, con *Dactylis glomerata* e *Lolium arundinaceum*, 1249 m, WSW, 22 July 2016, Leg. *E. Del Vico*, Det. *N.M.G. Ardenghi* (PAV). – Subspecies new for the flora of Lazio.

This subspecies, typical of mesophilous to mesoxerophilous grasslands (Foggi et al. 2017), is reported from most Italian administrative regions, but not yet from Lazio (Bartolucci et al. 2018).

N.M.G. Ardenghi, E. Del Vico, L. Facioni

Festuca trichophylla (Ducros ex Gaudin) K.Richt. subsp. *trichophylla* (Poaceae)

+ **LAZ:** Poggio Bustone (Rieti), Monti Reatini, Prati S. Giacomo (WGS84: 42.51347°N; 12.90438°E), prateria a *Cynosurus cristatus* con *Lolium perenne*, terra rossa, 1310 m, WSW, 2 July 2015, Leg. *E. Del Vico*, *L. Facioni*, Det. *N.M.G. Ardenghi* (PAV); Micigliano (Rieti), Monti Reatini, Erba pulita (WGS84: 42.46443°N; 12.99754°E), festuceto a *F. trichophylla* subsp. *trichophylla*, con *Poa molinerii*, *Koeleria splendens* e *Thymus praecox* subsp. *polytrichus*, marne, 1702 m, E, 15 July 2017, Leg. *E. Del Vico*, Det. *N.M.G. Ardenghi* (PAV); Rieti (Rieti), Monti Reatini, l'anello-Campoforogna (WGS84: 42.44679°N; 12.99214°E), prateria a *Cynosurus cristatus*, calcare, 1616 m, SE, 21 July 2015, Leg. *E. Del Vico*, Det. *N.M.G. Ardenghi* (PAV); Cantalice (Rieti), Monti Reatini, Colle Mattutino (WGS84: 42.49041°N; 12.91424°E), prateria a *Brachypodium rupestre*, con *Dactylis glomerata* e *Bromopsis erecta*, calcare, 1192 m, SE,

23 June 2016, Leg. *E. Del Vico*, Det. *N.M.G. Ardenghi* (PAV); Poggio Bustone (Rieti), Monti Reatini, Colle Pietrolone (WGS84: 42.49889°N, 12.90310°E), marne, prateria a *Cynosurus cristatus*, con *Lolium perenne*, 1070 m, WSW, 24 June 2016, Leg. *E. Del Vico*, Det. *N.M.G. Ardenghi* (FI, PAV). – Subspecies new for the flora of Lazio.

This subspecies was not yet reported from Lazio (Bartolucci et al. 2018), despite it being quite common in the Monti Reatini area (central Apennines).

N.M.G. Ardenghi, E. Del Vico, L. Facioni

Galanthus reginae-olgae Orph. subsp. *reginae-olgae* (Amaryllidaceae)

+ **LAZ:** Ischia di Castro (Viterbo), Valle del F. Fiora, nei pressi dell'Eremo di Poggio Conte (WGS84: 42.510893°N; 11.625411°E), 113 m, bosco misto con cerro, carpino bianco e alloro, esp. W-SW, 23 December 2017, *A. Scoppola, C. Nicolini*, Det. *L. Peruzzi*, (FI, UTV No. 35351). – Species new for the flora of Lazio.

According to Davis (1999) and Pignatti (2017) it is a NE-Steno-Mediterranean taxon occurring in Greece, the northwestern and western Balkan Peninsula, Sicilia, and peninsular Italy. The records from the four administrative regions in mainland Italy are all recent: Toscana (Mazzoni et al. 2009), Calabria (Di Marco et al. 2011), Basilicata (Bernardo and Caldararo 2015), and Campania (Bamonte 2016). In Lazio, it was observed and collected in 2007 in Ponte San Pietro, close to the border with Toscana, where several hundred individuals grew in mixed Turkey and downy oak wood (L. Peruzzi pers. comm.). It was then cultivated for some years at the Pisa Botanical Garden, but the discovery in Lazio was never published. The current finding comes from a locality not far from Ponte San Pietro in the Fiora river valley, where the local environment (woodland) is particularly favorable due to water availability during the growing season. Here, this taxon grows abundantly on deep fertile volcanic soil. It flowers from late November; leaves either about 2–4 cm long or absent at the onset of flowering.

A. Scoppola, M. Martino

Helianthemum oleandicum (L.) Dum.Cours. subsp. *italicum* (L.) Ces. (Cistaceae)

+ **CAM:** Vico Equense (Napoli), loc. Croce della Conocchia (WGS84: 40.646848°N; 14.496707°E), 1297 m, rocky slops, 7 July 2015, *F. Scafidi*, *E. Di Gristina* (PAL109646, FI). – Subspecies new for the flora of Campania.

This taxon is endemic to the Euro-Mediterranean Region (Raab-Straube 2018). In Italy, it is reported for northern and central administrative regions, and it is recorded as doubtfully present in Puglia (Bartolucci et al. 2018). To date, the locality reported here represents the southern limit of its Italian range.

F. Scafidi, E. Di Gristina

Lysimachia arvensis (L.) U.Manns & Adreb subsp. *arvensis* (Primulaceae)

+ **CAL:** Oriolo (Cosenza), C.da Scalapitta, nell'alveo del torrente Scalapitto (WGS84: 40.04053°N; 16.451051°E), alveo fluviale in secca, 325 m, 17 August 2017, *F. Roma-Marzio* (FI). – Subspecies new for the flora of Calabria.

Three taxonomically doubtful subspecies are recognized in Italy for *Lysimachia arvensis* (Peruzzi and Bartolucci 2016, Bartolucci et al. 2018): *L. arvensis* subsp. *arvensis*, *L. arvensis* subsp. *latifolia* (L.) Peruzzi, and *L. arvensis* subsp. *parviflora* (Hoffmanns. & Link) Peruzzi. In Calabria, only *L. arvensis* subsp. *parviflora* was recorded so far (Bartolucci et al. 2018). The plants reported here are characterized by red-orange petals with three-celled marginal hairs.

F. Roma-Marzio

Milium vernale M.Bieb. subsp. *vernale* (Poaceae)

+ **TOS:** San Rossore (Pisa), coastal pine forest with *Pinus pinea* L. (WGS84: 43.737031°N; 10.334932°E), on sandy soil, 0-5 m, 4 May 2015, leg. *G. Bonari* (FI). – Species new for the flora of Toscana.

To date, this species was known in Italy for the main islands, the south and the center of the Peninsula northwards to Lazio, Umbria, and Marche (Bartolucci et al. 2018). It includes six different variants accepted at subspecific rank, four of which recorded for the Italian flora (Valdés and Scholz 2009). Among these, *M. vernale* subsp. *intermedium* Prob., described from Algeria and putatively reported for Italy but no longer taken into account (Pignatti 2017), remains unresolved. Certainly, systematic and taxonomic boundaries among these taxa are not clear, with the exception of *M. vernale* subsp. *montianum* (Parl.) K.Richt., a morphologically, ecologically and chorologically better circumscribed unit. The Tuscan finding can be attributed to the autonymic subspecies by its culms not sheathed up to the panicle, by the uppermost leaf and the panicle open, with branches not, or scarcely, verticillate.

E. Banfi, G.Bonari

Pteris vittata L. (Pteridaceae)

+ (CAS) **UMB:** Gubbio (Perugia) (WGS84: 43.351888°N; 12.572579°E), mura dell'Anfiteatro Romano, 380 m a.s.l., 2 April 2014, *G. Mei* (FI). – Casual alien species new for the flora of Umbria.

The observed population consists of a very small number of individuals, all characterized by reduced size, likely a symptom of stress.

G. Mei

Quercus suber L. (Fagaceae)

+ (CAS) **ABR:** Pescara (Pescara), aiuola spartitraffico, presso via Antonio Lo Feudo (WGS84: 42.450919°N; 14.218694 E), a ca. 4 m, 9 August 2017, *N.Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

Some young individuals of the species have developed near some adult ones introduced for ornamental purposes in some road-flowerbeds located in the southern part of the city of Pescara. *Quercus suber* is a western Mediterranean species, spread in Italy in Liguria, Toscana, Lazio, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna, and alien in Umbria (Bartolucci et al. 2018). In Abruzzo, the species was present, in the past, in the province of Chieti, as evidenced by various findings discovered in a byzantine settlement of the 6th-7th century AD at Crecchio (Sciò 1993).There is evidence that the presence of *Q. suber* in the region lasted until at least 1700 AD in some areas located along the Adriatic coast (Romanelli 1790). In these places, some existing toponyms refer to this plant.

N. Olivieri

Nomenclature and distribution updates from other literature sources

Nomenclature and distribution updates according to Meve and Liede (2002), Barbaro and Kreutz (2007), Crespo et al. (2015), Ardenghi and Polani (2016), Wilson (2016), Lazzeri (2017), Banfi (2018), Baum and Johnson (2018), Di Gristina et al. (2018), Gutiérrez-Larruscain et al. (2018), Nardi et al. (2018), Madhani et al. (2018), Selvaggi et al. (2018) and corrections to Bartolucci et al. (2018) are provided in Supplementary material 1.

F. Bartolucci

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Supplementary material 1

Supplementary material

Edited by: Fabrizio Bartolucci

Data type: species data

Explanation note: 1. Nomenclature updates; 2. Distribution updates; 3. Synonyms, misapplied or included names.

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RESEARCH ARTICLE

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Global and Regional IUCN Red List Assessments: 5

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Abstract

In this contribution, the conservation status of four vascular plants according to IUCN categories and criteria are presented. It includes the assessment of *Arceuthobium oxycedri* (DC.) M.Bieb., *Ionopsidium albiflorum* Durieu, *Trifolium latinum* Sebast., and *Vicia incisa* M.Bieb. at a Regional level (Italy).

Keywords

conservation, extinction risk, IUCN protocol, threats

How to contribute

The text of the global and regional assessment should be submitted electronically to Simone Orsenigo (simone.orsenigo@unimi.it) or to Giuseppe Fenu (gfenu@unica.it); text up to 8000 characters in length (space included) must include a distribution map and a picture of the assessed species.

Red List assessments

Arceuthobium oxycedri (DC.) M.Bieb.

Regional Assessment (Italy)
Taxonomy and nomenclature
Order: Santalales *Family:* Santalaceae

Arceuthobium oxycedri (DC.) M.Bieb., Fl. Taur.-Caucas. 3: 629. 1820

Common name: vischio del ginepro (It), juniper dwarf mistletoe (En)

Geographic distribution range: *Arceuthobium oxycedri* (Fig. 1) is present in many countries bordering the Mediterranean Sea, in the Caucasus and central Asia (in many former Soviet republics), in the Indian subcontinent, and in western China (Ciesla et al. 2002). In Italy, *A. oxycedri* has been reported from several sites, all close to each other and located in a small area between eastern Toscana and western Marche, in the Provinces of Arezzo (nine localities) and Pesaro/Urbino (six localities) (Brilli-Cattarini and Gubellini 1983, Gonnelli and Scarponi 2003; Fig. 2).

Distribution: countries of occurrence: Afghanistan, Azerbaijan, Algeria, Albania, Armenia, Bosnia-Herzegovina, Bulgaria, China, Croatia, Cyprus, France, Georgia, Greece, India, Iran, Iraq, Italy, Kyrgyzstan, Lebanon, Macedonia, Montenegro, Morocco, Pakistan, Portugal, Russia, Serbia, Slovenia, Spain, Syria, Tajikistan, Tunisia, Turkey, Turkmenistan, Ukraine, and Uzbekistan.

Biology: *Plant growth form:* woody perennial epiphyte, obligate parasite on *Juniperus* sp. pl. and other taxa belonging to Cupressaceae (in Italy only on *Juniperus communis* L., *J. oxycedrus* L. and *J. deltoides* R.P.Adams). Dwarf mistletoe shoots have chlorophyll, but with no photosynthetic significance (Hawksworth and Wiens 1996, Hawksworth et al. 2002).

Flowering time: late summer-early autumn (September to October).

Reproduction: *Arceuthobium oxycedri* is a dioecious plant that only reproduces from seeds. Dispersal is promoted by the hydrostatic contraction of a mature fruit that propels a single, small seed upon ballistic flight to a near location, where a host may be inoculated. The dwarf mistletoes rely almost exclusively on this ballistic mechanism; however, birds and mammals may be important, for the rare, long-distance dissemination of seeds (Hawksworth and Wiens 1996, Hawksworth et al. 2002). The dwarf

Figure 1. *Arceuthobium oxycedri* in Toscana. Picture by V. Gonnelli.

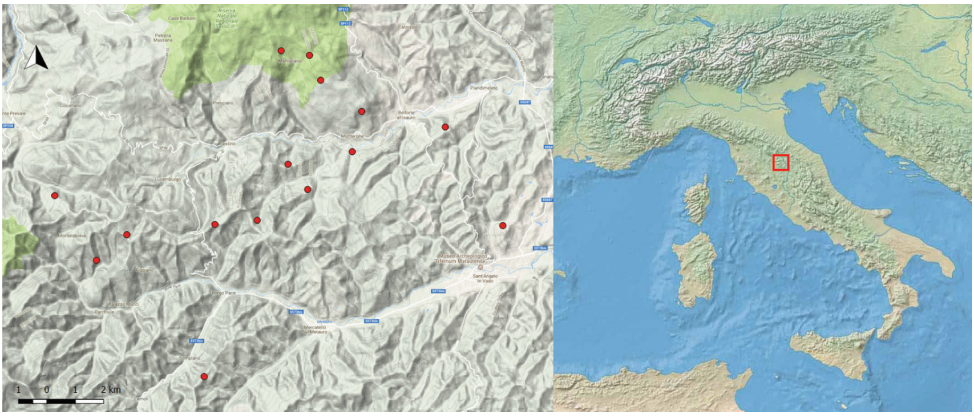

Figure 2. Geographic range and distribution map of *Arceuthobium oxycedri* in Italy.

mistletoe does not produce shoots until two or three years following infection and flower production requires four or five years. Detailed information concerning establishment, reproduction, and seed germination are reported in Hawksworth and Wiens (1996), Hawksworth et al. (2002), and Krasylenko et al. (2017).

Habitat and ecology: *Arceuthobium oxycedri* habitat and ecology depend strictly on the host on which it lives. In Italy, it grows on *J. communis*, *J. deltoides*, and *J. oxycedrus* individuals located in open and degraded mixed oak woods and in shrubby grasslands, on marly-arenaceous and clay-calcareous soils, at altitudes between 500 and 1000 m a.s.l. (Gonnelli and Scarponi 2003). Shrubby grasslands on which *A. oxycedri* can be found in Italy generally correspond to the habitat "*Juniperus communis* formations on heaths or calcareous grasslands" (code 5130) of the Habitat Directive 92/43/EEC.

Population information: for Italy, there is no detailed information available on quantitative population estimation or on population dynamics and trends.

Threats: 2.3.2 *Small-holder grazing, ranching or farming*. Shepherds and farmers sometimes cut junipers (hosting *A. oxycedri* of which they are unaware) to improve pastures.

7.3 *Other ecosystem modifications*. The agro-pastoral and forestry activities that degrade the mixed oak woods in which *A. oxycedri* lives are abandoned in some areas, for socio-economic reasons; this increases the tree cover and reduces the possible occurrence of junipers (which are rather heliophilous) within woods, consequently also of *A. oxycedri*. Currently, the absence of targeted management leads to the reduction of suitable sites for the persistence of the species; therefore, a decline in AOO, habitat quality, and number of individuals can be expected.

CRITERIA APPLIED:

Criterion B: **EOO:** 101.6 km^2 calculated with minimum convex hull in QGis 2.14
AOO: 60 km^2 calculated with a 2 × 2 km cell fixed grid

a) Number of locations: two locations have been identified according to threats 2.3.2 and 7.3. At present, four sites are not subjected to any threat, but any change in grazing

control or management could have negative impacts on all the growing sites within the same administrative region.
b) Decline in EOO (i), AOO (ii), quality and extent of habitat (iii), number of subpopulations (iv).

Red List category and Criteria (Regional Assessment)

EN	**Endangered**	**B1ab(i,ii,iii,iv) + B2ab(i,ii,iii,iv)**

Rationale for the assessment: *Arceuthobium oxycedri* is widespread especially in central Asia, but in Italy it is found only in a few sites, all close to each other and located in a small area between eastern Toscana and western Marche. AOO and EOO are rather small and the Italian population is threatened by the abandonment of agro-pastoral and forestry activities in some locations and the intensity of agro-pastoral activities in others. Due to the dispersal and reproduction mechanisms, the Italian populations are isolated from the populations of other countries and the loss of some local subpopulations cannot be easily recovered. For these reasons, this plant can be considered Endangered at a Regional level (Italy).

Previous assessment: *Arceuthobium oxycedri* was not previously evaluated (NE) at Regional level for Italy, while it was assessed as Least Concern (LC) at global level (IUCN 2007).

Conservation actions: *Arceuthobium oxycedri* is not protected at either regional, national or international levels. The Italian sites are not included in any protected area.

Conservation actions needed: further monitoring and research activities are recommended in order to better understand the population trends of the species in Italy.

Daniele Viciani, Vincenzo Gonnelli, Matilde Gennai

Ionopsidium albiflorum Durieu

Regional assessment (Italy)
Taxonomy and nomenclature
Order: Brassicales *Family:* Brassicaceae

Ionopsidium albiflorum Durieu Rev. Bot. Recueil Mens 2: 433 (1847) ≡ *Bivonaea albiflora* (Durieu) Prantl in Engler & Prantl, Nat. Pflanzenfam. 3(2): 166 (1891) ≡ *Pastorea albiflora* (Durieu) Tod. in Bertoloni, Fl. Ital. 10: 520 (1854).

Common name: White diamond flower (En)

Geographic distribution range: *Ionopsidium albiflorum* (Fig. 3) is distributed in the southwestern Mediterranean Basin. Italian populations represent the northeastern limit of its range. In Italy, it is reported in Puglia, Basilicata and Sicilia, while its occurrence in Toscana is doubtful (Bartolucci et al. 2018). In Puglia, it has been observed in the fol-

Figure 3. *Ionopsidium albiflorum* photographed in Santeramo in Colle (Bari). Picture by E.V. Perrino and G.N. Silletti.

lowing localities: between Masseria Plantamura and Bosco di Morazia (Perrino et al. 2013), and at Masseria Simone (*25.4.2015, E.V. Perrino, G.N. Silletti, 40491, BI*), both located in the Santeramo in Colle (Bari) municipality; Martina Franca (Bari) (Silletti 2013); Parco del Conte (*18.1.1897, 31.1.1898, 23.2.1898, A. Palanza, 44390, BI*), Bosco Caputi (*14.2.1897, 15.2.1899, A. Palanza 44389, BI*) in the municipality of Ruvo di Puglia (Bari), Bosco Scacchiavolpe (*21.2.1897, A. Palanza, 44390, BI*) in the municipality of Cassano Murge (Bari) (Palanza 1900); Bosco Acquara in the municipality of Orsara di Puglia (Foggia) (Trotter and Romano 1914). The presence in the stations of Parco del Conte, Bosco Caputi, Bosco Scacchiavolpe, and Bosco Acquara is no longer confirmed. In Basilicata, the species was observed only in the Regional Park of "*Murgia Materana*" (Matera) (Medagli and Gambetta 2003). In Sicilia, it is reported in four localities in the province of Palermo, three of them by Lojacono-Poiero (1888-1908) have not been recently confirmed: Alpe Cucco and Bosco del Cappelliere, in the municipalities of Godrano and Marineo, respectively; Nicolosi in the municipality of Lercara Friddi. The fourth site (Marcenò et al. 1985) refers to Cozzo Padorno on Mt. Sicani in the municipality of Prizzi. Only the five sites recorded in the last 35 years have been used for the assessment, excluding the other seven for which there has been no confirmation for more than 100 years (Fig. 4).

In Toscana, its presence should be considered highly doubtful, because the only known herbarium specimen is very old and was collected as *I. savianum* (Caruel) Arcang. (originally determined as *Bivonaea saviana* Caruel by *Forsyth Major* in April 1883, from Mt. Calvi), and then revised in a genetic study as *I. albiflorum* Durieu (Koch 2012).

Distribution: Countries of occurrence: Algeria, Italy, Morocco, and Tunisia

Biology: *Plant growth form:* annual (therophyte)

Flowering time: from March to April

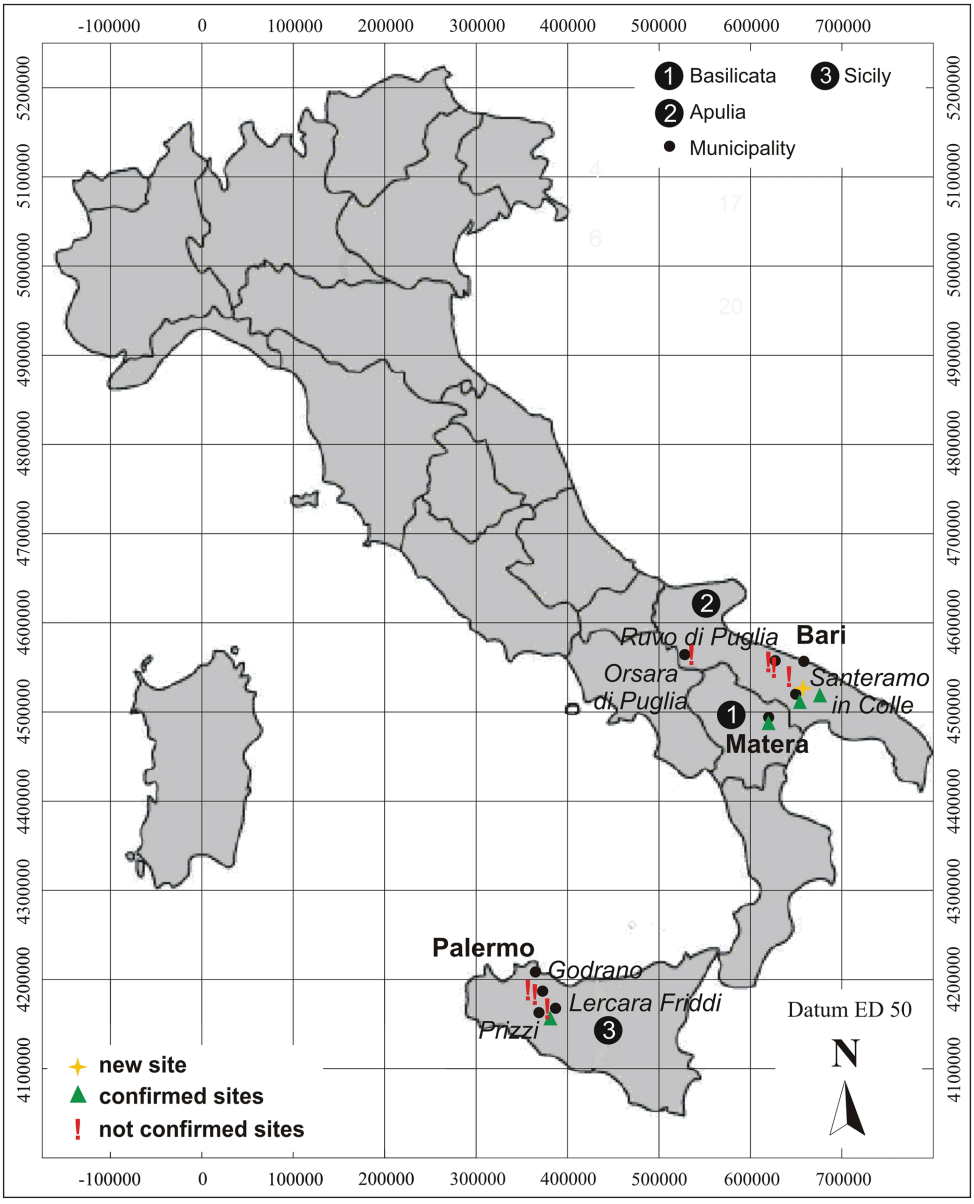

Figure 4. Geographic range and distribution map of *Ionopsidium albiflorum* in Italy.

Reproduction: no information on pollination strategy and seed germination is available.

Habitat and Ecology: *Ionopsidium albiflorum* typically grows on uncultivated meadows up to about 800 m a.s.l.

Population information: There is no detailed information available on population dynamics. It is noteworthy that the 30 individuals observed in the spring of 2009

between Masseria Plantamura and Bosco di Morazia, despite the absence of anthropogenic disturbance, were not observed in the following two years, and reappeared only in 2012 with a few individuals. The second site, Santeramo in Colle (Masseria Simone), is probably the most representative Italian subpopulation, counting more than 1,000 individuals in only 200 m^2.

Threats: *6.1. Recreational activities*: in some cases, an increased intensity of human trampling could negatively affect the small populations observed.

7.3 Other ecosystem modifications: changes in natural land use to agriculture or reforestation would lead to the loss of the habitat of the species.

9.3.3. Herbicides and pesticides: in the sites near crop fields.

CRITERIA APPLIED:

Criterion B: **AOO:** 20 km^2 calculated with a 2×2 km cell fixed grid
EOO: 8,794 km^2 calculated with minimum convex hull (with Google Earth Pro)

a) Number of locations: four (according to threat 7.3)
b) Documented decline in EOO (i), AOO (ii), number of subpopulations (iv)
c) Extreme fluctuations in number of mature individuals (iv)

Red List category and Criteria (Regional Assessment)

EN	**Endangered**	**B2ab(i,ii,iv)c(iv)**

Rationale for the assessment: in Italy, *I. albiflorum* is found in Puglia, Basilicata, and Sicilia. It has an AOO of 20 km^2, four locations have been identified, a decline has been documented in EOO, AOO, and number of subpopulations, and extreme fluctuations in number of mature individuals have been observed. Therefore, it is classified as Endangered.

Previous assessment: At a Regional level, the species was assessed as Critically Endangered (CR) in Puglia, Endangered (EN) in Sicilia, and Vulnerable (VU) in Basilicata (Conti et al. 1997). No assessment at global level of the species exists (IUCN 2017).

Conservation actions: The sites, except that of Masseria Simone and Parco del Conte, are included in the following protected areas: National Park of "*Alta Murgia*", SAC/SPA IT9120007 "*Murgia Alta*", SAC IT9110032 "*Valle del Cervaro Bosco dell'Incoronata*" (Puglia), SAC/SPA IT9220135 "*Gravine di Matera*", Regional Park of the "*Murgia Materana*" (Basilicata), SPA ITA020048 "*Monti Sicani, Rocca Busambra e Bosco della Ficuzza*", SAC ITA020031 "*Monte d'Indisi, Montagna dei Cavalli, Pizzo Pontorno e Pian del Leone*" (Sicilia). Currently, there are no conservation actions for this extremely rare species.

Conservation actions needed: It would be useful to start *in situ* and *ex situ* conservation actions, in addition to research activities on population monitoring in all Italian administrative regions where the species is reported, in order to better understand the species' reproductive biology, ecology, level of threat, and population trend.

Enrico Vito Perrino, Robert Philipp Wagensommer,
Alessandro Crisafulli, Giuseppe Nicola Silletti

Figure 5. *Trifolium latinum* photographed in the Decima-Malafede Regional Park (Rome, Italy). Picutre by C. Fratarcangeli.

Trifolium latinum Sebast.

Regional assessment (Italy)
Taxonomy and nomenclature
Order: Fabales *Family:* Fabaceae

Trifolium latinum Sebast. in Plantae Romanae 1, 7 (1813)

Common name: Trifoglio latino (It).

Geographic distribution range: *Trifolium latinum* (Fig. 5) grows in Bulgaria, northern Greece, European Turkey (Kozuharov 1976, Zohary 1970, Zohary and Heller 1984), and Italy, where it was described from a small area in the SW suburbs of Rome (Tenuta dei Massimi) in 1813 (Sebastiani 1813, Sebastiani and Mauri 1818). According to the material in the *Herbarium Romanum*, the species was collected in the same area until the end of the 19th century; it was then believed extinct in Italy (Pignatti 1982, Iamonico et al. 2011) until its rediscovery in a different, but nearby, locality in the Decima-Malafede Regional Park of the Municipality of Rome (Fanelli et al. 2012; Fig. 6). The species was described as rare in the historical record; the current range is also restricted to a small stretch of no more than 50 m in the coppices of *Quercus frainetto* Ten. and *Quercus cerris* L., along a dirt road.

Distribution: Countries of occurrence: Bulgaria, Greece, Italy, European Turkey.

Biology: *Plant growth form*: annual (therophyte).

Flowering and fruiting time: Flowering in May and extending into early June.

Reproduction: Dispersal by seeds. Seeds seem to form a seed bank, since the species re-grew abundantly after the almost total destruction of the population in 2015, but it was not possible to assess the longevity of seeds in soils.

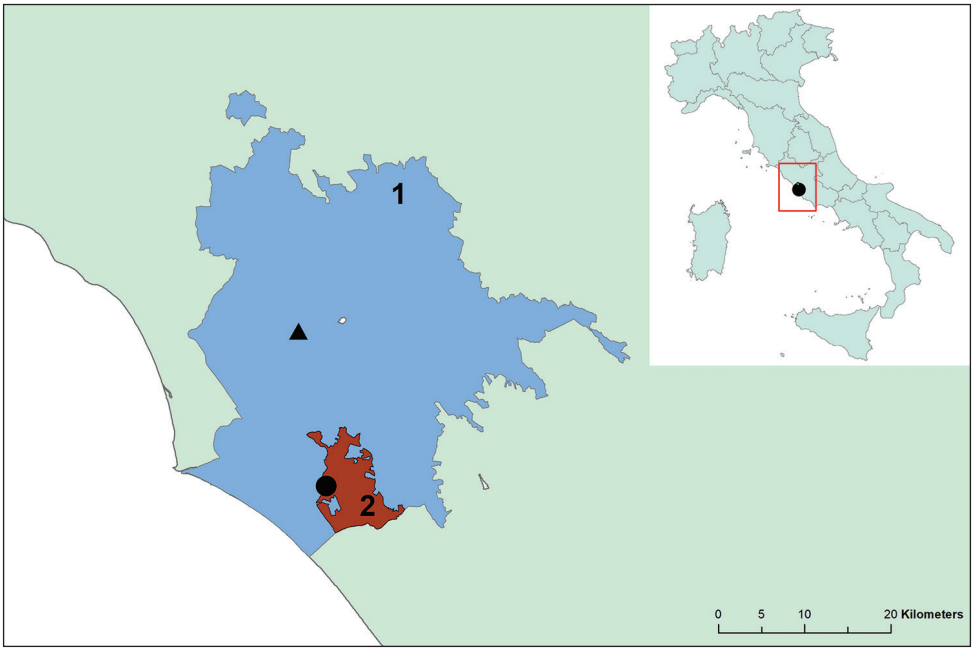

Figure 6. Occurrence of *Trifolium latinum*. The black circle marks the current population; the black triangle indicates the historical site. 1: Municipality of Rome; 2: Decima-Malafede Regional Park.

Habitat and ecology: It grows in the fringes and clearings of sub–Mediterranean deciduous forests dominated by *Quercus cerris-Q. frainetto* in moderate shadow on subacid sandy soils (Fanelli et al. 2012).

Population information: The Italian population was monitored from 2012 onwards. The extent of occurrence is about 60 m^2, whereas the AOO is less than 40 m^2. These seem rather stable due probably to the presence of a persistent soil seed bank. The population is, instead, declining: in 2012 it comprised 391 flowering individuals, in 2013 it was not monitored, 241 individuals were counted in 2014 and in 2015 it was almost exterminated (only three individuals) due to the ploughing of the white road along which the species grows by the owner of the area; it recovered in 2016 (103 individuals) and in 2017 counted 112 individuals. Although the species survived the inconsiderate destruction of its habitat, its population decreased by 71%.

Threats: *7.3 Other ecosystem modification:* the population was almost exterminated in 2015 due to ploughing of the dirt road where the species occurs. This intervention was motivated with the need to prevent fire expansion in the woodland; the risk is still present due to current forestry practices in the area.

11.1 Habitat shifting and alteration: the population seems to be related to a particular microclimate, which could explain the extremely restricted AOO of the population and the absence in apparently suitable and similar habitats in the same area. Climate change can alter these microclimatic conditions, thus decreasing or extinguishing the population.

CRITERIA APPLIED:

Criterion B: **AOO**: 4 km^2 calculated with a 2×2 km cell fixed grid
a) Number of locations: one, since the species occur in a single locality
b) Decline in quality and extent of habitat (iii); the number of individuals is subjected to continuous decline (more than 70%) since its discovery in 2011 (iv).
Criterion D: The number of mature individuals is less than 250 in the years following the species' rediscovery in Italy.

Red List category and Criteria (Regional Assessment)

CR	**Critically Endangered**	**B2ab(iii,iv)**

Rationale for the assessment: In Italy, the species is present in a single locality with an AOO of 4 km^2, however the area actually occupied by the species is limited to a few dozen square metres. The ongoing threats to the only known population, the decline in quality of the habitat and the decline in number of mature individuals support classification of the species as Critically Endangered according to the formula B2ab(iii, iv).

Previous assessment: Extinct at the Regional level in Italy (Conti et al. 1992).

Conservation actions: *Trifolium latinum* is not protected under either national or regional laws. The species occurs in the Decima–Malafede Regional Park and in the SCI "Sughereta di Castel di Decima" IT6030053, but the area is privately owned and no specific conservation measures have been applied, even though the Park was immediately informed of the existence of this critically endangered species.

Conservation actions needed: For this population to persist, the habitat must not be altered, which means that the particular microclimate and shading conditions must be preserved. No forestry practice should be allowed in the forest on the fringe of which the species occurs, with an area of respect of at least 2 km^2. A moderate disturbance is needed to preserve the species from competition with shrub species, since *T. latinum* is a species of clearings and fringes. Regular mowing at intervals of three-four years should be performed in the stretch of white road where the species occurs, but ploughing and, in general, the passage of machines should be absolutely avoided. *Ex situ* conservation in the seed bank of the Botanical Garden of Rome should continue and germination tests should be carried out.

Giuliano Fanelli, Michele De Sanctis, Alessandro Serafini Sauli

Vicia incisa M.Bieb.

Regional assessment (Italy)

Taxonomy and nomenclature

Order: Fabales *Family*: Fabaceae.

Vicia incisa M.Bieb., Fl. Taur.-Caucas. 3: 471. 1819 ≡ *Vicia sativa* L. var. *incisa* (M.Bieb.) Boiss., Fl. Orient. 2: 574. 1872 ≡ *Vicia sativa* L. subsp. *incisa* (M.Bieb.) Arcang., Comp. Fl. Ital.: 201. 1882 = *Vicia pimpinelloides* Mauri, Roman. Pl. Cent. XIII: 35. 1820.

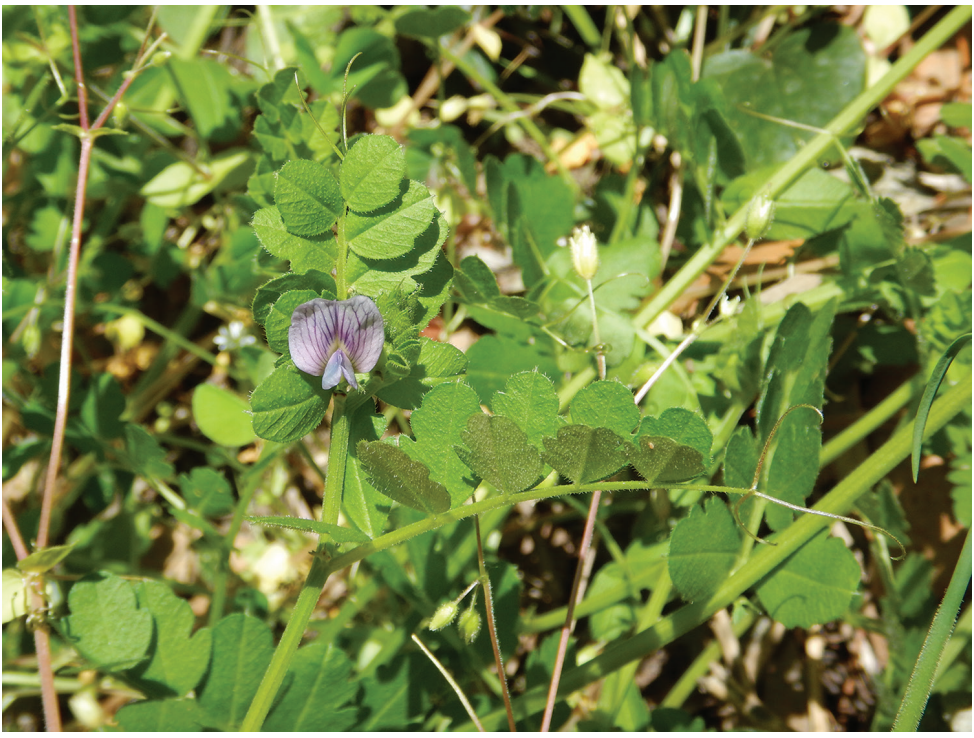

Figure 7. Flowering individual of *Vicia incisa* at Castelli Romani (Lazio, Italy). Pictures by M. Latini.

Common name: Veccia incisa (It), Incised vetch (En), Goroshek Nadrezannyi (Ru)

Geographic distribution range: *Vicia incisa* (Fig. 7) has a SE-Europe-Pontic distribution range. In Italy, the species occurs exclusively in two administrative regions: Lazio and Sicilia (Fig. 8). In Lazio, *V. incisa* is present only at Castelli Romani (Abbate et al. 2009, Anzalone et al. 2010). Here, the species was repeatedly collected at Albano Laziale and Castel Gandolfo in 1827 and 1854; later, it was not recorded for a long period and was re-discovered in the same sites only in 1982 (Anzalone 1983). During field surveys conducted in 2017, only two populations were observed at Castelli Romani along the road edges near chestnut woodlands, while a third population, growing in woodland clearings (P. Bassani, pers. comm.), was not recorded. The species was also cited by Mauri (1820) and by other Italian botanists (e.g., Arcangeli 1882) for Casetta Mattei (western areas of the city of Rome), but also this locality was not confirmed (Iberite et al. 2017). In Sicilia, the species occurs in Castiglione di Sicilia, where it was first discovered and collected in 1998 (Cristaudo and Margani 2005), but this population was not observed during field surveys in 2017; conversely, another population was discovered about 1 km away in the same municipality, on private land at C. Sangenisi.

Distribution: Countries of occurrence: Bulgaria, Crimea, Greece, Italy, Turkey.

Biology: *Plant growth form:* annual herb (therophyte). *Chromosome number:* $2n = 14$ (Roti Michelozzi and Barberis 1989; Meriç and Dane 1999).

Figure 8. Distribution map of *Vicia incisa* in Italy.

Flowering and fruiting time: Flowering from April to May, fruiting from May to June (in Italy).

Reproduction: Insect pollination, barochorus dispersion.

Habitat and Ecology: In Italy, *Vicia incisa* occurs at 300-600 m a.s.l. in clearings of deciduous oak/chestnut woodlands and along road margins on volcanic soils.

Population information: Italian populations are in decline: extinction events occurred both in historical (Casetta Mattei) and recent times (one population in Castelli Romani). There is no detailed information on population dynamics, but the number of mature plants can be estimated at about 100 individuals for both Castelli Romani and C. Sangenisi populations.

Threats: *1.1 Housing & Urban Areas:* the populations in Lazio are threatened by expansion of urban areas.

4.1 Roads & Railroads: in Lazio, the plants grow on the border or very close to roads, thus road management activities could have a negative impact.

7.3 Other ecosystem modifications: vegetation dynamics can cause habitat variations, which are unfavourable for this species; in Lazio, one population growing in clearings has disappeared probably due to the closure of the vegetation structure.

CRITERIA APPLIED:

Criterion B: **EOO:** 1,967 km^2 calculated with minimum convex hull in QGIS 2.14.10.
AOO: 16 km^2 calculated with a 2 × 2 km fixed cell grid.

a) Number of locations: three locations were identified according to the detected threats: Albano Laziale, Castel Gandolfo, and Castiglione di Sicilia.

b) Decline in quality and extent of habitat (iii); number of locations or subpopulations (iv); number of mature individuals (v).

Criterion D: Number of mature individuals < 250.

Red List category and Criteria (Regional Assessment):

EN	**Endangered**	**B1ab(iii,iv,v) + B2ab(iii,iv,v) + D**

Rationale for the assessment: In Italy, *Vicia incisa* is found exclusively in two regions (Lazio and Sicilia), with an EOO of 1,967 km^2 and an AOO of 16 km^2. Only three populations are currently known, two in Lazio and one in Sicilia. The total number of mature individuals is estimated at about 200. Because of its rarity, the decline in quality and extent of habitat and in the number of locations, combined with the low number of mature individuals, this taxon qualifies as EN Endangered. B1ab(iii,iv,v) + B2ab (iii,iv,v) + D in accordance with assessment reported above.

Previous assessment: Previously listed at national (Italy) level as CR (Rossi et al. 2013), while at a global level the species was not evaluated (IUCN 2017).

Conservation action: The populations at Castelli Romani occur within the Castelli Romani Regional Park; moreover, the population at Castel Gandolfo is included in SIC IT6030039 "Albano (Località Miralago)". The Sicilian population is not currently subject to any official protection measures, since its only stand does not fall within the nearby Etna Regional Park nor a SIC of the Natura 2000 network. However, it is located on private land, whose owner has been protecting it for several years from grazing and fires, which probably caused the disappearance of the other previously known station.

Conservation action needed: Research activities and monitoring programmes are recommended to better understand the population trends of the species; further field searches for other stations are also suggested.

Marta Latini, Gianluca Nicolella, Salvatore Cambria

Acknowledgements

Many thanks are due, concerning *Vicia incisa*, to P. Bassani for sharing his knowledge of the populations in Lazio, to A. Cristaudo for field research in Sicily and to F. Russo for allowing us to visit the C. Sangenisi locality.

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RESEARCH ARTICLE

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Chromosome numbers for the Italian flora: 5

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Abstract

In this contribution new chromosome data obtained on material collected in Italy are presented. It includes 7 chromosome counts for *Centaurea* (Asteraceae).

Keywords

cytogeography, cytotaxonomy, karyotype, *Centaurea*

How to contribute

The text concerning new chromosome data should be submitted electronically to Lorenzo Peruzzi (lorenzo.peruzzi@unipi.it), including indications on voucher specimens and methods used.

Chromosome counts

Centaurea aspromontana Brullo, Scelsi & Spamp. (Asteraceae)

Chromosome number. 2*n* = 18 (Fig. 1)

Voucher specimen. **ITALY. Calabria.** Sotto piano Zivernà (Reggio Calabria), 21 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009594).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in

Figure 1. *Centaurea aspromontana* Brullo, Scelsi & Spamp., 2*n* = 18. Scale bar: 10 μm.

Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea aspromontana*, as well as all other species investigated in this contribution, belongs to *C. deusta* Ten. species complex, within *C.* sect. *Phalolepis* (Cass.) DC. *Centaurea aspromontana* is endemic to southern Calabria, where it can be found in a few localities (Peruzzi et al. 2017). Our chromosome count, performed on plants from the *locus classicus* (Brullo et al. 2001, Peruzzi et al. 2015), is the first for this species (Bedini et al. 2010 onwards) and confirms the basic chromosome number *x* = 9 typical of *C.* sect. *Phalolepis* (Hilpold et al. 2014).

Centaurea calabra G.Caruso, S.A.Giardina, Raimondo & Spadaro (Asteraceae)

Chromosome number. 2*n* = 18 + 0–2B (Fig. 2)

Voucher specimen. **ITALY. Calabria.** Presila Catanzarese, tra Sersale e Zagarise (Catanzaro), 6 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009592).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea calabra* is endemic to a narrow area restricted to the Ionian coast, typically associated to chasmophytic communities, in Calabria (Caruso et al. 2013). Our chromosome count, performed on plants collected very close to the *locus classicus* (Caruso et al. 2013, Peruzzi et al. 2015), is the first for this species (Bedini et al. 2010 onwards). Out of 13 root tips sampled, six showed a regular 2*n* = 18 chromosome complement, five showed 2*n* = 18 + 1B and two showed 2*n* = 18 + 2B.

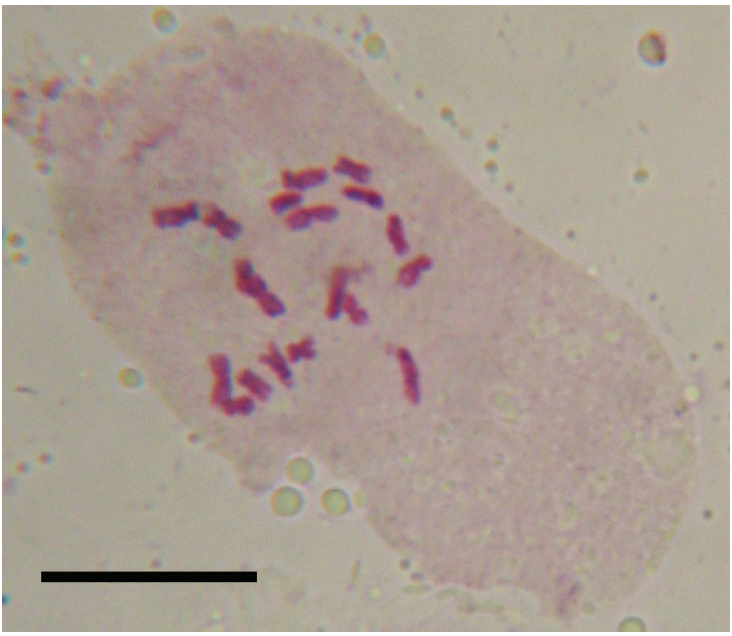

Figure 2. *Centaurea calabra* G.Caruso, S.A.Giardina, Raimondo & Spadaro, 2*n* = 18 + 1B. Scale bar: 10 μm.

Centaurea ionica Brullo (Asteraceae)

Chromosome number. 2*n* = 18 (Fig. 3)

Voucher specimen. **ITALY. Calabria.** Rupi presso Stilo (Reggio Calabria), 21 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009595).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea ionica* is endemic to Calabria, where it can be found in just five known localities mainly distributed near the Ionian side of the Region (Peruzzi et al. 2017). Our chromosome count, performed on plants from the *locus classicus* (Brullo et al. 2001, Peruzzi et al. 2015), is the first for this species (Bedini et al. 2010 onwards).

F. Roma-Marzio, K.F. Caparelli, L. Peruzzi

Centaurea poeltiana Puntillo (Asteraceae)

Chromosome number. 2*n* = 18 (Fig. 4)

Voucher specimen. **ITALY. Calabria.** Aspromonte, Pietra Impiccata (Reggio Calabria), 21 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009596).

Figure 3. *Centaurea ionica* Brullo, 2*n* = 18. Scale bar: 10 μm.

Figure 4. *Centaurea poeltiana* Ten., 2*n* = 18. Scale bar: 10 μm.

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea poeltiana* is endemic to Calabria, where it grows in the southern part of the Region, mainly in beech or oak forests (Peruzzi et al. 2006). Our

chromosome count, performed on plants from the *locus classicus* (Puntillo 1996, Peruzzi et al. 2015), is different from the only other published count, i.e., $2n = 36$, obtained from plants collected near Montalto di Aspromonte, a few kilometres away from our sampling area (Peruzzi et al. 2006). Accordingly, this species shows at least two cytotypes, at diploid and tetraploid level.

Centaurea sarfattiana Brullo, Gangale & Uzunov (Asteraceae)

Chromosome number. $2n = 18$ (Fig. 5)

Voucher specimen. **ITALY. Calabria.** Sila, Lago Passante (Catanzaro), 6 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009593).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea sarfattiana* is endemic to the Sila massif (Calabria), where it grows in dwarf shrubs vegetation on siliceous substrata (Brullo et al. 2004). Our chromosome count, performed on plants from the *locus classicus* (Brullo et al. 2004, Peruzzi et al. 2015), is the first for this species (Bedini et al. 2010 onwards).

Centaurea scillae Brullo (Asteraceae)

Chromosome number. $2n = 18 + 2B$ (Fig. 6)

Voucher specimen. **ITALY. Calabria.** Tra Bagnara e Scilla (Reggio Calabria), 21 August 2017, *L. Peruzzi et K.F. Caparelli* (PI n° 009590).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea scillae* is endemic to Calabria, where it grows in few localities along the Tyrrhenian coast in the extreme south-western part of the Region (Peruzzi et al. 2017). Our chromosome count, performed on plants from the *locus classicus* (Brullo et al. 2001, Peruzzi et al. 2015), is the first for this species (Bedini et al. 2010 onwards). Out of six root tips sampled, all showed $2n = 18 + 2B$.

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Centaurea deusta Ten. (Asteraceae)

Chromosome number. $2n = 18$ (Fig. 7)

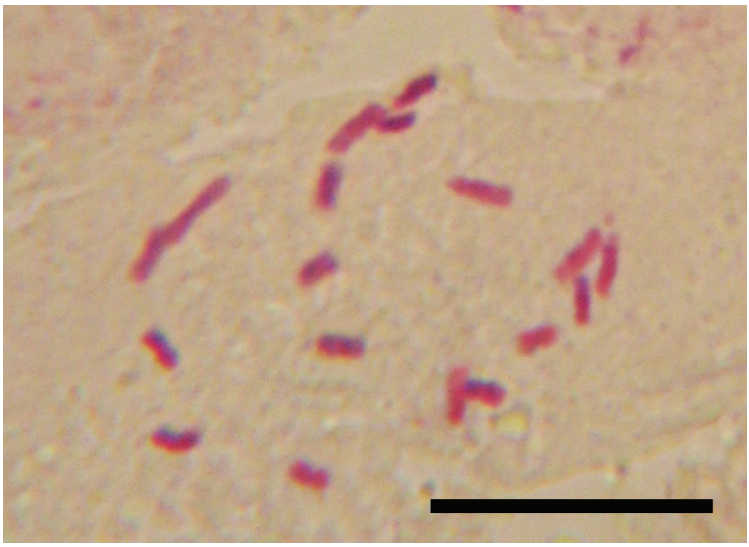

Figure 5. *Centaurea sarfattiana* Brullo, Gangale & Uzunov, 2*n* = 18. Scale bar: 10 μm.

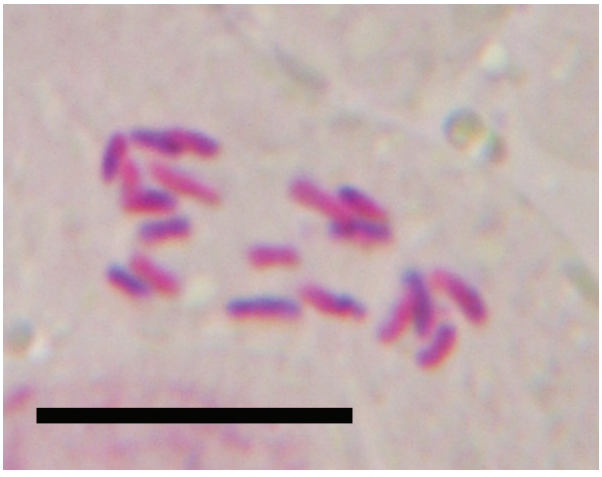

Figure 6. *Centaurea scillae* Brullo, 2*n* = 18 + 2B. Scale bar: 10 μm.

Voucher specimen. **ITALY. Calabria.** Monte Sellaro (Cerchiara di Calabria, Cosenza), 30 August 2017, *L. Peruzzi* (cypselae collected in the field and stored in the Germplasm Bank of Department of Biology, Pisa, under acc. GB-PI-1665).

Method. Squash preparations were made on root tips obtained from germinating cypselae. Root tips were pre-treated with 0.4% colchicine for 3 hours and then fixed in Carnoy fixative solution for 1 hour. After hydrolysis in HCl 1N at 60 °C, the tips were stained in leuco-basic fuchsine.

Observations. *Centaurea deusta* occurs in the eastern part of the Mediterranean basin, from Italy to Bulgaria (Greuter 2006 onwards). Our chromosome count is the

Figure 7. *Centaurea deusta* Ten., $2n = 18$. Scale bar: 10 μm.

first from Calabria, and it agrees with previous counts obtained from Italy (Damboldt et al. 1973, Brullo et al. 1992, Tessitore et al. 1994). All the extra-Italian counts also gave $2n = 18$ chromosomes (Rice et al. 2014 onwards). Matthas (1976) found one B-chromosome on plants from Puglia and Campania.

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