

Remarks on the exotic flora of Capo Mortola (Ventimiglia, northern Italy) and its changes over time

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Abstract

In this study, we compared current data and data of the census made in the 1990s related to the vascular flora of Capo Mortola (Ventimiglia, Italy), considering 270 taxa not dependent on crop management. The current status reported 198 alien species: 5 invasive, 65 naturalized 75 casual, 38 occurring as casual in human-dominated systems, but without direct intervention by humans and not close to parent plant, 15 occurring as casual alien, but still with some uncertainties for a definitive classification, and plus 3 cryptogenic and 1 eradicated (extinct) taxa, while in 1996 were 229 species: 87 naturalized and 142 adventitious (casual). Of these, 40 taxa show an increasing trend and 41 a decreasing or disappearing trend. If we consider the wild areas of Capo Mortola, 10 taxa are new to the Italian flora (7 casual and 3 naturalized) while 13 are new to the Ligurian flora only (all casual). If we also consider the neglected areas of the Botanical Gardens, 18 new casual species for the Italian flora and 10 for the Ligurian one would be added. In addition, 9 status changes are proposed on a national scale and 17 on a regional scale. An in-depth analysis was conducted on the presence and the local history of a subset of 34 exotic plants, 11 of which are new or have a new status for the Italian flora.

Keywords

Exotic taxa, flora, invasive alien species, Italy, Liguria

Introduction

The Italian exotic flora has been the subject of numerous studies. It has received increasing attention in recent decades due to the awareness of the threat that invasive alien species represent for biodiversity. In the neighbouring France, Sant and Alziar

(2013) reconstructed the changes in the flora of the hill of the Château de Nice, an area of about 10 ha with natural, historical and landscape value, with reference to patrimonial taxa, rare, exotic or invasive, starting from 1840. For the alien species, these authors have developed comparisons starting from the study of Fritz Mader (1909). He was the first botanist to introduce the floristic invasions problem along the coastal strip, including the Riviera Ligure and the Côte d'Azur, where gardens and plant collections have reached their highest levels since the second half of the 19th century. These areas are highly vulnerable to plant invasion risk. In southeastern France, Ducatillion et al. (2015) assembled useful data for the invasion risk evaluation: out of 400 species planted initially in an arboretum, only 13 are naturalized. More recently, a working group coordinated by Cottaz (2020) updated the list of invasive species in the region Provence-Alpes-Côte d'Azur (PACA), now including 298 taxa. De Vilmorin (1950) published a report on the exotic flora acclimated on the Côte d'Azur that helps us to understand how various acclimated species of that period are today naturalized or invasive.

In Italy, the checklist of Galasso et al. (2018a) – and its subsequent updates (Galasso et al. 2018b, c, 2019a, b, 2020a, 2020b, 2021a, b) – constitutes the reference document for the records that are regularly reported in this journal. However, during the elaboration of this checklist, no information was available about the extreme western part of Liguria, close to the Italian-French border including the Giardini Botanici Hanbury (GBH) and their immediate surroundings. Probably, these authors did not report the taxa occasionally escaped from botanical gardens and private gardens. However, about half (over 10 ha) of the GBH compendium at Capo Mortola is covered by many natural habitats (such as cliffs, mixed woods, pine forests, garrigues, scrubs, arid grasslands, reeds, dry stone walls, ruins, etc.) harbouring a large number of naturalized species. Campodonico (2008) already highlighted the naturalization of many exotic species in the Riviera di Ponente and the fact that they spread “mainly *via* fertile seed dispersal by wind, water, birds, and mammals, as well as voluntary or unintentional human interventions”. Recently, some authors (Guadagni et al. 2013) reported the presence of naturalized exotic species in the same area as new records, but these were already recorded in different editions of the Hanbury plant checklist.

By examining the publications and manuscripts related to this area, it is possible to reconstruct the story (introduction and naturalization process) of many exotic species in neighbouring natural and semi-natural habitats, leading to a significant increase in the checklist mentioned before. The main purposes of this report are four: I) to list the alien taxa recently found in Capo Mortola and its immediate surroundings (Fig. 2); II) to verify the categories attributed to the exotic species growing spontaneously and already reported in the last catalogue (Campodonico et al. 1996) 25 years later; III) try to understand the changes that have taken place in the exotic flora over the course of about 25 years; IV) to highlight the species new to Italy and Liguria according to the present Italian checklist (Galasso et al. 2018a).

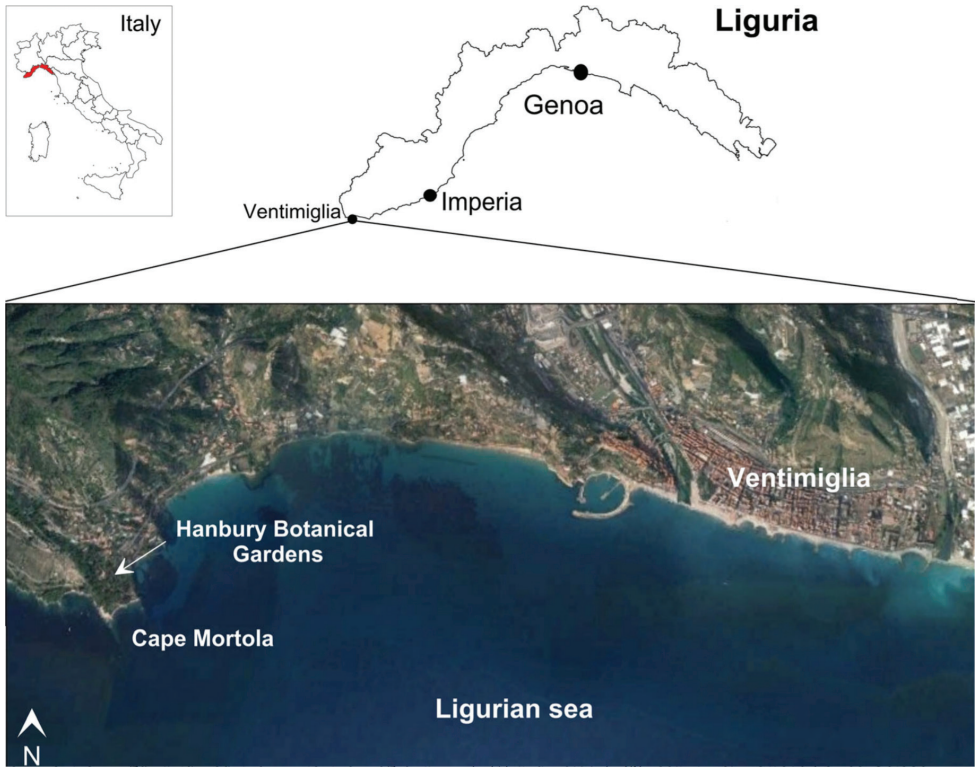


Figure 1. The location of the study area.

Study area

Capo Mortola is a promontory on the western coast of Liguria, in the municipality of Ventimiglia, a few kilometers from the French border (Fig. 1). It includes a Regional Protected Area of about 20 ha and the western part of the Special Area of Conservation (SAC) “Capo Mortola” of about 50 ha. This SAC extends from sea level up to 260 m a.s.l. and its geographical limits have the following coordinates: 43°46'45.0"N, 7°32'32.7"E and 43°47'21.2"N, 7°33'30.1"E.

The study area includes the entire surface of the compendium of the GBH: about half of this compendium is dominated by natural and semi-natural habitats such as cliffs, mixed woods, pine forests, garrigues, scrubs, arid grasslands, reeds, dry stone walls, ruins, and the remaining part is cultivated as a garden (with exotic plant collections), but it also includes some natural sectors subject to minimal gardening activities (mowing). A cycling / pedestrian path that follows the ancient Roman road runs in a trench outside the botanical gardens, cutting the compendium in two from east to west. The study area is represented within the brown line in Fig. 2 and includes the inhabited area of Mortola Inferiore and the natural or cultivated areas outside the GBH, located to the west, north

and east of these. Fig. 2 shows the map of the vegetation and land use of the study area; Fig. 3 shows some examples of the natural and semi-natural habitats of the study area.

The study area has a Mediterranean pluviseasonal oceanic bioclimate with upper thermomediterranean thermotype and dry ombrotype (Rivas Martínez et al. 2011; Pesaresi et al. 2014, 2017), with an average annual temperature of *ca.* 16 °C and an average annual rainfall of *ca.* 800 mm. The driest month is July (18 mm), while November is the rainiest month with an average of 121 mm; the average temperature in the hottest month of the year (July) is 23.3 °C while the average temperature during the coldest month (January) is 9.2 °C. The area has passed through several changes over the last centuries; in the lower portion it is still possible to see a stretch of the ancient

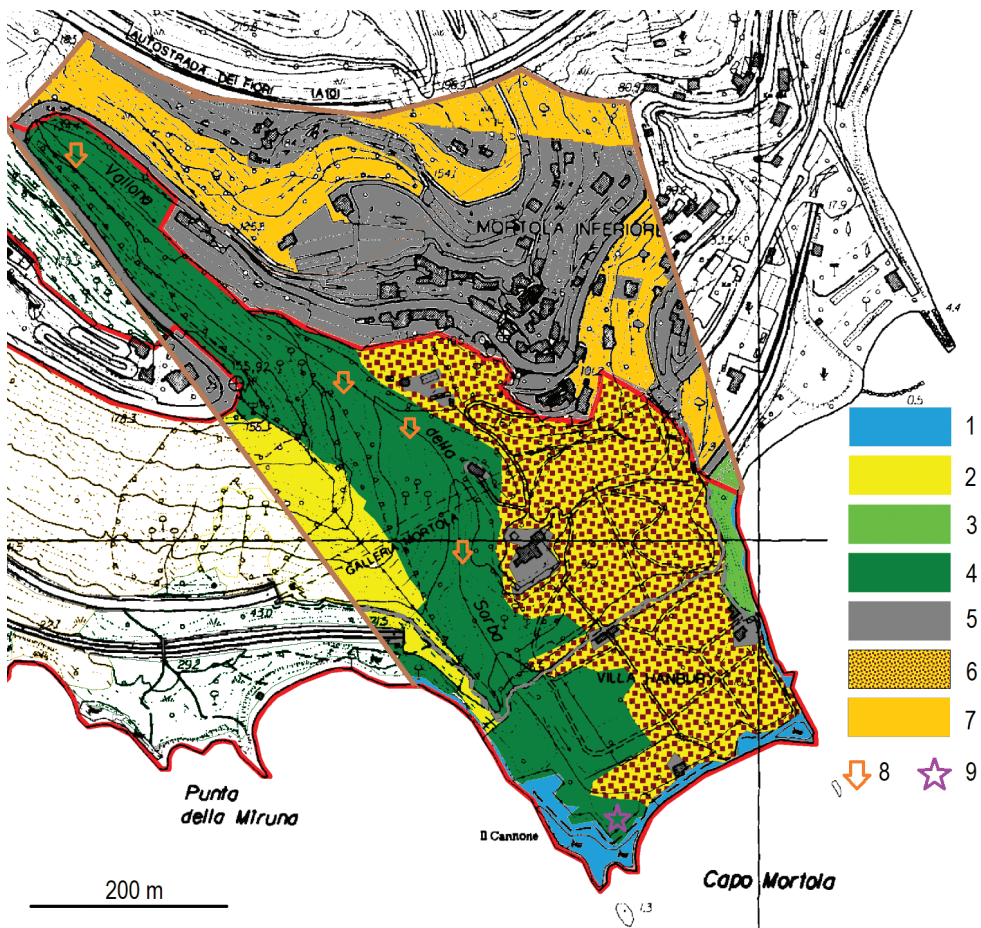


Figure 2. Vegetation and land use of the study area. 1: discontinuous communities of sea cliffs, seashores and bare rocks; 2: arid grasslands, garrigues and scrubs; 3: holm oak bushes; 4: forests dominated by pines; 5: settled areas (including roads, and greenhouses); 6: agricultural mosaic, with cultivated garden, dry stone walls, paths and semi-natural or abandoned areas; 7: olive groves; 8: riparian woods; 9: reed. The study area is bounded by the coastline and falls within the brown line. The red line marks the western part of the SAC.

Roman road, Via Iulia Augusta. The superficial hydrographical network is characterized by the lower half of the Vallone della Sorba stream; the acclivity is around 45% in the upper portion and on the western side of the Cape, which decreases in the lower portion up to values of just over 10% and with sub-flat zones. The two sides of the syncline of Capo Mortola are very well exposed with bioclastic limestones (Capo Mortola Calcareenites) while the core of the grey blue marls (Olivetta San Michele Silty Marls) have almost completely been obliterated by several terraces. Along the north side of the area some weakly cemented yellowish sands are detected (Faccini et al. 2015). A more detailed description of the area is available in the illustrative report of the SAC management plan adopted in 2016 (Mariotti et al. 2016).

The GBH were created starting from 1867 by the supervision of its founder Sir Thomas Hanbury (1832–1907), who bought the building and the surrounding areas with the goal to acclimate species of rare plants and plants with high pharmacological interest coming from warm-temperate regions all over the world. He was supported by his brother Daniel Hanbury (1825–1875), pharmacologist and botanist, and by Ludwig Winter (1846–1912), a German botanist and landscape architect. Scientific activities began in 1880. The GBH, the regional protected area and the SAC Capo Mortola are currently managed by Università degli Studi di Genova. The progression and changes in



Figure 3. Examples of the natural and semi-natural habitats of the study area. Above: cliff and scrub; below: riparian forest and pine forest.

the plant collections are the result of intense exchanges and purchases made by Thomas and the curators of the botanical gardens who followed one another, in particular Gustav Cronmeyer (?1832–1892), Kurt Dinter (1868–1945) and especially, Alwin Berger (1871–1931), during the first phase of the history of the gardens, which ended in 1907 with Thomas's death (Mariotti and Minuto 2017). Even in the subsequent phases, under the care of Thomas' son, Cecil, and daughter-in-law Dorothy, and during the post-war recovery initially curated by Onorato Masera and, later, by the curators and directors of the Università degli Studi di Genova (Pier Giorgio Campodonico, Salvatore Gentile, Paola Profumo and others) the collections had fluctuating trends, with significant new entries and losses of species and varieties (Campodonico et al. 1999a, b; Zappa and Campodonico 2005, 2006, 2007; Campodonico and Zappa 2006; Zappa et al. 2010, 2011, 2014, 2019; Mariotti and Zappa 2015). Evidence of these changes can be found in the plant catalogues (Cronmeyer 1889; Dinter 1897; Berger 1912; Ercoli and Lorenzi 1938; Campodonico et al. 1996), various editions of the *Index Seminum* (compiled by various authors from 1880 to 1939) and *Sowing & Planting* manuscripts (Zappa 2011; Zappa et al. 2019). Further information on the flora of Capo Mortola can be found in various publications (Berger 1905; Campodonico 1992; Gentile and Gentile 1994; Campodonico et al. 1999a, b; Zappa and Campodonico 2005, 2006, 2007; Bardonì 2016).

Methods

The compendium of GBH is an area of about 20 ha, which is continuously monitored. Not only the flora, but also meteorological data have long been collected and recently processed (Vagge et al. 2019). Native taxa and taxa whose presence is determined by direct human management were not considered here. We only considered alloctonous taxa with an autonomous reproduction and development at a distance from the cultivated parent plant, with particular regard to those that have settled in natural and semi-natural habitats. They are mainly represented by mixed woods, scrubs and garrigues of the Vallone della Sorba, by mown lawns near the sea and by stone walls of the terraces and the edges of the Roman road. Furthermore, inside the 9 ha indicated as Garden, there are many areas without any cultivation activities; species growing exclusively in areas maintained with cultivation activities were not considered. The search for alien plants was then extended outside the GBH on a surrounding area of about 15 ha, including settlements, agricultural areas and paths, albeit with some difficulties caused by the fencing of private spaces. For the compendium, the comparison is based on the catalogue published 25 years ago by Campodonico et al. (1996), who used the following categories: acclimated (ACCL), assisted (ASS), adventive (ADV), cultivated (CULT), established / naturalized (Sptnzz./NAT), native/spontaneous (Spt./NATIVE). The meaning of these terms was defined by Campodonico (1998). We reclassified the alien taxa according to

the national standardisation system (Galasso et al. 2018a), based on the definitions provided by Richardson et al. (2000) and Pyšek et al. (2004), but supplemented by more detailed subcategories:

- C** cryptogenic species;
- CAS** occurring as a casual alien outside human-dominated systems;
- CAS#** occurring as a casual alien in human-dominated systems, but without direct intervention by humans and not close to parent plant;
- CAS?** occurring as casual alien, but still with some uncertainties for a definitive classification;
- DD** data deficient (unknown regional distribution or unknown alien status);
- NAT** occurring as a naturalized alien outside human-dominated systems;
- NAT#** occurring as a naturalized alien in human-dominated systems, without direct intervention by humans and not close to parent plant;
- INV** occurring as an invasive alien outside human-dominated systems;
- ERA** eradicated, eliminated during the last ten years;
- +** new taxon for the Italian or the Ligurian flora;
- +>** new status (status change) of the taxon for the Italian or the Ligurian flora;

The nomenclature is according to Galasso et al. (2018a) and subsequent updating; taxa not included in the Portal to the Flora of Italy (2022) are named according to Plants of the World online (POWO, 2021).

Results

The Table 1 shows the 270 taxa analyzed and classified according to the status categories cited above. The list includes previous status at Capo Mortola (Campodonico et al. 1996), the status in Italy and in Liguria [Galasso et al. (2018a), updated according to Galasso et al. (2018a, b, 2019a, b, 2020a, b, 2021a, b), and according to Wikipantbase#Liguria (Barberis et al. 2021)] and information on the trend.

We also provide some additional information and comments on a sample of 34 taxa for which we reconstructed the history of their presence in the study area.

Acacia provincialis A. Camus (Fabaceae)

+> (NAT) ITALIA (LIG): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.66"N, 7°33'10.40"E), semi-natural evergreen post-fire shrubland in wild area of Hanbury Botanic Garden, 77 m, 1 April 2021, *M. Mariotti* (HMGBH). – Status change from casual to naturalized alien for the flora of Italy (Liguria).

Acacia provincialis is an ornamental plant native to South Australia and Victoria, introduced in Tasmania; in Europe, it is recorded in France and Italy, where it has been introduced for ornamental and environmental purposes. The species was described by Camus in 1927 from cultivated material at Pampelonne, Ramatuelle, in the south of France (PACA), where the plant had been in cultivation since the 1870s and was popular in the cut flower trade as noted by Vilmorin (1893), Anonymous (1919), and Stapf and Ballard (1929). According to O'Leary (2007) in his review of *Acacia retinodes* Schltld. and closely related species, *A. uncifolia* (J.M.Black) O'Leary and *A. provincialis*, since the description the species was confused with these related taxa. In Italy, all specimens previously attributed to *A. retinodes* must be referred to *A. provincialis* (Galasso et al. 2018a).

In autumn 1867, a few months after the establishment of the garden, plants labelled as *A. retinodes* were introduced to La Mortola from Charles Huber's nursery-garden in Hyères. *A. retinodes* was recorded in all the catalogues of plants growing at La Mortola in Sir Thomas Hanbury's Garden: Cronemayer (1889), Dinter (1897), Berger (1912), Ercoli and Lorenzi (1938), Campodonico et al. (1996); in the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as established ("Sptnzz."). It has been established for several years, as shown by the various editions of the Index Seminum (various authors 1890–1939).

We carefully examined our specimens according O'Leary's review, in particular many of the principal morphological features that allow to distinguish the three related species *A. retinodes*, *A. uncifolia*, and *A. provincialis*. Based on variable length of phyllodes, spacing of phyllodes along stem (uncrowded), long flowering time, number of flowers/head, and pod width we were able to identify the specimens as *A. provincialis*.

All specimens examined grow in the wild in a valley at La Mortola and have to be referred to *A. provincialis*; the species is widespread in a wild area of the Vallone della Sorba, in a post-fire Mediterranean shrubland community, locally with *A. longifolia* (Andrews) Willd., *Eucalyptus* sp. and *Searsia pallens*, as well as with native species of the maquis.

***Acer oblongum* Wall. ex DC. (Sapindaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'1.55"N, 7°33'20.48"E), exotic evergreen woodland, 50 m, 12 August 2021, *E. Zappa*, *F. Pastor* (HMGBH). – Casual alien species confirmed for the flora of the compendium.

Acer oblongum is an ornamental plant with native range from NE-Pakistan to C- and S-China and Indo-China, which is widely cultivated for gardens and bonsai. It was introduced in the GBH from seeds obtained from Villa Thuret (Antibes, France) – sent on 3rd January 1870 – (Sowing & Planting 3, manuscript) – and it is recorded in the 1889, 1897, 1912, 1938, and 1996 Catalogues. Campodonico et al. (1996) in Hortus Mortolensis recorded the species as adventive. One old specimen grows in the central area of GBH, near the Dragon's Fountain. Young plants are widespread in the surrounding neglected slopes, in semi-shade positions without any human cultivation; these plantlets

are periodically removed to prevent further development. The species is recorded in various editions of the Index Seminum (since 1890 and following). Albericci et al. (2011) recorded a monumental tree of *Acer oblongum* in the Parco Gropallo (Genova, Italy), not found elsewhere in Italy with this size and age; they do not mention the possible naturalization of this species, but highlight its ability to adapt to the Mediterranean climate.

***Alectryon tomentosus* (F.Muell.) Radlk. (Sapindaceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.62"N, 7°33'22.62"E), exotic evergreen woodland, 40 m, 12 August 2021, *E. Zappa* (HMGBH); *ibidem*, Capo Mortola, Strada Romana (WGS84: 43°46'57.11"N, 7°33'21.91"E), wall above the ancient Roman Road, 22 m, 3 March 2022, *E. Zappa* (HMGBH). – Casual alien species new for the flora of Italy (Liguria).

Alectryon tomentosus is an ornamental plant, native to New South Wales and Queensland (Australia) that occurs naturally in rainforests; it commonly sprouts in Australian urban bushland, gardens, and roadsides. It is extremely hardy and can withstand dry periods and neglect (http://www.brisrain.org.au/01_cms/details.asp?ID=19). In the 19th century, it was introduced as seed from the Royal Botanic Gardens Sydney (4th July 1898) to La Mortola (Sowing & Planting 6, manuscript); it is recorded in 1912, 1938 and 1996 Hortus Mortolensis; in the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as adventive. The species is recorded in various editions of the Index Seminum (since 1912 and following). One old specimen grows in the “Australian Wood”; many young plants originating from the seeds produced by *planta culta* are widespread in the garden, in shady and semi-shade positions, especially in evergreen woodlands of the compendium; we observed a few individuals outside the botanical garden on the wall alongside the Strada Romana.

***Asparagus virgatus* Baker (Asparagaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'2.55"N, 7°33'21.27"E), exotic woodland, 63 m, 11 February 2021, *E. Zappa* (HMGBH). – Casual alien species confirmed for the flora of the compendium.

Asparagus virgatus is an ornamental plant, native to Angola, South Africa, Malawi, Mozambique, Namibia, Tanzania, Yemen, Zambia and Zimbabwe, introduced into Queensland (Australia), Réunion, Trinidad-Tobago. In Europe, it is reported only as cultivated for ornamental purposes. At La Mortola the species was first introduced in October 1901, by Carl Ludwig Sprenger (1846–1917), Naples (Sowing & Planting 7, manuscript), and then recorded in the 1912, 1938, and 1996 catalogues. In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as adventive. In GBH *A. virgatus* grows along marginal borders, in semi-shady and sheltered, undisturbed locations.

***Brachychiton discolor* F.Muell. (Malvaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'57.20"N, 7°33'21.54"E), exotic evergreen woodland, 25 m, 9 September 2021, *F. Pastor* (HMGBH). – Casual alien species new for the flora of the compendium, where it was previously known only as cultivated (acclimated).

Brachychiton discolor is an ornamental tree native to New South Wales and Queensland, in dry rainforests, on well-drained slopes (Fern 2014). In Europe it was known only as ornamental since 2016, when it was recorded as casual alien in Sicilia (Raab-Straube and Raus 2016).

At la Mortola the species was first introduced in May 1893, as seeds from the Botanic Garden of Melbourne (Sowing & Planting 5, manuscript), and then recorded in 1912, 1938, and 1996 catalogues. It was described as a very handsome young tree that had not yet flowered (sub *B. luridus* C.Moore ex F.Muell.) (Berger 1912). In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as acclimated. One old specimen grows in the “Australian Wood”; some young plantlets originating from *planta culta* are widespread in the garden, in semi-shady neglected positions.

***Bupleurum fruticosum* L. (Apiaceae)**

+> (C) **LIG:** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'57"N, 7°33'16"E), evergreen woodland margins, 50 m, 12 August 2021, *E. Zappa* (HMGBH). – Species to be considered cryptogenic in Liguria.

Bupleurum fruticosum is a steno-Mediterranean species, typical of clayey slopes and stony garrigues (Pignatti et al. 2018), reported as native in Sicilia, Sardegna and Liguria (Isola Gallinara), not confirmed in Puglia (Bartolucci et al. 2018); the species is recorded as cryptogenic species in Toscana (Roma-Marzio and Peruzzi 2018) and as cryptogenic species extinct in Puglia (Roma-Marzio and Peruzzi 2018).

In Liguria, on the Isola Gallinara in front of Albenga (Savona), Béguinot (1907) observed the species only in one location and consider it among species introduced in cultivation; later Orsino (1975) recorded the species only in the highest area near the Villa and agrees with Béguinot in considering that this stand was first introduced as ornamental.

Caruel (1889) reports that *B. fruticosum* is often cultivated as ornamental in the gardens of the Italian peninsula and, in some cases, it has been erroneously considered wild, as in Nice by De Candolle according to De Notaris (1844) [«*Nicaeae, utique, sed in (hortis cultum)*»].

The species occurs at Capo Mortola in evergreen wood areas. Date and origin of its introduction to the GBH is unknown: it was recorded in 1889, 1897, 1912, 1938, and 1996 catalogues. Seeds, collected from plants cited as indigenous, were available in exchange since the 1888 Index Seminum; the last edition of Hortus Mortolensis

(Campodonico et al. 1996) considers the species established (“Sptnzz.”), i.e., naturalized. Furthermore, Berger (1905) did not include the species in the enumeration of the plants growing wild at La Mortola *Florula Mortolensis*.

As for Liguria, we suggest considering *B. fruticosum* a cryptogenic species for Liguria.

***Chasmanthe bicolor* (Gasp.) N.E.Br. (Iridaceae)**

+> (NAT) **LIG:** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'00.0"N, 7°33'11.5"E), exotic woodland, 70 m, 18 March 2021, *E. Zappa* (HMGBH); *ibidem*, Capo Mortola, rio Sorba Valley (WGS84: 43°46'54.26"N, 7°33'16.00"E), *Pinus halepensis* woodland, 25 m, 11 March 2022, *F. Dente* (HMGBH). – Status change from casual to naturalized alien for the flora of Liguria.

Chasmanthe bicolor is an ornamental bulbous plant native to Cape Province (South Africa) and introduced to California, Great Britain (Scilly Isles), Italy (<https://www.catalogueoflife.org/data/taxon/TPZZ>). According GBIF Secretariat (2021a), it is recorded as introduced also in France, Portugal, New Zealand and Australia. In Italy it is recorded as naturalized alien in Campania and Sicilia, casual alien in Calabria, Lazio, Liguria, Puglia and Toscana.

In GBH it was first grown from seeds received from Villa Thuret, Antibes in January 1870 (sub *Antholyza*; Berger 1912) (Sowing & Planting 3, manuscript). It is recorded in the 1889, 1897, 1912, 1938 and 1996 Catalogues; it has been established for several years, as Berger (1912) noted: “it is now almost a weed in the garden, but useful for covering bare places under trees with a pleasant green during winter and spring”. In the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as established (“Sptnzz.”) naturalized under the name of *C. aethiopica* (L.) N.E.Br. *C. bicolor* is widespread both in the garden, in woodland, in sunny, semi-shade and shady sheltered positions, neglected slopes and terraces and in evergreen woodland in the wild area of Vallone della Sorba.

***Chasmanthium latifolium* (Michx.) H.O.Yates (Poaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'1"N, 7°33'12"E), exotic woodland, 70 m, 12 August 2021, *E. Zappa* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously recorded as cultivated.

Chasmanthium latifolium is an ornamental plant native to C-Canada, C- and E-USA to NE-Mexico, introduced to Europe in Austria and Belgium.

It was first introduced to GBH in 1994 (Hanbury Botanic Garden Accessions Register, manuscript); in the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as cultivated, but in recent years it became adventive. In the GBH, the species grows wild along the edge of flowerbeds and borders, in sheltered positions.

***Chrysanthemoides monilifera* (L.) Norl. subsp. *monilifera* (Asteraceae)**

+> (NAT) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.66"N, 7°33'10.40"E), semi-natural evergreen post-fire shrubland in wild area of Hanbury Botanic Garden, 80 m, 18 March 2021, *E. Zappa, L. Minuto* (HMGBH). – Naturalized alien species confirmed for the flora of Italy (Liguria).

Chrysanthemoides monilifera ($\equiv$ *Osteospermum moniliferum* L.) is a semi-succulent shrub 1–3 m high, native to the sandy soils of southern and southeastern South Africa, where there are six subspecies (Scott and Brown 1992). Introduced to California, Australia (Queensland, South Australia, Victoria, Western Australia), Norfolk Island, New Zealand (North Island), France, Spain, and Italy, in Sicilia where it is no longer recorded. The species is included in the CABI (2021a) invasive species database. *C. monilifera* has been both deliberately and accidentally introduced into other countries. It is known to have been introduced as a garden ornamental. Subsp. *monilifera* was introduced into Australia as an ornamental plant in the 1850s and was grown in gardens in Sydney, Melbourne and Adelaide (Parsons and Cuthbertson 1992). At La Mortola it was introduced in February 1869 from seeds given by Gustave Thuret of Antibes (Berger 1912). It is recorded in the 1889, 1897, 1912, 1938 and 1996 Hortus Mortolensis, where is reported as naturalized, and various editions of the Index Seminum since 1888. Gentile and Gentile (1994) observed the species in garrigues with *Salvia rosmarinus* Spenn. as differential species of groupings of the thermoxeric series.

***Chrysojasminum humile* (L.) Banfi (Oleaceae)**

+> (NAT) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'57"N, 7°33'16"E), exotic woodland, 50 m, 15 July 2021, *E. Zappa, M. Mariotti* (HMGBH); *ibidem*, Capo Mortola, rio Sorba Valley (WGS84: 43°47'0.00"N, 7°33'12.10"E), mixed woodland of *Pinus halepensis* and exotic species, 50 m, 15 July 2021 (HMGBH). – Status change from casual to naturalized alien for the flora of Italy (Liguria).

Chrysojasminum humile is an ornamental plant native to Afghanistan, Assam, N-C-China, S-C-China, East and West Himalaya, Iran, Myanmar, Nepal, Pakistan, Tadzhikistan, Tibet, introduced to Greece, Italy, Sicilia, and Yugoslavia. In Europe, it is cultivated as ornamental and is recorded as casual alien in Italy (Galasso et al. 2018a). In GBH it is widespread in the garden, and in the wild area in rio Sorba valley.

We do not know the date and origin of its introduction to the GBH: it was recorded in the 1889, 1897, 1912, 1938 and 1996 catalogues. Seeds were available in exchange since the 1891 Index Seminum. In the last edition (Campodonico et al. 1996) the species is reported as cultivated; then it became naturalized as now it is widespread in neglected sites of the compendium, mainly in an evergreen woodland in the wild area of Vallone della Sorba, where it is common in shady locations.

***Clematis armandii* Franch. (Ranunculaceae)**

+ (CAS) **LIG:** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.52"N, 7°33'13.72"E), exotic woodland, 52 m, 18 March 2021, *E. Zappa*, *F. Pastor* (HMGBH). – Casual alien species new for the flora of Liguria.

Clematis armandii is an ornamental plant native to N-C-China, S-C-China, SE-China, Myanmar, Tibet, Vietnam, occurring in forests, forest margins, slopes, shrubs, along streams. In Europe it is known only as cultivated. It is among the plants collected by Ernest Henry Wilson (1876–1930) for James Herbert Veitch (1868–1907) in his first expedition (1899–1902) to China (Wilson 1905) and introduced to cultivation by James Veitch & Sons Nurseries. In this nursery, plants raised from seeds, sent by Wilson in 1900, flourished for the first time in spring 1905 as reported in a note on Gardeners' Chronicle (Anonymous 1905). In his note "Recently introduced trees, shrubs & c. from Central China", Veitch (1903) assumed *C. armandii* as "the best of the several species of *Clematis* introduced by Wilson in his recent trip".

At la Mortola, a plant or cuttings of *C. meyeniana* Walp., later identified by Alwin Berger as *C. armandii* (Mottet 1921), was first introduced in 1904, October 25th (Sowing & Planting 8, manuscript) from the Royal Botanic Gardens, Kew. The species is recorded in 1912, 1938, and 1996 editions of Hortus Mortolensis. In the 1938 catalogue, the species is reported to grow from seeds collected by Wilson in China. Seeds were available in exchange since the 1917 Index Seminum. In the last edition of the catalogue (Campodonico et al. 1996), the species is reported as acclimated; then it became established as now it is widespread in an evergreen woodland in the wild area in Vallone della Sorba, where it is common in shady neglected sites.

***Enchylaena tomentosa* R.Br. (Amaranthaceae)**

+> (NAT) **ITALIA (LIG):** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'53.89"N, 7°33'28.46"E), sunny and dry slopes on poor soil and stones, cliff, rocks, 10 m, 12 August 2021, *E. Zappa* (HMGBH). – Status change from casual to naturalized alien for the flora of Italy (Liguria).

Enchylaena tomentosa is a small shrub native to Australia and introduced into New Caledonia and Palestine. In Italy, it was recorded by Alberti (2013) as casual alien species here, on the cliff rocks of Capo Mortola. The species is widespread on the Cape, in marginal sunny rock sites and slopes.

It was first introduced to GBH in April 1903, from seeds sent by Villa Thuret (Sowing & Planting 8, manuscript); it is recorded in 1912, 1938 and 1996 editions of Hortus Mortolensis; in the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as established ("Sptnzz.") naturalized.

Ephedra altissima Desf. (Ephedraceae)

+ (NAT) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'2.29"N, 7°33'20.24"E), woodland margins, walls, terraces in olive groves, 65 m, 2 February 2021, *F. Pastor* (HMGBH); *ibidem*, Capo Mortola, Discesa del Marinaio (WGS84: 43°47'2.94"N, 7°33'21.89"E), Mediterranean shrubland, neglected olive trees, 75 m, 11 March 2022, *F. Dente* (HMGBH). – Naturalized alien species new for the flora of Italy (Liguria).

Ephedra altissima is an ornamental and medicinal climbing plant, native to Algeria, Canary Islands (Tenerife), Chad, Libya, Mauritania, Morocco, Tunisia, and western Sahara. In Europe it is known only as cultivated. It was first introduced to GBH before 1870 from seeds sent by Daniel Hanbury to La Mortola (letter dated 23rd March 1870 in Winter manuscript). It is recorded in the 1889, 1897, 1912, 1938, and 1996 catalogues; it is also recorded in various editions of the Index Seminum (1890 onwards). In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as established (“Sptnzz.”), apparently naturalized. *E. altissima* is widespread inside and outside the compendium, on trees and walls, in sunny and sheltered neglected sites mainly in olive grove terraces; both female and male specimens are present, probably scattered by birds. We observed the species also on olive trees in sunny sites outside the Gardens.

Ferula communis L. subsp. *communis* (Apiaceae)

+> (C) **LIG**: observed at Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'0.30"N, 7°33'24.08"E), garrigues and arid slopes in wild areas of Hanbury Botanic Garden, widespread in the garden in sunny sites, 80 m, 2021. – Status change from native to cryptogenic for the flora of Liguria.

According to Caruel (1889), in Liguria the species occurs along the sea coast on the island of Bergeggi near Noli (datum from Giuseppe De Notaris), and on the Isola Gallinara near Albenga (datum from Antonio Bertoloni! and Giuseppe De Notaris), and in the region of Nice (France) (datum from Carlo Allioni). De Notaris (1844) reported Prof. Agostino Sassi's citation in Gallinara island and Giuseppe Berti in Bergeggi island near Noli; Ottone Penzig (handwritten notes on a copy of the volume of De Notaris (1844) kept in Genova) added Bicknell's record in Capo Mele.

At La Mortola, the species was introduced in 1868 by Daniel Hanbury on May 20th and sown near the sea and in the garden (Berger 1912). It was recorded in the 1889, 1897, 1912, 1938 and 1996 catalogues and various editions of the Index Seminum since 1888. Campodonico et al. (1996) in the last edition of Hortus Mortolensis classify the species as established (“Sptnzz.”) naturalized. Marinella Zepigi uploaded on the “Acta Plantarum” portal a photo of the plant taken in Grimaldi (west of Capo Mortola) in 2008. The presence of this species, of ancient medicinal use, in the Bergeggi and Gallinara islands, once monastic settlements, lead us to assume its possible

introduction by humans in these sites, as certainly occurred at Capo Mortola. This assumption is not yet documented by solid evidence and we suggest considering the species as cryptogenic for the flora of Liguria.

***Jaborosa integrifolia* Lam. (Solanaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'54.57"N, 7°33'22.45"E), grassy places in exotic woodland, 26 m, 11 November 2021, *E. Zappa* (HMGBH). – Casual alien species confirmed for the flora of the compendium.

Jaborosa integrifolia is an ornamental plant whose native range is from Brazil to N-Argentina and introduced into Alabama (USA). In Europe, it is recorded as casual alien species in Sardegna (Podda et al. 2012). At La Mortola, the species was first introduced before 1872 (Winter, manuscript); it is recorded in the 1938 and 1996 catalogues. In the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as adventive. In the compendium, the species is widespread in grassy sites and alongside paths.

***Jasminum mesnyi* Hance (Oleaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'0.39"N, 7°33'16.64"E), exotic woodland, 63 m, 23 April 2021, *F. Pastor* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously known only as cultivated (acclimated).

Jasminum mesnyi is an ornamental plant native to S-C-China and Vietnam, introduced into Alabama and Florida (USA), NE-Argentina, Honduras, India, SE-Mexico, Pakistan, and western Himalaya. The species is recorded as invasive in USA, Australia, South Africa, Libya, and Iraq (GBIF Secretariat 2021b); in Italy it is recorded as casual and naturalized alien species (Galasso et al. 2018a).

J. mesnyi (sub *J. primulinum* Hemsl.) is among the plants collected by Wilson during his first trip in China in 1899–1902. In December 1903, three plants were introduced to La Mortola by Miss Ellen Willmott (Sowing & Planting 8, manuscript). The species is recorded in the 1912, 1938 and 1996 catalogues. In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as acclimated. In the compendium, we observed *J. mesnyi* growing in mixed borders and in shady and sheltered positions without direct human influence.

***Koelreuteria bipinnata* Franch. (Sapindaceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'56.86"N, 7°33'21.23"E), exotic woodland, 20 m, 12 August 2021, *E. Zappa* (HMGBH); *ibidem*, Capo Mortola, Strada Romana (WGS84: 43°46'56.6"N, 7°33'20.4"E), 20 m, 3 March

2022, *E. Zappa* (HMGBH); *ibidem*, Capo Mortola, rio Sorba Valley (WGS84: 43°47'0.27"N, 7°33'14.21"E), evergreen woodland, 60 m, 11 March 2022, *F. Dente* (HMGBH). – Casual alien species new for the flora of Italy (Liguria).

Koelreuteria bipinnata is an ornamental plant, native to S-China, occurring in sparse forests and slopes at 400–2,500 m a.s.l. (Xia and Gadek 2007), and introduced to the USA (California, Alabama and Arkansas) (Serviss et al. 2006; International Dendrology Society 2021) It is among the plants collected by Wilson during the Veicht expedition in 1900 (Rehder and Wilson 1914). Seeds of *K. bipinnata* were introduced to La Mortola in May 1893, sent by Henry Correvon of Geneva (Switzerland) (Sowing & Planting 5, manuscript).

The species is recorded in 1912, 1938 and 1996 editions of Hortus Mortolensis. Seeds were available in exchange starting from the 1911 Index Seminum; in the last catalogue (Campodonico et al. 1996), the species is reported as adventive. Many plant-lets originating from the old specimen are widespread in the compendium, in shady positions, mainly in the lower garden, known as the Piana. We observed two mature individuals growing wild, one alongside the Strada Romana and the other in Vallone della Sorba, near the stream banks.

***Lavandula dentata* L. (Lamiaceae)**

+ (CAS) **LIG**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'58.30"N, 7°33'18.82"E), sunny sheltered positions, walls, 56 m, 2 February 2021, *F. Pastor* (HMGBH); *ibidem*, La Mortola, ex strada SS1 (WGS84: 43°47'05.3"N, 7°33'15.8"E), wall, 105 m, 3 March 2022, *F. Pastor* (HMGBH). – Casual alien species new for the flora of Liguria.

Lavandula dentata is an ornamental shrub native to Algeria, Balears, Eritrea, Ethiopia, Morocco, Palestine, Saudi Arabia, Spain, and Yemen, naturalized elsewhere around the Mediterranean (Greece, Italy, Tunisia) as well as in Bulgaria, Canary Islands, Cape Verde, Madeira, western Australia, New Zealand, and California.

The date and origin of its introduction to the GBH remains obscure; surely it happened before 1889, as the species is reported in the 1889, 1897, 1912, 1938 and 1996 catalogues. It is also recorded in the various editions of the Index Seminum (since 1909). In the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as adventive. *L. dentata* is widespread in the garden and outside in the village of La Mortola, on rocks, and walls, in sunny and sheltered positions.

***Nandina domestica* Thunb. (Berberidaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'1.06"N, 7°33'16.29"E), mixed borders, 66 m, 12 August 2021, *E. Zappa* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously known only as cultivated (acclimated).

Nandina domestica is an ornamental plant native to N-C-China, S-C-China, SE-China, and Japan; introduced into S-USA, Assam, Korea, New South Wales (Australia), and Italy. We do not know date and origin of the species' introduction to the GBH; it is surely before 1889, as the species is reported in the 1889, 1897, 1912, 1938 and 1996 catalogues. Seeds are available in various editions of the Index Seminum (since 1890 and following). In the last edition of Hortus Mortolensis (Campodonico et al. 1996) the species is reported as acclimated. Now it grows in mixed borders, in semi-shady sites, probably scattered by birds; we observed one individual under a cypress tree.

***Parrotia persica* (DC.) C.A.Mey. (Hamamelidaceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'0.00"N, 7°33'12.10"E), exotic woodland in wild area of Hanbury Botanic Garden, 60 m, 1 April 2021, *E. Zappa*, *M. Mariotti* (HMGBH). – Casual alien species new for the flora of Italy (Liguria).

Parrotia persica is an ornamental tree native to Iran, and Transcaucasia and introduced into Great Britain and Uzbekistan. It is not recorded in the updated checklist of the vascular flora alien to Italy (Galasso et al. 2018a). We do not know date and origin of the introduction to GBH, but it was recorded in the 1889, 1897, 1912, 1938 and 1996 catalogues. The last edition of Hortus Mortolensis (Campodonico et al. 1996) reports the species as acclimated.

At La Mortola, two plants of different age grow in an evergreen woodland with *Pinus halepensis* Mill. subsp. *halepensis* in Vallone della Sorba in the wild area of the compendium.

***Passiflora morifolia* Mast. (Passifloraceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'3.21"N, 7°33'15.56"E), borders in exotic woodland, 83 m, 21 September 2021, *F. Pastor* (FI, HMGBH). – Casual alien species new for the flora of the compendium.

Passiflora morifolia is an ornamental plant with a native range from Mexico (Guerrero, Chiapas) to S-tropical America, introduced into Canary Islands, S-C-China, Palestine, and Zimbabwe. It has been recently introduced into Europe, mainly for ornamental purposes. In Italy, it is recorded as naturalized in Sardegna (Galasso et al. 2020a).

At La Mortola, *P. morifolia* was introduced in 1999 coming from the Botanic Gardens of Rotterdam as seeds (sub *P. brionioides* Kunth, Hanbury Botanic Garden Accessions Register, manuscript); in the same year, two plants were introduced from Giardino Boccanegra (Ventimiglia, Italy). In recent years, the species has become adventive and, from the cultivated areas, has spread into the compendium, maybe scattered by birds, and grows in marginal sites, on walls, and fallow locations.

***Pittosporum venulosum* F.Muell. (Pittosporaceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'0.0"N, 7°33'11.5"E), exotic woodland in wild area of Hanbury Botanic Garden, 75 m, 1 April 2021, *E. Zappa* (HMGBH). – Casual alien species new for the flora of Italy (Liguria).

Pittosporum venulosum (= *P. procerum* Naudin) is an ornamental tree native to Australia (East Queensland). The plants of Capo Mortola are certainly derived from the typical material of *Pittosporum procerum*. This name is reported by WFO (2021) database as ambiguous, while POWO (2021) considers it as a synonym of *P. venulosum*.

In 1899 Charles Naudin described *P. procerum* and introduced it to cultivation in Villa Thuret, Antibes (France); in 1903 and 1904 seeds were introduced from Villa Thuret to La Mortola (Sowing & Planting 8, manuscript). Seeds became available for exchange since 1912 (Index Seminum 1912). The species is recorded in the 1912, 1937 and 1996 catalogues; the last edition of Hortus Mortolensis (Campodonico et al. 1996) reports the species as acclimated. We observed some plants, in juvenile and mature phases, in Vallone della Sorba, the wild area of the compendium, in a mixed evergreen woodland with *Pinus halepensis* subsp. *halepensis*.

***Quercus coccifera* L. (Fagaceae)**

+ (C) **LIG**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.4"N, 7°33'24.3"E), evergreen woodland margins, 65 m, 18 March 2021, *E. Zappa*, *L. Minuto* (HMGBH). – Cryptogenic species confirmed for the flora of Liguria.

Quercus coccifera is a western Mediterranean species. Pignatti et al. (2017) according Brullo and Spampinato (2004), reported the species widespread mainly in Languedoc, Catalonia and Tunisia, in Italy only in western Liguria (0–200 m); while Bartolucci et al. (2018) recorded the species occurring in Puglia, Basilicata, Sicilia, Sardegna and doubtfully in Liguria.

Penzig (handwritten notes on a copy of the volume of De Notaris (1844) kept in Genova) reported: “Nym. Prosp. Lig.”, and Ardoino’s, Allioni’s, Reichenbach’s, Burnat’s recordings of the species as very rare occurring around Nice. Parlatore (1868) reported Allioni’s citation: around Nice, where it is rare. The Portal to the Flora of Italy (2022) reports this species in Liguria only with doubtful records.

The species occurs at Capo Mortola in evergreen wood and in post-fire Mediterranean shrubland community. We do not know date and origin of the introduction to the GBH: it was recorded in the 1889, 1897, 1912, 1938 and 1996 catalogues. Seeds were available in exchange since the 1896 Index Seminum; the last edition of Hortus Mortolensis (Campodonico et al. 1996) reports the species as acclimated. It was not included in *Florula Mortolensis* (Berger 1905), the catalogue of all plants growing wild at La Mortola.

For Liguria, we suggest considering *Q. coccifera* as a cryptogenic species.

***Roldana petasitis* (Sims) H.Rob. & Brettell (Asteraceae)**

(NAT) **LIG:** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'2.01"N, 7°33'11.76"E), evergreen woodland margins, 60 m, 15 June 2021, *F. Pastor* (HMGBH). – Naturalized alien species: further record for Liguria.

Roldana petasitis is an ornamental plant native to the Gulf of Mexico, and NE-Mexico and introduced to Azores, Canary Islands, France, Italy, Java, Madeira, Mauritius, Australia (New South Wales, Norfolk Island, Victoria), Réunion, and Spain. In Italy, it is recorded as casual alien species (Galasso et al. 2018a; Galasso et al. 2019b) in Basilicata, Lazio, Puglia and Sicilia, naturalized in Liguria (Longo 2012).

The species was reported in the 1897, 1912, 1938 and 1996 catalogues. In 1996, the species is reported in Hortus Mortolensis as acclimated (Campodonico et al. 1996); it became established in recent years. In the compendium *R. petasitis* grows along woodland edges on stream banks in Vallone della Sorba, without direct human intervention.

***Romneya coulteri* Harv. (Papaveraceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.98"N, 7°33'17.95"E), exotic woodland, 58 m, 12 August 2021, *E. Zappa* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously known only as cultivated (acclimated).

Romneya coulteri is an ornamental plant native from S-California to Mexico (N-Baja California), introduced into New South Wales, S-Australia, and W-Australia. In Europe, it is known only as cultivated.

R. coulteri was first introduced to GBH before 1897, as it is recorded in the 1897, 1912, 1938, and 1996 catalogues. In April 1899, a plant was introduced by Miss Ellen Willmott and in May 1901, seeds from the Southern California Acclimatization Association were delivered to La Mortola (Sowing & Planting 8, manuscript). In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as acclimated. In the compendium, some individuals of the species grow wild in sunny and sheltered positions lacking direct human interventions.

***Rosa banksiae* W.T.Aiton var. *normalis* Regel (Rosaceae)**

(+) (NAT) **ITALIA (LIG):** Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'3.14"N, 7°33'9.08"E), evergreen woodland, 80 m, 18 March 2021, *E. Zappa* (HMGBH). – Status change from casual to naturalized alien for the flora of Italy (Liguria); naturalized alien variety new for the flora of Italy (Liguria).

***Rosa banksiae* W.T.Aiton [var. *normalis* Regel] f. *lutescens* Voss (Rosaceae)**

(+) (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'3.47"N, 7°33'16.32"E), evergreen woodland margins, 85 m, 1 April 2021, *F. Pastor* (HMGBH); *ibidem*, Capo Mortola, rio Sorba Valley (WGS84: 43°47'4.35"N, 7°33'8.50"E), evergreen woodland, 100 m, 1 April 2021, *F. Pastor* (HMGBH). – Casual alien form new for the flora of Italy (Liguria).

Rosa banksiae is an ornamental plant, native to western mountainous half of China: Yunnan, Shensi, Kansu, Hupeh and Szechwan where it was found wild by Europeans collecting in China. The species ([var. *banksiae*] f. *banksiae*, the double-white flowered variety) was first introduced to England in 1807 by William Kerr. The yellow double flowered form ([var. *banksiae*] f. *lutea* (Lindl.) Rehder) was brought in later by John Damper Parks in 1824; under cultivation a single state of the last has been obtained, which is described and figurate in plate 7171 of Botanical Magazine. In the wild state, yellow flowers do not seem ever to occur (Henry 1902).

Rosa banksiae var. *normalis* (with single flower) is a rampant evergreen climber reaching up to 15 m or more, native to central and western China from Hubei and Gansu to Yunnan, usually at low altitudes but recorded up to 1,800 m a.s.l. It grows in valleys, by streams and rocky places, flowering from April to June. It was first introduced to Europe by Robert Drummond in 1796, and planted at Megginch Castle on Tayside, where it seldom flowered and remained unrecognized until cuttings were taken to Nice in 1905, where they flowered and were identified (Phillips and Rix 1988).

R. banksiae var. *normalis* is recorded in the 1938 and 1996 editions of Hortus Mortolensis, but it was introduced around 1912, maybe as part of the collection received from Mr. Wilson, as reported by Berger (1912). “Wilson N° 619, L.M., 2 July 1913” is written on the label of a specimen in our herbarium (HMGBH); the seeds were available in the 1913 Index Seminum.

According the forum actaplantarum.org, Franco Fenaroli recorded *R. banksiae* photographed in 2008 outside the boundary wall of a villa at Gardone Riviera (Province of Brescia) and said he had never seen it naturalized; Daniela Longo cited *R. banksiae* photographed in 2013 at Capo Mortola. Both do not provide any information on infraspecific rank. Based on the images available online, the plants photographed seem to refer to two different varieties: var. *normalis* (single flower) in Capo Mortola and var. *banksiae* (double or full flowered) in Gardone Riviera.

Campodonico et al. (1996) reported *R. banksiae* var. *normalis* as established (“Spt-nzz.”), as it is widespread in the compendium, mainly in the wild area in Vallone della Sorba, where is common in shady situations within the woodland, climbing on trees up to 10 m or more.

The yellow single-flowered form (f. *lutescens*) is of unknown origin and its date of introduction is not recorded. Phillips and Rix (1988) noted both the double and single forms apparently growing on the same plant in an old garden on the Riviera and explained that the single yellow may appear as a reverse sport on the commoner double. Nothing is known as to its introduction at La Mortola, but it was already cultivated before December 1870, as noted by J.V.V. (1877), by Thomas Hanbury (1878)

on Gardeners' Chronicle and by Winter (manuscript, 6th December 1870, letter to Daniel Hanbury). In the same years, as reported by Emanuele Orazio Fenzi (1878) on Gardener's Chronicle, Eugenio Baroni, chief gardener at Florence Botanic Garden, obtained yellow single flowers plant. Woodall (1878), in another note on Gardeners' Chronicle reported about single yellow form specimen in Nice and other locations in French Riviera observed in the spring of 1873 and in flower in 1876.

Berger (1912) noted that single yellow flower form was the most abundant rose in the garden of Sir T. Hanbury. *R. banksiae* f. *lutescens* is recorded in 1889, 1897, 1912, 1938 and 1996 catalogues; it has been established for several years, as shown by the various editions of the Index seminum (since 1890 and following). Campodonico et al. (1996) reported f. *lutescens* as adventive; it is widespread in the garden and in semi-natural areas of Vallone della Sorba.

***Rosa brunonii* Lindl. (Rosaceae)**

+ (NAT) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'3.76"N, 7°33'8.61"E), evergreen woodland, 84 m, 5 April 2021, *F. Pastor* (HMGBH). – Naturalized alien species new for the flora of Italy (Liguria).

Rosa brunonii is an ornamental plant native to Afghanistan, Assam, S-C-China, East and West Himalaya, Myanmar, Nepal, Pakistan, and Tibet, introduced to Europe in 1823 as *R. napaulensis* Andrews.

We do not know date and origin of the introduction to the GBH: the species is recorded in the 1938 and 1996 editions of Hortus Mortolensis; seeds were available in exchange since the 1922 Index Seminum. In the last edition (Campodonico et al. 1996), the species is reported as established ("Sptnzz."), as it is widespread in the compendium, mainly in the wild area of Vallone della Sorba, where is common in shady situations, climbing on trees up to 15 m or more.

R. brunonii 'La Mortola' is an ornamental cultivar originated in the GBH by a sport of *R. brunonii*, first brought to England by Edward Bunyard in the 1930s (Quest-Ritson 2013) and introduced into commerce by Sunningdale Nursery in 1954 (HelpMeFind 2021).

***Searsia pallens* (Eckl. & Zeyh.) Moffett (Anacardiaceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'59.66"N, 7°33'10.40"E), semi-natural evergreen post-fire shrubland in wild area of Hanbury Botanic Garden, 77 m, 25 February 2021, *E. Zappa* (HMGBH). – Casual alien species new for the flora of Italy (Liguria).

Searsia pallens is an ornamental plant native to Botswana, South Africa, and Lesotho. In Europe it is only known as cultivated. The species was introduced to La Mortola in June 1872, as *Rhus excisa* Thunb. var. *pallens* (Eckl. & Zeyh.) Sond. by seeds received from prof. Peter Mac Owan (Berger 1912), director of the Cape Town Botanical Garden.

The species was reported in the 1889, 1897, 1912, 1938, and 1996 catalogues. Seeds became available for exchanges since 1909. Inside the boundary of the compendium, in the wild area of Vallone della Sorba, individuals of *S. pallens* occur in a post-fire Mediterranean shrubland community.

***Senecio linifolius* L. (Asteraceae)**

+ (CAS) **ITALIA (LIG)**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'3"N, 7°33'21"E), margins of sunny and dry slopes in Hanbury Botanic Garden, 70 m, 1 April 2021, *E. Zappa* (HMGBH); *ibidem*, Capo Mortola, Discesa del Marinaio (WGS84: 43°47'2.94"N, 7°33'21.89"E), mediterranean shrubland, 75 m, 11 March 2022, *F. Dente* (HMG-BH). – Casual alien species new for the flora of Italy (Liguria).

Senecio linifolius is a small half succulent shrub native to the eastern Cape Province and Lesotho, previously known in literature with the illegitimate name *Senecio longifolius* L.

Senecio linifolius L. (Linnaeus 1759) was based on a South African collection in the herbarium of Johannes Burman (Wijnands 1983). Linnaeus (1763) later published the replacement name *S. longifolius* L. for the species to avoid homonymy with his new combination *S. linifolius* (L.) L. (Linnaeus 1763) for a Mediterranean species based on *Solidago linifolia* L. (Linnaeus 1753). The name *S. linifolius* L. [1759] is therefore correctly applied to the South African species (Calvo et al. 2013).

The species was introduced as *S. longifolius* L. to La Mortola by seeds received in June 1872, probably from Prof. Peter MacOwan (Berger 1912); it soon became spontaneous in the garden according to Berger. It was recorded in the 1889, 1897, 1912, 1938, and 1996 catalogues; seeds became available for exchanges since the 1888 Index Seminum. In the last edition of Hortus Mortolensis, Campodonico et al. (1996) consider the species established ("Sptnzz."). We observed some plants outside the Garden on sunny and dry slope.

***Setaria palmifolia* (J.Koenig) Stapf (Poaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'56.92"N, 7°33'20.16"E), exotic woodland garden, 26 m, 4 February 2021, *F. Pastor* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously known only as assisted.

Setaria palmifolia is an ornamental plant native from tropical and subtropical Asia to E-Australia, introduced to W- and S-Australia, New Zealand, Pacific Islands and S- and C-America, with sporadic records in C-Africa (GBIF Secretariat 2021c), where it has naturalized and become invasive in many new territories, especially on the Pacific islands, including Hawaii (CABI 2021b). In Europe, it is known only as cultivated. The species is recorded in the EPPO database.

We do not know date and origin of the introduction to the GBH, but it was surely before 1889, as the species was reported in the 1889, 1897, 1912, 1938, and 1996

catalogues. In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as assisted, but in recent years it became established. At La Mortola, *S. palmifolia* occurs as a weed in flowerbeds and borders, especially, but not limited to, those that are regularly watered, in sheltered positions.

***Trachelospermum jasminoides* (Lindl.) Lem. (Apocynaceae)**

(CAS#): Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°47'2.29"N, 7°33'20.24"E), sunny places on terraces in olive groves, 62 m, 15 September 2021, *F. Pastor* (HMGBH). – Casual alien species, new for the flora of the compendium, where it was previously known as acclimated.

Trachelospermum jasminoides is an ornamental plant native to N-C-China, S-C-China, SE-China, Hainan, Japan, Korea, Taiwan, Tibet, and Vietnam; it has been introduced and can be found naturalized in Pakistan, India, the USA, Mexico, C-America, and the Bahamas (Rojas-Sandoval 2017). The species is a popular garden plant in Australia, New Zealand, and Europe. In GBH it was first introduced before 1891, as it is reported in the Index Seminum since 1891 and is recorded in the 1897, 1912, 1938, and 1996 catalogues. In the last edition of Hortus Mortolensis (Campodonico et al. 1996), the species is reported as acclimated. The species grows along marginal borders, but not limited to, those that are regularly watered, in semi-shady and sheltered positions. Some young individuals grow wild on terraces of olive orchards. The cultivar ‘Wilsonii’, reported by Campodonico et al (1996) as adventive, is currently observed only as cultivated.

***Vachellia karroo* (Hayne) Banfi & Galasso (Fabaceae)**

+ (CAS) **LIG**: Ventimiglia (Imperia), Capo Mortola, in the Area Protetta Regionale Giardini Botanici Hanbury (WGS84: 43°46'58.70"N, 7°33'23.42"E), sunny and dry places, 12 m, 21 September 2021, *F. Pastor* (HMGBH). – Casual alien species new for flora of Liguria.

Vachellia karroo is an ornamental plant native to South Africa, Angola, Botswana, Malawi, Mozambique, Namibia, Zambia, and Zimbabwe; introduced into the Mediterranean area, Portugal, NE-Argentina, Bolivia, C-Chile, India, Iraq, Mauritius, Myanmar, Paraguay, and Australia (Queensland and Western Australia), where the species is known to behave invasively. In Europe, it is cultivated as ornamental and is recorded as casual and naturalized alien in Italy (Galasso et al. 2018a), but was recently recorded as invasive in Sardegna (Galasso et al. 2021a). In the GBH it was introduced in autumn 1867, with other acacias brought from Charles Huber’s nursery-garden in Hyères (Plants sent by Hubers to the Palazzo Orenco. Dec. 1867. Manuscript, Hanbury Archives); the species was reported in the 1889, 1897, 1912, 1938, and 1996 catalogues. Seeds became available for exchanges since 1890. Campodonico et al. (1996) reported the taxa as established (“Sptnzz.”). In the compendium, *V. karroo* is widespread in sunny and semi-shady dry locations, in marginal shrubland.

Table 1. Alien species of the flora of Capo Mortola and its changes observed in the last twenty-five years.

Taxon (1)		Previous names [1996](2)		Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>nordmanniana</i>		<i>Acacia retinodes</i> Schltdl.		ADV	–	↓	CAS	–	Cauc		
<i>Acacia provincialis</i> A.Camus				NAT	NAT	≈	INV	CAS	Australia		RNS
<i>Acacia retinodes</i> Schltdl.				NAT	W	nr	W	–	Australia	(a)	
<i>Acanthus arboreus</i> Forsk.				ACCL	CAS#	↑	CAS	CAS	Arabia, Trop. Africa		
<i>Acanthus mollis</i> L. subsp. <i>mollis</i>		<i>Agave americana</i> L. var. <i>americana</i> <i>Agave americana</i> L. var. <i>marginata</i> Trel.		NATIVE	NAT	≈	NAT	NAT	Medit		
<i>Acer oblongum</i> Wall. ex DC.				ADV	CAS#	≈	–	–	China, Himalaya		(+)
<i>Aeonium arboresum</i> (L.) Webb & Berthel.				ACCL	NAT	↑	NAT	NAT	Canary Is	(b)	
<i>Agave americana</i> L. subsp. <i>americana</i>				ACCL	CAS	↑	INV	INV	Mexico		
<i>Agave americana</i> L. subsp. <i>americana</i> ‘Marginata’		<i>Agave americana</i> L. var. <i>marginata</i> Trel.		ACCL	CAS	↑	–	–	Culta		nr
<i>Agave fourcroydes</i> Lem.				ASSIST	NAT	↑	INV	NAT	C-Amer	(c)	
<i>Agave salmiana</i> Oto ex Salm-Dyck subsp. <i>ferox</i> (K.Koch)				ACCL	CAS	↑	INV	NAT	Mexico		
Hochstätter											
<i>Ageratina paezanensis</i> (Kunth) R.M.King & H.Rob.		<i>Eupatorium baugeanum</i> Regel & Körn.		ADV	DD	?	–	–	Not known		
<i>Ailanthus altissima</i> (Mill.) Swingle				NAT	INV	↑	INV	INV	China		
<i>Ajuga orientalis</i> L.				NAT	CAS#	↓	NATIVE	NAT	E-Medit		
<i>Alcea rosea</i> L.				NAT	NAT	≈	NAT	CAS	Middle East		RNS
<i>Alectryon tomentosus</i> (E.Muell.) Radlk.		<i>Aloë arborescens</i> Mill. var. <i>arborescens</i> <i>Aloë striata</i> Haw. × <i>Aloë saponaria</i> (Aiton) Haw.		ADV	CAS	≈	–	–	Australia		+
<i>Aloë arborescens</i> Mill. subsp. <i>arborescens</i>				ACCL	NAT	↑	NAT	CAS	S-Afr		RNS
<i>Aloë striata</i> Haw. subsp. <i>striata</i> × <i>Aloë microstigma</i> Salm-Dyck subsp. <i>microstigma</i>				ADV	–	↓	–	–	Culta		
<i>Aloiampelos ciliaris</i> (Haw.) Klopfer & Gideon F.Sm.				ACCL	CAS	↑	CAS	CAS	S-Afr	(d)	
<i>Apelodesmos mauritanicus</i> (Poir.) T.Durand & Schinz		<i>Aloë ciliaris</i> Haw.		ADV	DD	?	NATIVE	NATIVE	W-Medit		
<i>Anemone coronaria</i> L.				NAT	CAS?	↓	NATIVE	NAT	E-Medit		
<i>Anemone pavonina</i> Lam.				ADV	CAS	≈	NAT	NAT	S-Eur		
<i>Antirrhinum majus</i> L.				ADV	NAT	↑	NAT	NAT	SW-Eur, N-Afr		
<i>Araujia sericifera</i> Brot.		<i>Araujia sericifera</i> Brot.		ADV	CAS	≈	INV	NAT	Brazil		
<i>Aristolochia sempervirens</i> L.				NAT	NAT	≈	NATIVE	NAT	E-Medit		(+)
<i>Asarina procumbens</i> Mill.				ADV	CAS#	≈	–	–	SW-Eur		(+)
<i>Asclepias curassavica</i> L.				ADV	CAS#	≈	NAT	–	S-Amer		(+)

Taxon (1)	Previous names [1996](2)	Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Asclepias physocarpa</i> (E.Mey.) Schltr.	<i>Gomphocarpus physocarpus</i> E.Mey.	ADV	CAS	≈	NAT	–	S-Afr		R+
<i>Asparagus aethiopicus</i> L. 'Sprengeri'	<i>Asparagus densiflorus</i> (Kunth) Jessop 'Sprengeri'	ADV	CAS	≈	CAS	CAS	Culta		
<i>Asparagus asparagoides</i> (L.) Druce	<i>Asparagus asparagoides</i> (L.) Wright	ADV	CAS	≈	NAT	–	S-Afr		R+
<i>Asparagus setaceus</i> (Kunth) Jessop		ADV	CAS	≈	NAT	–	S-Afr		R+
<i>Asparagus virgatus</i> Baker		ADV	CAS#	≈	–	–	S-Afr		(+)
<i>Aubrieta columinae</i> Guss. subsp. <i>columnae</i>		ADV	CAS	≈	NATIVE	CAS	CS-Apennines		
<i>Aubrieta deltoidea</i> (L.) DC.		ADV	CAS#	≈	NAT	–	S-Medit, Canary Is		R+
<i>Azolla filiculoides</i> Lam.		ADV	DD	?	INV	–	N-Amer		
<i>Baccharis halimifolia</i> L.		ADV	ERA	↓	INV	–	CN-Amer	(c)	
<i>Bauhinia aculeata</i> L. subsp. <i>grandiflora</i> (Juss.) Wunderlin		ACCL	CAS#	↑	–	–	SW-Amer		(+)
<i>Bellevia trifoliata</i> (Ten.) Kunth		NAT	NAT	≈	NATIVE	NATIVE	CE-Medit		
<i>Berberis sargentiana</i> C.K.Schneid.		NAT	CAS?	↓	–	–	China		
<i>Beta vulgaris</i> L. subsp. <i>vulgaris</i>	<i>Beta vulgaris</i> L. subsp. <i>vulgaris</i> convar. <i>cicla</i> (L.) Alef. var. <i>flavescens</i> DC.	NAT	NAT	≈	CAS	CAS	Culta		NS
<i>Bidens lanceolata</i> (L.) Banfi, Galasso & Bartolucci	<i>Coreopsis lanceolata</i> L.	ADV	DD	?	NAT	–	N-Amer		
<i>Blainvillea acmella</i> (L.) Philipson	<i>Spilanthes acmella</i> Murray	ADV	DD	?	–	–	Trop-Subtrop		
<i>Borago officinalis</i> L.		NAT	NATIVE	nr	NATIVE	NATIVE	S-Eur		
<i>Brachychiton discolor</i> E.Muell.		ACCL	CAS#	↑	CAS	–	Australia		R(+)
<i>Buddleja davidii</i> Franch.		NAT	NAT	≈	INV	NAT	China		
<i>Bupleurum fruticosum</i> L.		NAT	C	≈	NATIVE	NATIVE	S-Eur, N-Afr		RNS
<i>Calendula officinalis</i> L.		NAT	NAT	≈	NAT	NAT	Unknown		
<i>Calendula suffruticosa</i> Vahl subsp. <i>algarbiensis</i> (Boiss.) Nyman		ADV	DD	?	–	–	Iberia		
<i>Callianthe peruviana</i> (Lam.) Dorr	<i>Abutilon arboreum</i> Sweet	ADV	CAS	≈	–	–	Peru		+
<i>Campanula poscharskyana</i> Degen		ADV	CAS	≈	NAT	CAS	S-Dalmatia		
<i>Campsis radicans</i> (L.) Bureau	<i>Campsis radicans</i> (L.) Seem.	ADV	CAS	≈	NAT	CAS	N-Amer		
<i>Canarina canariensis</i> (L.) Vadke		ADV	DD	?	–	–	Canary Is		
<i>Capparis spinosa</i> L.		ACCL	CAS?	↑	NATIVE	DD	Medit, S-Asia		
<i>Carpobrotus acinaciformis</i> (L.) L.Bolus		NAT	NAT	≈	INV	NAT	S-Afr		
<i>Celastrus angulatus</i> Maxim.		NAT	DD	?	–	–	China		
<i>Celtis australis</i> L. subsp. <i>australis</i>		ADV	CAS	≈	NATIVE	NATIVE	S-Eur, Madera		RNS
<i>Cercis siliquastrum</i> L. subsp. <i>siliquastrum</i>		NAT	NAT	≈	NATIVE	CAS	Medit		
<i>Chamaecris foetidissima</i> (L.) Medik.	<i>Iris foetidissima</i> L.	ACCL	CAS	↑	NATIVE	NATIVE	SW-Eur, Medit		

Taxon (1)	Previous names [1996](2)			Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Chamaecrops humilis</i> L. subsp. <i>humilis</i>				NAT	NAT	≈	NATIVE	NATIVE	W-Medit		
<i>Chasmanthe aethiopica</i> (L.) N.E.Br.				NAT	W	nr	INV	D	S-Afr	(a)	
<i>Chasmanthe bicolor</i> (Gasp.) N.E.Br.		<i>Chasmanthe aethiopica</i> (L.) N.E.Br.		NAT	NAT	≈	NAT	CAS	S-Afr	(f)	RNS
<i>Chasmanthium latifolium</i> (Michx.) H.O.Yates		<i>Uniola latifolia</i> Michx.		CULTA	CAS#		–	–	N-Amer		(+)
<i>Chenopodium bengalense</i> (Lam.) Spielm. ex Steud.D.Don		<i>Chenopodium giganteum</i> D.Don		NAT	DD	?	CAS	–	India, Nepal		
<i>Chlorophytum comosum</i> (Thunb.) Jacq.				ADV	CAS?	≈	NAT	–	S-Afr		
<i>Chrysanthemoides monilifera</i> (L.) Norl.				NAT	NAT	≈	NC	–	S-Afr		NS
<i>Chrysosminum fruticos</i> (L.) Banfi		<i>Jasminum fruticos</i> L.		NAT	CAS	↓	NATIVE	NATIVE	S-Eur	(g)	RNS
<i>Chrysosminum humile</i> (L.) Banfi		<i>Jasminum humile</i> L.		CULTA	NAT	↑	CAS	CAS	Himalaya		RNS
<i>Cichorium intybus</i> L. var. <i>foliosum</i> Hegi				NAT	CAS#	↓	–	–	Culta		RNS
<i>Cistus crispus</i> L.				NAT	NAT	≈	NATIVE	CAS	W-Medit		RNS
<i>Clematis armandi</i> Franch.				ACCL	CAS	↑	CAS	–	China		R+
<i>Cneorum tricoccon</i> L.				ADV	CAS?	≈	NATIVE	NATIVE	W-Medit		
<i>Cocculus laurifolius</i> DC.				NAT	NAT	≈	–	–	SE-Asia, Jap		+
<i>Colutea arborescens</i> L.				ADV	CAS	≈	NATIVE	CAS	CSW-Eur		R+
<i>Convolvulus sabatius</i> Viv. subsp. <i>mauritanicus</i> (Boiss.) Murb.				ADV	CAS	≈	NAT	–	NW-Afr		
<i>Coriandrum sativum</i> L.				ADV	–	↓	NAT	–	N-Afr, Middle East		
<i>Coronilla valentina</i> L.		<i>Coronilla valentina</i> L. subsp. <i>glauca</i> (L.) Batt.; <i>Coronilla valentina</i> L. subsp. <i>valentina</i>		NAT	NATIVE	nr	NATIVE	NATIVE	S-Medit	(h)	
<i>Cotinus coggia</i> Scop.				ADV	NATIVE	nr	NATIVE	NATIVE	CS-Eur, Asia		
<i>Cotonaster franchetii</i> Bois				ACCL	CAS	↑	INV	–	China-SE-Asia	(i)	R+
<i>Cotonaster horizontalis</i> Decne.				ADV	CAS?	≈	INV	NAT	China	(j)	
<i>Cotonaster integerrimus</i> Medik.				NAT	NAT	≈	NATIVE	NATIVE	Eur, W-Asia		
<i>Cotonaster pannosus</i> Franch.				ADV	CAS	≈	NAT	CAS	China		(+)
<i>Griinum bullispermum</i> (Burm.f.) Milne-Redh. & Schweick.				ADV	CAS#	≈	–	–	S-Afr		RNS
<i>Cupressus sempervirens</i> L.				NAT	NAT	≈	NAT	CAS	E-Medit		RNS
<i>Cyclamen persicum</i> Mill.				NAT	NAT	≈	CAS	CAS	S-Medit, Middle East	(k)	RNS
<i>Cyrtium falcatum</i> (L.f.) C.Presl				ADV	CAS#	≈	NAT	NAT	Asia, India		
<i>Gytisus filipes</i> Webb & Berthel.		<i>Cytisus filipes</i> (Webb & Berthel.) Masf.		ADV	DD	?	–	–	Canary Is		(l)
<i>Danaë racemosa</i> (L.) Moench				ACCL	DD	?	CAS	CAS	Asia Minor, Turkey, Lebanon		

Taxon (1)	Previous names [1996](2)	Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Dasyliotris serratifolium</i> (Karw. ex Schult. & Schult.f.) Zucc.		ACCL	DD	?	—	—	Mexico		
<i>Datura innoxia</i> Mill.	<i>Datura meteloides</i> DC. in Dunal	ADV	CAS	≈	INV	—	N-Amer, Mexico		R+
<i>Datura metel</i> L.		ADV	,	↓	—	—	Trop-Subtrop		
<i>Datura stramonium</i> L.		NAT	NAT	≈	INV	NAT	Not known		
<i>Dichondra micrantha</i> Urb.		ADV	CAS	≈	NAT	NAT	China, Jap		
<i>Dimorphotheca ecklonis</i> DC.	<i>Osteospermum ecklonis</i> (DC.) Norl.	ADV	CAS	≈	CAS	CAS	S-Afr		
<i>Diospyros lotus</i> L.		ADV	DD	?	NAT	—	Asia, Jap		
<i>Dolichandra unguis-cati</i> (L.) L.G.Lohmann	<i>Maefdyena unguis-cati</i> (L.) A.H.Gentry	NAT	NAT	≈	CAS	CAS	Brazil		NS
<i>Echium lusitanicum</i> L.		ADV	DD	?	—	—	Iberia		
<i>Echium candicans</i> L.f.	<i>Echium fatuosum</i> Jacq.	ACCL	CAS	↑	NAT	CAS	Canary Is		
<i>Echium wildpretii</i> H.Pearson ex Hook.f.		ADV	—	↓	—	—	Canary Is		
<i>Enchylaena tomentosa</i> R.Br.		NAT	NAT	≈	CAS	CAS	Australia		NS
<i>Epilobium albisima</i> Desf.		NAT	NAT	≈	—	—	N-Afr		+
<i>Erigeron karwinskianus</i> DC.		NAT	NAT	≈	INV	INV	S-Afr		
<i>Erigeron sumatrensis</i> Retz.	<i>Conyza albida</i> Willd. ex Spreng.	NAT	INV	↑	INV	INV	CS-Amer		
<i>Erythrum cheiri</i> (L.) Crantz		NAT	NAT	≈	NAT	NAT	Culta		
<i>Eschscholzia californica</i> Cham. subsp. <i>californica</i>	<i>Eschscholzia californica</i> Cham.	ADV	CAS	≈	CAS	CAS	N-Amer		
<i>Eucalyptus globulus</i> Labill. subsp. <i>globulus</i>		ADV	CAS	≈	NAT	CAS	Australia		
<i>Eugenia uruguayensis</i> Cambess.	<i>Eugenia guabiju</i> O.Berg	ADV	CAS#	≈	—	—	Argent		(+)
<i>Ferula communis</i> L. subsp. <i>communis</i>		NAT	C	nr	NATIVE	NATIVE	Medit		RNS
<i>Ficus carica</i> L.		NAT	NAT	≈	NATIVE	NATIVE	SE-Medit, Middle East	(m)	
<i>Fresia leichlinii</i> Klatt subsp. <i>alba</i> (G.L.Mex.) J.C.Manning & Goldblatt	<i>Fresia refracta</i> (Jacq.) Eddl. ex Klatt	ADV	CAS	≈	NAT	CAS	S-Afr	(n)	
<i>Freylinia lanceolata</i> (L.f.) G.Don		ADV	DD	?	—	—	S-Afr		
<i>Genista canariensis</i> L.	<i>Cytisus canariensis</i> (L.) Steud.	ADV	DD	?	—	—	Canary Is		
<i>Genista tinifolia</i> L.		NAT	NAT	≈	C	NAT	W-Medit		
<i>Geranium palmatum</i> Cav.		ADV	CAS#	≈	—	—	Canary Is		(+)
<i>Geranium sanguineum</i> L.	<i>Geranium sanguineum</i> L. var. <i>sanguineum</i>	NAT	NAT	≈	NATIVE	NATIVE	Eur-Cauc, Asia Minor		
<i>Glandularia tenera</i> (Spreng.) Cabrera	<i>Verbena tenera</i> Spreng. var. <i>pulchella</i> (Sweet) Sims	ADV	—	↓	CAS	—	S-Amer		

Taxon (1)	Previous names [1996](2)	Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Glebionis segetum</i> (L.) Fourr.	<i>Chrysanthemum segetum</i> L.	ADV	CAS	≈	NATIVE	NATIVE	SW-Asia		
<i>Glottiphyllum linguiforme</i> (L.) N.E.Br.		NAT	CAS#	↓	–	–	S-Afr		(+)
<i>Helianthopitum amplexicaule</i> Vahl		ADV	CAS	≈	NAT	CAS	Brazil		
<i>Helieborus lividus</i> Aiton subsp. <i>corsicus</i> (Briq.) P.Fourn.		ADV	–	↓	NATIVE	–	Corsica-Sardinia		
<i>Hesperoparis lusitanica</i> (Mill.) Bartel	<i>Yucca</i> <i>Capparis lusitanica</i> Mill.	NAT	DD	?	–	–	C-Amer		
<i>Hibiscus trionum</i> L.		ADV	–	↓	NAT	NC	S-Medit, SW-Asia		
<i>Hypericum canariense</i> L.		ADV	CAS#	≈	–	–	Canary Is		(+)
<i>Impatiens balsamina</i> L.		ADV	CAS?	≈	CAS	CAS	China, India		
<i>Ipomoea indica</i> (Burm.) Merr.		ADV	CAS	≈	INV	INV	CS-Amer		
<i>Iris germanica</i> L.		ADV	CAS	≈	NAT	NAT	Medit, Middle East		
<i>Jaborosa integrifolia</i> Lam.	<i>Koebeuteria bipinnata</i> Franch. var. <i>integrifolia</i> (Merr.) T.C.Chen	ADV	CAS#	≈	CAS	–	Argent		R(+)
<i>Jacaranda minosifolia</i> D.Don		ADV	CAS#	≈	CAS	–	Argent		R(+)
<i>Jasminum mesnyi</i> Hance		ADV	CAS#	≈	NAT	–	China		R(+)
<i>Koebeuteria bipinnata</i> Franch.		ADV	CAS	≈	–	–	China		+
<i>Laburnum anagyroides</i> Medik. subsp. <i>anagyroides</i>	<i>Laburnum anagyroides</i> Medik. <i>Lantana camara</i> L.; <i>L. camara</i> 'Hybrida' <i>Pisum sativum</i> L. subsp. <i>sativum</i> <i>Laurus nobilis</i> L. <i>Lavandula dentata</i> L. <i>Leucopium vernum</i> L. <i>Ligustrum lucidum</i> W.T.Aiton <i>Limoniastrum monopetalum</i> (L.) Boiss. <i>Linaria purpurea</i> (L.) Mill. <i>Linum narbonne</i> L. <i>Lobelia erinus</i> L. <i>Lunaria annua</i> L. <i>Lycbhis coronaria</i> (L.) Desr.	ADV	CAS?	≈	NATIVE	NATIVE	CS-Eur		
<i>Lantana camara</i> L. subsp. <i>aculeata</i> (L.) R.W.Sanders		NAT	CAS#	↓	NAT	–	Trop Amer		R(+)
<i>Lathyrus oleraceus</i> Lam. subsp. <i>oleraceus</i>		NAT	DD	?	CAS	–	S-Eur, Medit		
<i>Laurus nobilis</i> L.		NAT	NAT	≈	NATIVE	NATIVE	Medit		
<i>Lavandula dentata</i> L.		ADV	CAS	≈	CAS	–	W-Medit		R+
<i>Leucopium vernum</i> L.		NAT	NAT	≈	NATIVE	NATIVE	C-Eur		
<i>Ligustrum lucidum</i> W.T.Aiton		ACCL	NAT	↑	INV	NAT	China, Se-Asia		
<i>Limoniastrum monopetalum</i> (L.) Boiss.		ADV	CAS	≈	NATIVE	–	Medit, Iberia		R+
<i>Linaria purpurea</i> (L.) Mill.		NAT	DD	?	NATIVE	–	CS-Italy, Sicily		
<i>Linum narbonne</i> L.		NAT	DD	?	NATIVE	NATIVE	W-Medit, SW-Eur		
<i>Lobelia erinus</i> L.		ADV	CAS	≈	CAS	CAS	S-Afr		
<i>Lunaria annua</i> L.		NAT	NAT	≈	NATIVE	NATIVE	SE-Eur		
<i>Lycbhis coronaria</i> (L.) Desr.		ADV	DD	?	NATIVE	NATIVE	SE-Eur, Himalaya		

Taxon (1)	Previous names [1996](2)	Cat (3)	1996 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Lycianthes nanonmetii</i> (Carrière) Bitter	<i>Solanum nanonmetii</i> Carrière	ADV	CAS	≈	NAT	CAS	S-Amer		
<i>Macleya cordata</i> (Willd.) R.Br.		ADV	–	↓	–	–	China, Jap		
<i>Malcolmia chia</i> (L.) DC.		ADV	–	↓	–	–	E-Medit		
<i>Malcolmia maritima</i> (L.) W.T.Aiton	<i>Malcolmia maritima</i> (L.) R.Br.	ADV	–	↓	NATIVE	CAS	E-Medit		
<i>Maurandya barclayana</i> Lindl.	<i>Asarina barclayana</i> (Lindl.) Pennell	ADV	CAS#	≈	–	–	Mexico		(+)
<i>Melissa officinalis</i> L. subsp. <i>officinalis</i>		ADV	CAS#	≈	C	C	Turkey		
<i>Mezembryanthemum cordifolium</i> L.f.	<i>Aptenia cordifolia</i> (L.f.) Schwantes	NAT	–	↓	INV	CAS	S-Afr		
<i>Mimosa polycarpa</i> Kunth var. <i>spiegazzinii</i> (Pirota) Burkart	<i>Mimosa spiegazzinii</i> Pirota	ADV	–	↓	–	–	Argent		
<i>Minabilis jalapa</i> L.		ADV	CAS	≈	INV	NAT	Trop Amer		
<i>Muscari neglectum</i> Guss. ex Ten.		ADV	CAS	≈	NATIVE	NATIVE	Eur, Middle East, N-Afr		
<i>Myoporum insulare</i> R.Br.	<i>Myoporum tenuifolium</i> G.Forst.	ACCL	CAS	↑	INV	CAS	Australia		
<i>Myosotis alpestris</i> F.W.Schmidt		ADV	DD	?	NATIVE	NATIVE	Euras,		
<i>Nandina domestica</i> Thunb.		ACCL	CAS#	↑	CAS	–	N-Amer		R(+)
<i>Nephrolepis cordifolia</i> (L.) C.Presl		ADV	CAS	≈	NAT	NAT	China, Jap, India		
<i>Nicotiana glauca</i> Graham		NAT	NAT	≈	INV	CAS	Asia, Australia		
<i>Nicotiana tabacum</i> L.		NAT	CAS?	↓	CAS	–	S-Amer		RNS
<i>Nigella damascena</i> L.		NAT	NATIVE	nr	NATIVE	NATIVE	Unknown		
<i>Nothoscordum gracile</i> (Aiton) Stearn		–	CAS	↑	INV	CAS	Medit, Asia		
<i>Oenothera biennis</i> L.		ADV	–	↓	NAT	CAS	Min, Canar	(o)	
<i>Oenothera rosea</i> L'Hér. ex Aiton		NAT	NAT	≈	CAS	CAS	CS-Amer		
<i>Olea europaea</i> L.	<i>Olea europaea</i> L. subsp. <i>europaea</i>	ADV	NAT	↑	NATIVE	NATIVE	N-Amer		RNS
<i>Opuntia ficus-indica</i> (L.) Mill.		ACCL	NAT	↑	INV	NAT	Amer		
<i>Oxalis articulata</i> Savigny		NAT	NAT	≈	INV	NAT	Culta	(p)	
<i>Oxalis bouica</i> W.T.Aiton ex G.Don		ADV	NAT	≈	INV	NAT	Mexico		
<i>Oxalis corniculata</i> L.	<i>Oxalis purpurata</i> Jacq.	?NAT	NAT	≈	NAT	–	S-Amer		R+
<i>Oxalis pes-caprae</i> L.		NAT	NAT	≈	C	C	S-Afr		
<i>Oxyptatum coriuleum</i> (D.Don ex Sweet) Decne.		NAT	NAT	≈	INV	INV	SE-Asia		
<i>Pallenis maritima</i> (L.) Greuter	<i>Asteriscus maritimus</i> (L.) Less.	ADV	DD	?	–	–	S-Afr	(q)	
		NAT	NAT	≈	NATIVE	NATIVE	S-Amer		
							S-Medit,		
							Canary Is		

Taxon (1)		Previous names [1996](2)		Cat (3)	1996 (4)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Papaver commutatum</i> Fisch., C.A.Mey. & Trautv.				ADV	DD	DD	?	–	–	Cauc, Asia Minor		
<i>Papaver somniferum</i> L.		<i>Papaver somniferum</i> L. subsp. <i>somniferum</i>		ADV	DD	DD	?	NAT	CAS	Euras		
<i>Paraserianthes lophantha</i> (Willd.) I.C.Nielsen subsp. <i>lophantha</i>		<i>Albizia lophantha</i> (Willd.) Benth.		ADV	CAS	CAS	≈	NAT	NAT	Australia		
<i>Parrotia persica</i> (DC.) C.A.Mey.				ACCL	CAS	CAS	?	–	–	Iran		+
<i>Paspalum dilatatum</i> Poir.				NAT	NAT	NAT	≈	INV	NAT	S-Amer		
<i>Passiflora bryonioides</i> Kunth		<i>Passiflora bryonioides</i> Humb., Bonpl. & Kunth		ADV	–	–	↓	–	–	CN-Amer	(r)	
<i>Passiflora caerulea</i> L.				ADV	CAS	CAS	≈	NAT	CAS	S-Amer		
<i>Passiflora morifolia</i> Mast.				–	CAS#	CAS#	↑	NAT	–	Mexico	(s)	R(+)
<i>Pudownia tomentosa</i> (Thunb.) Steud.				ADV	CAS	CAS	≈	INV	CAS	China		
<i>Peltaria turkmena</i> Lipsky				ADV	DD	DD	?	–	–	E-Eur, W-Asia		
<i>Periploca graeca</i> L.				ADV	CAS	CAS	≈	C	C	E-Medit		
<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don) H.Gross				ADV	CAS	CAS	≈	NAT	CAS	Himalaya		
<i>Peusites pyrenaicus</i> (L.) G.López				ADV	CAS	CAS	≈	NAT	NAT	C-Medit		
<i>Petunia atkinsiana</i> (Sweet) D.Don ex W.H.Baxter		<i>Petasites fugans</i> (Vill.) C.Presl		NATIVE	NAT	NAT	nr	NATIVE	CAS	Culta		
<i>Phlomis fruticosa</i> L.		<i>Petunia -hybrida</i>		ADV	CAS	DD	?	NATIVE	–	GNE-Medit		
<i>Phoenix canariensis</i> H.Wildpret		<i>Phoenix canariensis</i> hort. ex Chabaud		ADV	DD	CAS	≈	NAT	CAS	Canary Is		
<i>Photinia arbutifolia</i> Lindl.		<i>Heteromelis arbutifolia</i> (Aiton) M.Roem.		ADV	CAS?	CAS?	≈	–	–	N-Amer		
<i>Physalis peruviana</i> L.				ADV	–	–	↓	NAT	CAS	CS-Amer		
<i>Phytolacca americana</i> L.				NAT	NAT	NAT	≈	INV	INV	N-Amer		
<i>Pinus canariensis</i> C.Sm. ex DC.				ADV	CAS	CAS	≈	NAT	CAS	Canary Is		
<i>Pinus pinea</i> L.				ADV	CAS	CAS	≈	NAT	NAT	Medit		
<i>Pitosporum phylliroides</i> DC.				ACCL	CAS#	CAS#	↑	–	–	Australia	(+)	
<i>Pitosporum tobira</i> (Thunb.) W.T.Aiton				NAT	NAT	NAT	≈	NAT	NAT	China, Jap		NS
<i>Pitosporum undulatum</i> Vent.		<i>Pitosporum procerum</i> Naudin		NAT	NAT	NAT	≈	CAS	CAS	Australia		+
<i>Pitosporum venulosum</i> E.Muell.				ACCL	CAS	CAS	↑	–	–	Australia		
<i>Plumbago auriculata</i> Lam.				ACCL	CAS?	CAS?	↑	NAT	CAS	S-Afr		
<i>Polanisia trachysperma</i> Torr. & A. Gray		<i>Polanisia dodecandra</i> (L.) DC.		ADV	–	–	↓	NAT	CAS	N-Amer		
<i>Polygala myrifolia</i> L.				ADV	CAS?	CAS?	≈	CAS	CAS	S-Afr		
<i>Portulaca oleracea</i> L.		<i>Portulaca oleracea</i> L. subsp. <i>oleracea</i>		NATIVE	CAS?	CAS?	nr	C	C	Medit, Macaronesia, Africa		
<i>Prunus cerasifera</i> Ehrh.				NAT	CAS?	CAS?	↓	NAT	NAT	Se-Eur, Asia Minor		

Taxon (1)	Previous names [1996](2)			Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Prunus cerasifera</i> Ehrh. 'Atropurpurea'				ADV	CAS?	≈	–	–	Culta		
<i>Pteris vittata</i> L.				ADV	CAS	≈	NATIVE	NAT	Trop-Subtrop		
<i>Ptilostemon gnaphaloides</i> (Cirillo) Sojak subsp. <i>gnaphaloides</i>				NAT	NAT	≈	NATIVE	NAT	S-Italy, NW Greece		
<i>Pyracantha coccinea</i> M. Roem.				ADV	CAS	≈	NATIVE	NAT	S-Eur, Asia Minor		
<i>Quercus coccifera</i> L.				ACCL	C	?	NATIVE	D	Medit		RNS
<i>Quercus pubescens</i> Willd. subsp. <i>pubescens</i>				ADV	NATIVE	nr	NATIVE	NATIVE	Eur-Cauc, Asia Minor		
<i>Rhaphiolepis bibas</i> (Lour.) Galasso & Banfi		<i>Eriobotrya japonica</i> (Thunb.) Lindl.		NAT	NAT	≈	NAT	NAT	Jap		
<i>Rhaphiolepis umbellata</i> (Thunb.) Makino				ACCL	CAS#	↑	CAS	–	Jap, Korea		R(+)
<i>Rhombophyllum dolabriforme</i> (L.) Schwantes				ADV	DD	?	–	–	S-Afr		
<i>Ricinus communis</i> L.				ADV	CAS	≈	INV	NAT	N-Afr, Middle East		
<i>Robinia pseudacacia</i> L.				ADV	NAT	↑	INV	INV	N-Amer		
<i>Roldana petasitis</i> (Sims) H. Rob. & Brettell		<i>Senecio petasitis</i> (Sims) DC.		ACCL	NAT	↑	NAT	NAT	Mexico		
<i>Romneya coulteri</i> Harv.				ACCL	CAS#	↑	–	–	N-Amer		(+)
<i>Rosa banksiae</i> W.T. Aiton var. <i>normalis</i> Regel		<i>Rosa banksiae</i> R.Br. in W.T. Aiton var. <i>normalis</i> Regel		NAT	NAT	≈	CAS	CAS	China		NS
<i>Rosa banksiae</i> W.T. Aiton [var. <i>normalis</i>] f. <i>lutescens</i> Voss		<i>Rosa banksiae</i> R.Br. in W.T. Aiton f. <i>lutescens</i> Voss		ADV	CAS	≈	–	–	China		
<i>Rosa brunonii</i> Lindl.				NAT	NAT	≈	–	–	Himalaya		+
<i>Rosa brunonii</i> Lindl. 'La Mortola'				NAT	NAT	≈	–	–	Culta		
<i>Salvia canariensis</i> L.				ADV	CAS	≈	NC	–	Canary Is		NS, R+
<i>Salvia coccinea</i> Buch'hoz ex Ed.				ADV	CAS#	≈	–	–	Culta		(+)
<i>Scarsia lancea</i> (L.f.) F.A. Barkley		<i>Salvia coccinea</i> Juss ex Murray 'Pseudococcinea' <i>Rhus lancea</i> L.f.		ADV	DD	?	–	–	S-Afr		
<i>Scarsia pallens</i> (Eckl. & Zeyh.) Moffett				DD	CAS	?	–	–	S-Afr		+
<i>Senecio angulatus</i> L.f.				NAT	INV	↑	INV	INV	S-Afr		
<i>Senecio deltoideus</i> Less.				NAT	INV	↑	CAS	CAS	S-Afr		NS
<i>Senecio linifolius</i> L.		<i>Senecio longifolius</i> L.		NAT	CAS	↓	W	–	S-Afr	(s)	+
<i>Senecio pterophorus</i> DC.				–	INV	↑	INV	INV	CS-Afr		(+)
<i>Setaria palmifolia</i> (J. Koenig) Stapf				ASSIST	CAS#	↑	–	–	Trop-Asia-Australia		(+)
<i>Sibbiporia europaea</i> L.		<i>Gymbadaria pilosa</i> (Jacq.) L.H. Bailey		NAT	CAS#	↓	–	–	CS-Italy, Sardinia		(+)

Taxon (1)		Previous names [1996](2)			Cat 1996 (3)		2022 (4)		Trend (5)		Italian checklist (6)		Ligurian checklist (7)		Geography (8)		Notes (9)		Novelties (10)	
<i>Silene pendula</i> L.					ADV		DD		?		NATIVE		–		Italy					
<i>Smyrniotum olusatrum</i> L.					NAT		NAT		≈		NATIVE		NATIVE		S-Eur-Medit, W-Asia, Canary Is					
<i>Solanum aviculare</i> G. Forst.					NAT		CAS		↓		CAS		CAS		Australia					
<i>Solanum dulcanara</i> L.					ADV		CAS		≈		NATIVE		NATIVE		Euras, N-Afr					
<i>Solanum lycopersicum</i> L.		<i>Lycopersicon esculentum</i> Mill.			ADV		CAS		≈		CAS		CAS		Peru					
<i>Solanum robustum</i> H. Wendl.					ADV		–		↓		–		–		Brazil					
<i>Soleirolia soleiroliae</i> (Req.) Dandy					ADV		–		↓		NATIVE		CAS		Corsica-Sardinia					
<i>Solysia heterophylla</i> Lindl.					NAT		NAT		≈		CAS		CAS		Australia				NS	
<i>Sorbus domestica</i> L.					NAT		NAT		≈		NATIVE		NATIVE		CS-Eur					
<i>Staphisagria requienii</i> (DC.) Spach subsp. <i>requienii</i>		<i>Delphinium requienii</i> DC. subsp. <i>requienii</i>			ADV		DD		?		NATIVE		CAS		France					
<i>Stenolophrum secundatum</i> (Walter) Kuntze					ADV		CAS–		≈		NAT		CAS		Trop-Subtrop					
<i>Synax officinalis</i> L.					ADV		DD		?		NATIVE		–		Greece, Asia Minor					
<i>Sulla coronaria</i> (L.) B. H. Choi & H. Ohashi		<i>Hedysarum coronarium</i> L.			NAT		NAT		≈		NATIVE		CAS		N-Afr, Iberia				RNS	
<i>Tagetes erecta</i> L.		<i>Tagetes-patula</i> L. 'Hybrida'			ADV		CAS		≈		CAS		CAS		Cult					
<i>Tanacetum parthenium</i> (L.) Sch. Bip.		<i>Chrysanthemum parthenium</i> (L.) Bernh.			ADV		CAS		≈		NATIVE		CAS		S-Eur-Cauc					
<i>Taraxacum spinosum</i> (Feuillee ex Molina) Britton & Rose		<i>Caesalpinia spinosa</i> (Molina) Kuntze			ACCL		CAS		↑		CAS		–		S-Amer				R+	
<i>Tarenaya hasleriana</i> (Chodat) Ilits		<i>Cleome hasleriana</i> Chodat; <i>Cleome houtteana</i> Schldl.			ADV		–		↓		CAS		–		Brazil, Argent					
<i>Tetrapanax papyrifer</i> (Hook.) K. Koch		<i>Tetrapanax papyrifer</i> (Hook.) J. K. Koch			NAT		–		↓		CAS		–		Taiwan					
<i>Teucrium fruticosum</i> L. subsp. <i>fruticosum</i>		<i>Teucrium fruticosum</i> L.			ADV		CAS		≈		NATIVE		NATIVE		Medit					
<i>Thalictrum minus</i> L.		<i>Thalictrum minus</i> L. subsp. <i>minus</i>			ADV		DD		?		NATIVE		NATIVE		N-Afr, Iberia					
<i>Thapsia garganica</i> L. subsp. <i>garganica</i>		<i>Thapsia garganica</i> L.			NAT		DD		?		NATIVE		–		S-Medit, Iberia					
<i>Thunbergia coccinea</i> Wall. ex D. Don		<i>Thunbergia coccinea</i> (Nees) Wall.			ADV		CAS#		≈		–		–		Burma, India				(+)	
<i>Toxicodendron pubescens</i> Mill.		<i>Toxicodendron quercifolium</i> (Michx.) Greene			ADV		–		↓		CAS		–		N-Amer					
<i>Trachidium caeruleum</i> L. subsp. <i>caeruleum</i>					NAT		NAT		≈		INV		NAT		W-Medit, Iberia					
<i>Trachelospermum jasminoides</i> (Lindl.) Lem.					ACCL		CAS#		↑		CAS		–		Japan, Korea, China				R(+)	
<i>Trachelospermum jasminoides</i> (Lindl.) Lem. 'Wilsonii'					ADV		–		↓		CAS		–		Cult				(t)	

Taxon (1)	Previous names [1996](2)	Cat 1996 (3)	2022 (4)	Trend (5)	Italian checklist (6)	Ligurian checklist (7)	Geography (8)	Notes (9)	Novelties (10)
<i>Tradescantia fluminensis</i> Vell.	<i>Tradescantia fluminensis</i> Vell. em. G.Brückn.	NAT	NAT	≈	INV	INV	S-Amer		
<i>Triticum aestivum</i> L.		ADV	CAS	≈	CAS	–	Unknown		R+
<i>Tropaeolum majus</i> L.		NAT	NAT	≈	INV	CAS	S-Amer		RNS
<i>Tulipa clusiana</i> Redouté	<i>Tulipa clusiana</i> DC. var. <i>clusiana</i>	NAT	CAS	↓	NAT	CAS	W-Asia		
<i>Tulipa raddii</i> Reboul	<i>Tulipa praecox</i> Ten.	NAT	CAS#	↓	NAT	CAS	Unknown		
<i>Urtica urens</i> L.		ADV	DD	?	NATIVE	NATIVE	Unknown		
<i>Vaccellia karroo</i> (Hayne) Banfi & Galasso	<i>Acacia karroo</i> Hayne	ADV	CAS	≈	INV	–	CS-Afr	(u)	R+
<i>Verbena bonariensis</i> L.		ADV	CAS	≈	NAT	NAT	S-Amer		
<i>Veronica austriaca</i> L. subsp. <i>dentata</i> (F.W.Schmidt) Wazl		ADV	DD	?	–	–	Eur		
<i>Viola arvensis</i> Murray subsp. <i>arvensis</i>		ADV	DD	?	NATIVE	NATIVE	Eur		
<i>Vitis labrusca</i> L.		ADV	CAS#	≈	NAT	CAS	N-Amer		
<i>Vitis vinifera</i> L.	<i>Vitis vinifera</i> L. subsp. <i>vinifera</i>	ADV	CAS#	↓	NATIVE	NATIVE	Unknown		
<i>Washingtonia filifera</i> (Linden ex André) H. Wendl. ex de Bary	<i>Washingtonia filifera</i> (Linden ex André) H. Wendl.	ADV	CAS#	↓	NAT	CAS	N-Amer, Mexico		
<i>Wigandia caracasana</i> Kunth	<i>Wigandia urens</i> (Ruiz & Pav.) Choisy var. <i>caracasana</i> (Humb., Bonpl. et Kunth) Gibson	NAT	NAT	≈	NAT	NAT	C-Amer		
<i>Wigandia kunthii</i> Choisy	<i>Wigandia urens</i> (Ruiz & Pav.) Choisy var. <i>urens</i>	NAT	NAT	≈	NAT	NAT	Peru		
<i>Xiphion xiphium</i> (L.) M.B. Crespo, Marr.Azorín & Mavrodiev	<i>Iris xiphium</i> L.	ADV	CAS#	≈	NATIVE	CAS	SW-Eur, N-Afr		
<i>Zanthoxylum americanum</i> Mill.		ADV	–	↓	–	–	N-Amer		

(1) The nomenclature follows Portal to the Flora of Italy (2022). (2) The names used in the 1996 catalogue (Campodonico et al. 1996) if different from those reported in column 1. (3) Status according Campodonico et al. (1996). (4) New status according our assessment. (5) Trend of the status from 1996 to 2022. (6) Status in Italy according to Galasso et al. (2018a) and related updates. (7) Status in Liguria according Galasso et al. (2018a) and related updates. (8) Area of origin. (9) Additional information. (10) News with respect to the national and regional floras.

ACCL: Acclimated; ADV: Adventive; ASSIST: Assisted; C: Cryptogenic species; CAS: Occurring as a casual alien outside human-dominated systems; CAS#: Occurring as a casual alien in human-dominated systems, but without direct intervention by humans and not close to parent plant; CAS#: Occurring with an undefined invasion status, likely as casual alien; CULTA: Cultivated; D: Doubtfully occurring; DD: Data deficient; ERA: Locally eradicated; INV: Occurring as an invasive alien; NAT: Occurring as a naturalized alien outside human-dominated systems; NC: No longer recorded; W: wrong record; =: No significant changes; ↓: Trend towards population reduction; ↑: Trend towards population growth; nr: trend not relevant.

Notes. The column 9 includes references to records on Wikiplantbase#Liguria (Barberis et al. 2021) and other informations: (a) Probably absent; reported by mistake in the past; (b) 3 Apr 2008 Longo D. (Barberis et al. 2021); (c) 9 Aug 2015 Blandoni (2016); (d) 15 Aug 2015 Blandoni (2016); (e) March 2016 Blandoni (2016); eradicated; (f) Recorded in the past by mistake as *C. aethiopica* (g) 17 Aug 2015 Blandoni (2016); (h) The subsp. or var. *glauca* is clearly different compared to the subsp. *valentina*; (i) 17 Aug 2015 Blandoni (2016); (j) A. Gentile 1987 (Barberis et al. 2021); (k) in Liguria according to Di Turi and Aristarchi in Galasso et al. 2019b; (l) A. Gentile in Longo D. (Barberis et al. 2021); (m) Archaeophyte; (n) apr 2008 Longo D. (Barberis et al. 2021); (o) 14 Aug 2015 Blandoni (2016); (p) Aug 2008 Longo D. (Barberis et al. 2021); (q) recorded in the past by mistake; (r) in Sardegna (G. Bacchetta in Galasso et al. 2020a); (s) absent according Galasso et al. (2018a) because confused with *S. inaequidens* DC.; (t) the information for Italy is to be referred to the species in a general sense; (u) for Italy (Sardagna) according to Galasso et al. (2021a).

Novelties (column 10): +: new for the Italian alien flora; R+: new for the Ligurian alien flora; (+): probably, but not yet with certainty, new to the Italian alien flora; RNS: new status proposed for the Ligurian alien flora; R(+): probably but not yet with certainty, new to the Ligurian alien flora; NS: new status proposed for the Italian alien flora.

Discussion and conclusions

The 1996 catalogue of the compendium listed 2,672 taxa; in the last thirty years this number varied between 2,500 and 3,000. The investigations carried out on 270 taxa recorded at the Area Protetta dei Giardini Botanici Hanbury (Capo Mortola, Ventimiglia, Italy) allowed us to record the current presence of 198 taxa of exotic origin, excluding cultivated or assisted taxa: 15 invasive, 65 naturalized, 76 casual, 37 occurring as casual in human-dominated systems, but without direct intervention by humans and not close to parent plant, 15 occurring as casual alien, but still with some uncertainties for a definitive classification. In addition to these, 3 species have been classified as cryptogenic and 1 as eradicated (extinct). In 1996, 229 species were reported: 87 naturalized and 142 adventitious (casual). 40 taxa show an increasing trend and 41 a decreasing or disappearing trend; 22 taxa reported as adventitious and 2 as naturalized in 1996 are no longer present or are present only with cultivated plants. On the other hand, numerous species, which in 1996 were classified as acclimated, have now become casual or naturalized. Regressive phenomena are also observed, which may depend, at least in part, on differences in the method of assessing status. The origin of the current alien flora of Capo Mortola is shown in Table 2: American taxa prevail with 21.8%; the Mediterranean and Mediterranean-Atlantic (including Macaronesian) ones are slightly less (20.7%). These are followed by Asian (15.7%), African (15.4% – mainly from South Africa), Eurasian (7.6%), and Australian/Australasian (6.6%) taxa.

Although an exact comparison with the national list (Galasso et al, 2018a) is not possible, because it does not consider taxa growing in botanic gardens, our study highlights 28 taxa that would be new to the Italian flora (25 casual and 3 naturalized) and 24 to the Ligurian flora (all casual) if we consider also the wild or neglected areas inside the botanical gardens. Many of these taxa will probably also be observed outside botanic gardens in the coming years. If we consider only the wild areas of Capo Mortola, 10 taxa are new to the Italian flora (7 casual and 3 naturalized) while 14 are new to the Ligurian flora only (all casual). In addition, 9 status changes are proposed on a national scale and 17 on a regional scale. Our study is the first in Italy to deal with the dynamics of invasion processes originating from botanic gardens. Over the past 25 years, 41 taxa that

Table 2. Origin of alien plants currently present in the study area (excluding cultivated or assisted taxa), listed in Table 1.

America	21.2%
Medit / Medit-Atl / Macaronesia	20.7%
Asia	15.7%
S-Africa / Africa / N-Africa	15.2%
Eur / Eur-Cauc / Euras /	7.6%
Australia / Australasia	6.6%
Culta	5.6%
Trop / subtrop	3.5%
Italy (other regions)	1.0%
Unknown	3.0%

Table 3. History of the introduction and the presence of a subset of taxa. **Sources.** Other sources: archival documents (currently kept for the most part at the Istituto Internazionale di Studi Liguri in Bordighera, Fondo Hanbury (henceforth IISL-FH), and, in part, at the Hanbury Botanic Gardens in Ventimiglia) and publications other than the following sources; S&P: Sowing & planting (handwritten records kept in IISL-FH); IS: Index seminum (Hanbury et al 1888; various authors 1890–1939); Cat1: Cronemayer (1889); Cat2: Dinter (1897); Cat3: Berger (1912); Cat4: Ercoli and Lorenzi (1938); Cat5: Campodonico et al (1996); 2022: this study.

Taxon	Other sources	S&P 1884–1907	IS 1888 1890–1939	Cat1 1889	Cat2 1897	Cat3 1912	Cat4 1938	Cat5 1996	2022
<i>Acacia provincialis</i> (*)	0	0	x	x	x	x	x	nat	nat
<i>Acer oblongum</i>	0	0	x	x	x	x	x	adv	cas#
<i>Alecryon tomentosus</i>	0	1897	0	0	0	x	x	adv	cas
<i>Asparagus virgatus</i>	0	1901	0	0	0	x	x	adv	cas
<i>Brachychiton discolor</i>	0	1893	0	0	0	x	x	accl	cas#
<i>Bupleurum fruticosum</i>	0	0	1888	x	x	x	x	nat	c
<i>Chasmanthe bicolor</i> (**)	1870	0	0	x	x	x	x	0	nat
<i>Chasmanthium latifolium</i>	1994	0	0	0	0	0	0	culta	cas#
<i>Chrysanthemoides monilifera</i>	1869	0	1888	x	x	x	x	nat	nat
<i>Chrysojasminum humile</i>	0	0	x	x	x	x	x	culta	nat
<i>Clematis armandii</i>	0	0	1917	0	0	0	x	accl	cas
<i>Enchylaena tomentosa</i>	0	1903	0	0	0	x	x	nat	nat
<i>Ephedra altissima</i>	1870	0	1890	x	x	x	x	nat	nat
<i>Ferula communis</i> subsp. <i>communis</i>	1868	0	1888	x	x	x	x	nat	c
<i>Jaborosa integrifolia</i>	1872	0	0	0	0	0	x	adv	cas#
<i>Jasminum mesnyi</i>	0	1903	0	0	0	x	x	adv	cas#
<i>Kolreuteria bipinnata</i>	1893	0	0	0	0	x	x	adv	cas
<i>Lavandula dentata</i>	0	0	1909	x	x	x	x	adv	cas
<i>Nandina domestica</i>	0	0	0	x	x	x	x	accl	cas#
<i>Parrotia persica</i>	0	0	0	x	x	x	x	accl	cas
<i>Passiflora morifolia</i>	1999	0	0	0	0	0	0	0	cas#
<i>Pittosporum venulosum</i>	0	1903	1912	0	0	x	x	accl	cas
<i>Quercus coccifera</i>	0	0	1896	x	x	x	x	accl	c
<i>Roldana petasitis</i>	0	0	0	0	x	x	x	accl	nat
<i>Romneya coulteri</i>	0	1899, 1901	0	0	x	x	x	accl	cas#
<i>Rosa banksiae</i> var. <i>normalis</i> f. <i>lutescens</i>	1870	0	0	x	0	x	x	adv	cas
<i>Rosa banksiae</i> var. <i>normalis</i> f. <i>normalis</i>	1912	0	1913	0	0	x	x	adv	nat
<i>Rosa brunonii</i>	0	0	1922	0	0	0	x	adv	nat
<i>Rosa brunonii</i> 'La Mortola'	0	0	0	0	0	0	x	nat	nat
<i>Searsia pallens</i>	0	0	1909	x	x	x	x	nat	cas
<i>Senecio linifolius</i>	1972	0	1888	x	x	x	x	nat	cas
<i>Setaria palmifolia</i>	0	0	0	x	x	x	x	assist	cas#
<i>Trachelospermum jasminoides</i>	0	0	1891	0	x	x	x	accl	cas#
<i>Vachellia karroo</i>	1867	0	1890	x	x	x	x	adv	cas

(*) before now mistakenly recorded as *A. retinodes*; (**) mistakenly recorded as *C. aethiopica*.

form this alien flora showed an increasing trend, while 41 taxa declined in the wild; 139 taxa showed no significant changes in their status. For 37 taxa, data are deficient, and an assessment of their status is now impossible. One species, *Baccharis halimifolia* L., was recently eradicated and appears to be extinct in nature. The local history of the presence of a sample group of 34 taxa (32 species), of which 11 are new to Italy or have a new sta-

tus, was analyzed (Table 3): 7 of these taxa were certainly introduced in the first 10 years from the foundation of the gardens in 1867, 17 in the following years of the 19th century, 8 in the first thirty years of the 20th century and 2 in the last decade of the same century. Excluding the cryptogenic species, only 10 of the remaining taxa are also reported in the exotic flora of the neighboring French PACA region. These data are preliminary, and it would be useful to extend the historical analysis and the comparison with the situation of the nearby Côte d’Azur to the complete set of species reported in Table 1.

We also tried to clarify the status of species recorded as native in Liguria in recent times, but whose native character was already questioned by botanists of the past. Our study represents a starting point for an analysis extended to all taxa over a wider area, in a territory that is very sensitive to the impact of invasions of exotic species on natural biodiversity, and for a comparison with neighboring France. The data obtained, although preliminary, do not show a worsening of the invasion process. Indeed, a specific evaluation protocol aimed at preventing the potential risk of escape of exotic species from the Giardini Botanici Hanbury and invasion of the surrounding areas was adopted in the last decade.

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An analysis of botanical studies of vascular plants from Italian wetlands

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Abstract

Wetlands are essential for life on Earth, but at the same time the most threatened environments due to the gradual alterations associated with climate change and human action. The botanical studies on wetland higher plants carried out in Italy from 1950 until today are analysed in this survey. The 1,265 contributions resulting from this study are analysed from a historical, geographical, and content point of view. Most of the scientific contributions were published in the 1980s and 1990s, often by the same research groups and on a local scale. The predominant research theme is the inventory. Most papers are mainly focused on lakes and rivers. The results of this literature survey point to the need to continue and intensify these studies, especially in southern Italy and in temporary wetlands. It is essential to make the huge amount of data resting in drawers or included in scientific reports but not published in scientific journals readily accessible. This could also be achieved through online geographical databases.

Keywords

Conservation, flora, freshwater ecosystems, Literature review, Trends in botany, vegetation

Introduction

Wetlands are one of the most important natural habitats providing many significant benefits to the environment and humans (Mahdavi et al. 2018). The Ramsar International Convention was adopted as early as 1971 for their protection. This Convention defined wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters” (Gardner and Finlayson 2018). Wetlands cover about 6% of the Earth’s surface and include mangroves, peatlands and marshes, rivers and lakes, deltas, floodplains and flooded forests and even coral reefs. A wetland is a generalized concept including internal and coastal areas. It is distributed in every climatic region, ranging from the polar zones to the arid ones (Gokce 2019).

Purification of water, reduction of flood risk, protection of shorelines, conservation of soil and water, filtration of sediment, removal of pollution, as well as aesthetic and recreational values are only some of the benefits associated with wetlands (Grenier et al. 2007; Powers et al. 2012; Ji et al. 2015). Wetlands are also the main habitat for hundreds of plants and animals, including one-third of all species at risk (Ozesmi and Bauer 2002; Reimer 2009; Kingsford et al. 2016). Due to their vital biological and ecological functions, wetlands have been called the “kidneys” of nature (Mitsch and Gosselink 2000) and are important indicators of environmental health (Touzi et al. 2007). Early civilizations were established near rivers, lakes and floodplains (Keddy 2010; Gokce 2019). The Mesopotamian civilization is consensually accepted to have started between the Euphrates and Tigris rivers; the other ancestral civilization, Egypt, commenced in the Nile Valley. The fact that civilization started in these regions is a reflection of how important the aquatic habitat is for biotic diversity. Therefore, wetlands are very critical ecosystems and some of them are the most productive habitats (Gokce 2019).

Despite the number of ecosystem services provided by wetlands, they were widely regarded as undesirable in the past and were frequently drained to be replaced with other types of land use, such as urban space and agriculture (Mitsch and Gosselink 2000; Dechka et al. 2002; Fraser and Keddy 2005; Ji et al. 2015). The reasons for wetland loss and deterioration include excessive use, land degradation, climate change, drought, salinization, eutrophication, pollution, decreased biotic diversity, and invasive exotic species (Mahdavi et al. 2018; Gokce 2019; Praleskouskaya and Venanzoni 2021). In recent years, attention has been focused on temporary small ponds as important biodiversity sources (Bagella et al. 2009).

Since wetlands are complex multifunctional systems, they are likely to be the most beneficial if conserved as integrated ecosystems rather than as individual component parts (Gokce 2019). From all this emerges the need to know the distribution of these important environments and to monitor their state of health in order to adopt appropriate management and conservation strategies. Wetlands can also be monitored through the study of the plant component. Wetland vegetation, indeed, plays a basic role in aquatic ecosystem ecology (Lastrucci et al. 2018). In particular, wetlands

represent an important factor in providing food and shelter for the aquatic fauna (Carpenter and Lodge 1986). Wetland plants also influence hydrological and sediment processes by regulating water flow, crest stability, and soil formation (Saaltink et al. 2018). Wetland plants are endangered by the same forces that generally threaten these ecosystems, including human activities such as wetland draining or filling, hydrologic alterations, chronic degradation due to nonpoint source pollution, and invasion of exotic species (Cronk and Fennessy 2016; Bolpagni et al. 2018; Cuenca-Lombrana et al. 2021). Agriculture, housing, industry and tourism are the main drivers responsible for hydrological alterations (Msofe et al. 2019).

Italy is recognized as one of the prominent hotspots for plant diversity at regional and global scales, hosting a rich and diverse range of ecosystems and habitat types (Pedrotti 1971). This is precisely the case of aquatic habitats, which represent a major portion of the total water surfaces in the Mediterranean region (Bolpagni et al. 2018). All national and local floras also include wetlands, but in this survey, we wanted to analyse the scientific contributions specifically dedicated to wet environments.

The state of knowledge on the plant biodiversity of wetlands in Italy is fragmentary. Pignatti's (1952–1953) work represents a milestone among the phytosociological monographs of wet areas in Italy. Montanari (1988a, 1988b) published a review of the botanical knowledge of Italian rivers. Corbetta and Pirone (1988) and Pirone and Frattaroli (1988) issued a compendium on the vegetation of rivers and freshwater wetlands of Abruzzo. The flora and vegetation of the watercourses of Sicilia, Calabria, and Basilicata were analysed by Ferro and Di Benedetto (1980), Brullo and Spampinato (1990, 1997), and Ferro and Parisi (2002). Sburlino et al. (2004, 2008) dealt with the aquatic and marshy vegetation of north-eastern Italy. Tomei and Kugler (2005) published a synthesis of the botanical knowledge of the wetlands of Toscana. Venanzoni et al. (2018) reviewed the marshy and wet vegetation described or present in Italy. Ciaschetti et al. (2021) summarized current knowledge on the sedge vegetation of the 'Major Highlands' of Abruzzo. Recently, Cuenca-Lombrana et al. (2021) published a compendium of research results for the Sardinian wetlands. Hence, the need for a review that would encompass the entire national territory. The 1,152 contributions presented and analysed here seem highly indicative of current knowledge about Italian wetland habitats. A survey going further back in time with respect to the contributions reported in this review would certainly have increased the total number of scientific papers, but would not change, in any meaningful way, the general significance of the research results.

Materials and methods

Research area and taxa

The Italian territory consists of a continental part that includes the Alpine arc, the Po-Venetian plain, Liguria, and the upper portion of the Apennines. The large part of Italy is a peninsula, *ca.* 1,000 km long and 170 km wide, with northwest-southeast ori-

entation at the centre of the Mediterranean Basin and 7,458 km of coastline; there are also two large islands, Sardegna and Sicilia, and more than 800 islets. The territory is predominantly hilly (41.6%), partly mountainous (35.2%), and slightly flat (23.2%).

It is the richest country in wetlands amongst those of the Mediterranean Basin. It counts 69 natural lakes equal to or larger than 0.5 km², 183 artificial basins larger than 1 km², and more than 230 rivers and streams of particular relevance: 58 exceeding 100 km in length, and 75 with average daily discharges greater than 10 m³ s⁻¹ (Bolpagni et al. 2018). On the whole, 57 sites were designated as Wetlands of International Importance (Ramsar Sites) (<http://www.ramsar.org/>). Italy is the second highest area, after the Iberian Peninsula, in terms of plant species richness in Europe (Bilz et al. 2011). The entire checklist of plants includes 9,948 specific and subspecific taxa, 8,288 native species and 1,660 alien species (Bartolucci et al. 2018; Galasso et al. 2018, and subsequent updates merged into the Portal to the Flora of Italy, <http://dryades.units.it/floritaly/index.php>). The first comprehensive inventory of aquatic plants on a nationwide scale resulted in 279 specific and subspecific taxa estimated at 88.5% of the total European and Mediterranean aquatic taxa (Bolpagni et al. 2018). The two main islands also have an important biological heritage linked to aquatic habitats. As many as 13,981 wetlands have been inventoried in Sardegna and Sicilia (<https://italiaiswet.it>), covering in these administrative regions a total surface of about 645.96 km² (ca. 1.3% of their territory).

Literature data

The reference list published by the Italian Botanical Society (Scoppola and Magrini 2005) was used as starting point for this review. This was supplemented with Albano et al. (2007) and the databases available online. The historical period investigated extends from 1950 to May 2022. Older literature would have brought an excessive amount of “noise” due to environmental variations that occurred over time mainly due to the change in land use and remediation to contrast malaria.

The online research was carried out, both with Italian and English terms, in Web of Science (<https://www.webofscience.com/wos/woscc/basic-search>), Scopus (<https://www.scopus.com/search/form.uri>), as well as in Google Scholar (<https://scholar.google.com>) with the terms, singular or plural: ‘amphibian’, ‘barrage’, ‘dam’, ‘delta’, ‘estuary’, ‘freshwater’, ‘lagoon’, ‘lake’, ‘marsh’, ‘pond’, ‘pool’, ‘reservoir’, ‘river’, ‘saline’, ‘swamp’, ‘torrent’, ‘water’, ‘wetland’, or combined with ‘Italy’, ‘Sardegna’, ‘Sicilia’ and ‘botanical’, ‘flora’, ‘phyto’, ‘plant’, and ‘vegetation’. Further additions were made using the indexes of the journals reported in Scoppola and Magrini (2005), which were only partially included in the online databases. ‘Gray literature’, such as technical reports, and academic theses, was not considered. After duplicate removal, title screening and abstract revision, the single papers were classified by wetland type and topic. Research was focused on higher plants and current vegetation. Algae, bryophytes, fungi, and palynological studies were not included. Only research specifically aimed at studying wetlands was included. Contributions on large areas that also include wetlands, as well as national and regional floras, were also not included.

The wetland study sites of each paper that could be identified were georeferenced in Google Earth (<https://earth.google.com>) and overlaid on the network of protected areas on QGIS 3.26 (<https://www.qgis.org>). Spatial datasets were downloaded from the national geoportal (<http://www.pcn.minambiente.it/mattm/>) and included all protected areas (Natura 2000, Ramsar sites, National and Regional Parks and Nature Reserves). The list is available as Suppl. material 1.

Types of wetlands and research themes

According to the European habitat types (Habitat Directive 92/43/EEC, and the online Italian interpretation manual available at <http://nvr.unipg.it/habitat/>), wetland types described in the analysed papers were identified as: 'River' for streaming waters corresponding to the habitats 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 91E0, 91F0; 'Estuarine waters' for mixed fresh and marine waters in estuaries or deltas (habitat 1130); 'Lakes and ponds' for standing perennial waters (habitats 3110, 3120, 3130, 3140, 3150, 3160); 'Saline' for inland or coastal saline waters (habitats 1150, 1310, 1320, 1340, 1410, 1420, 1430, 1510); 'Bogs' for waterlogged grounds (habitats 7110, 7120, 7140, 7150, 7210, 7220, 7230, 7240), 'Rice fields' for waterlogged ground cultivations and 'Temporary' for standing temporary waters, temporary pools, or temporary ponds (habitat 3170). Habitat distribution data was retrieved from the EU Reporting Nature Directive 2013–2018 by ISPRA (Angelini et al. 2016; <http://reportingdirettivahabitat.isprambiente.it/downloads>) in terms of 10 × 10 km cells. An estimate in relative terms of how rich the individual regions of freshwater habitats are and how much these have been studied was obtained by dividing the number of cells containing freshwater habitats by the total number of cells present and dividing the number of cells with freshwater habitats by the number of cells that contain at least one locality that appears in literature.

Dunes and rocky coasts were not considered in this review, while humid areas behind them were included in the previous categories according to their nature. The distinction between natural environments and human-made ones used in the Ramsar classification (Ramsar Convention Secretariat 2010, 2013) seemed to us of little use for the purposes of biological investigation in Italy because all the wetlands considered have undergone heavy modifications by humans; only rice fields have been pointed out.

We classified all contributions according to their focus into four research themes: conservation, ecology, inventory, and taxonomy; multiple classifications were also adopted when there were more several predominant topics (see details in Table 1).

Results

We found 1,265 scientific contributions dealing with higher plants in Italian wetlands, published between 1950 and 2022. The largest number of contributions, 554, was published in the 20 years between 1980 and 1999, 276 of which in the 1980s and 278 in the 1990s (Fig. 1).

Table I. Data on the presence of freshwater habitats by administrative region and related published studies. The 10 × 10 km grid cell and the occurrence of freshwater habitats is according to Angelini et al (2016).

Region	No. of cells	No. of cells with freshwater habitats	No. of cells with published studies	% of cells with freshwater habitats	% of cells with freshwater habitats having published studies
Abruzzo	141	108	22	76.60	20.37
Basilicata	128	55	8	42.97	14.55
Calabria	193	124	18	64.25	14.52
Campania	169	96	4	56.80	4.17
Emilia-Romagna	275	226	53	82.18	23.45
Friuli Venezia Giulia	107	103	19	96.26	18.45
Lazio	221	133	32	60.18	24.06
Liguria	87	81	10	93.10	12.35
Lombardia	300	280	65	93.33	23.21
Marche	122	82	11	67.21	13.41
Molise	62	52	3	83.87	5.77
Piemonte	310	297	34	95.81	11.45
Puglia	245	132	24	53.88	18.18
Sardegna	305	193	37	63.28	19.17
Sicilia	333	295	60	88.59	20.34
Trentino-Alto Adige	171	161	43	94.15	26.71
Toscana	291	246	63	84.54	25.61
Umbria	108	68	20	62.96	29.41
Valle d'Aosta	48	48	7	100.00	14.58
Veneto	232	208	46	89.66	22.12

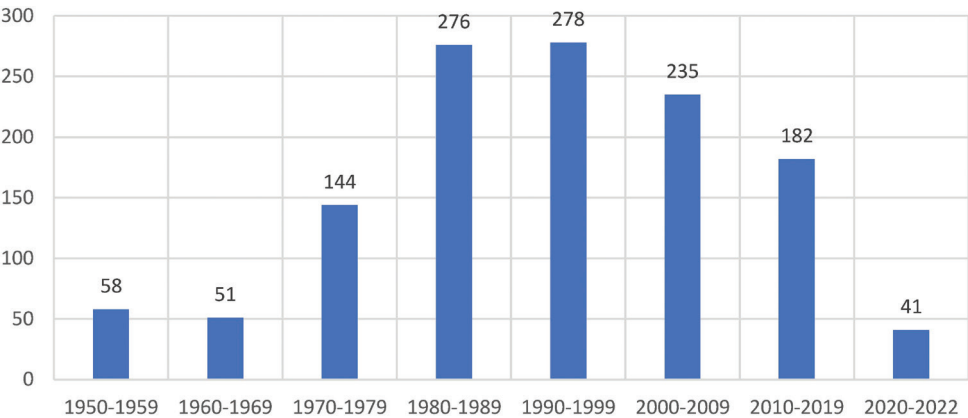


Figure I. Number of scientific contributions published per decade from 1950 to today.

Research has always been carried out on a local or regional basis. Many contributions have been published by the same research groups that have focused on one area and on neighbouring geographic areas.

The predominant research theme in all the years considered are floristic and vegetational inventories (932 papers). Studies on ecology, and conservation follow, with 241 and 123 contributions, respectively (Fig. 2). It is interesting to note how the trend of

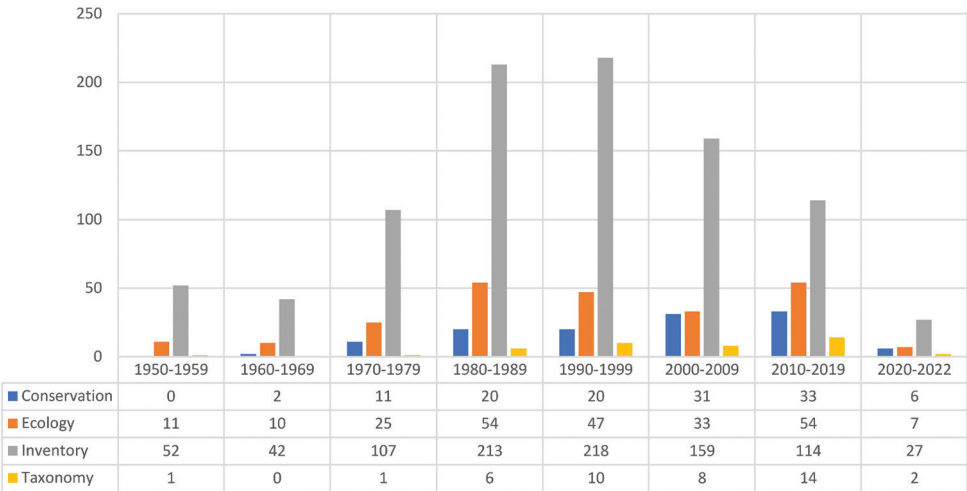


Figure 2. Number of scientific contributions classified per topic per decade from 1950 to today. The totals are higher than the contributions published because the same paper could be classified in more than one topic.

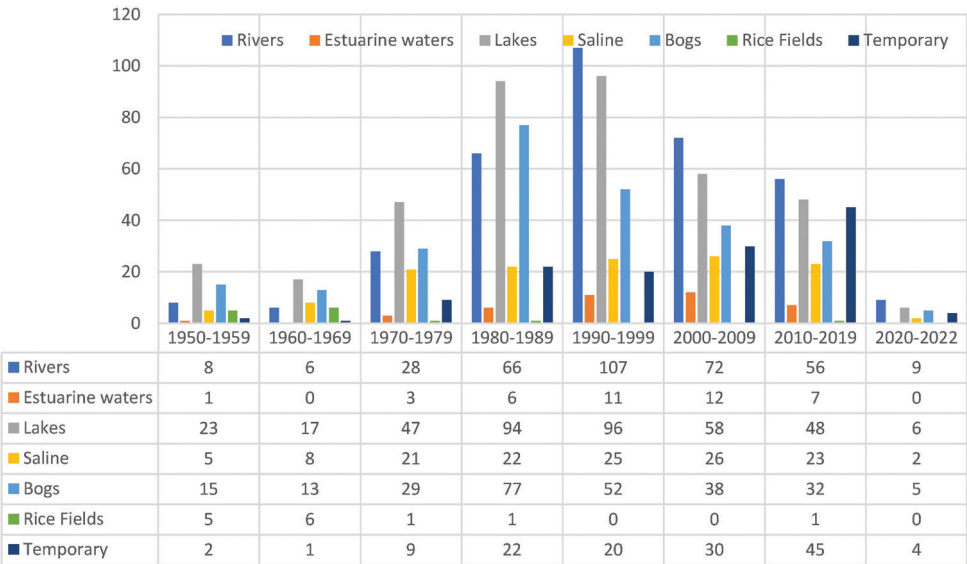


Figure 3. Number of scientific contributions per wetland type. For the definition of wetland types see Materials and methods.

conservation studies has increased significantly from 1980 onwards in parallel with the general awareness of the role of nature conservation. Studies on the topic of taxonomy are always the fewest and only reach 42 papers (Fig. 2).

As regards wetland types, the largest number of papers are mainly focused on lakes and ponds (389) and rivers (352); bogs, temporary wetlands, and saline habitats account for 261, 133 and 132, respectively (Fig. 3). Papers on estuarine waters (40) and

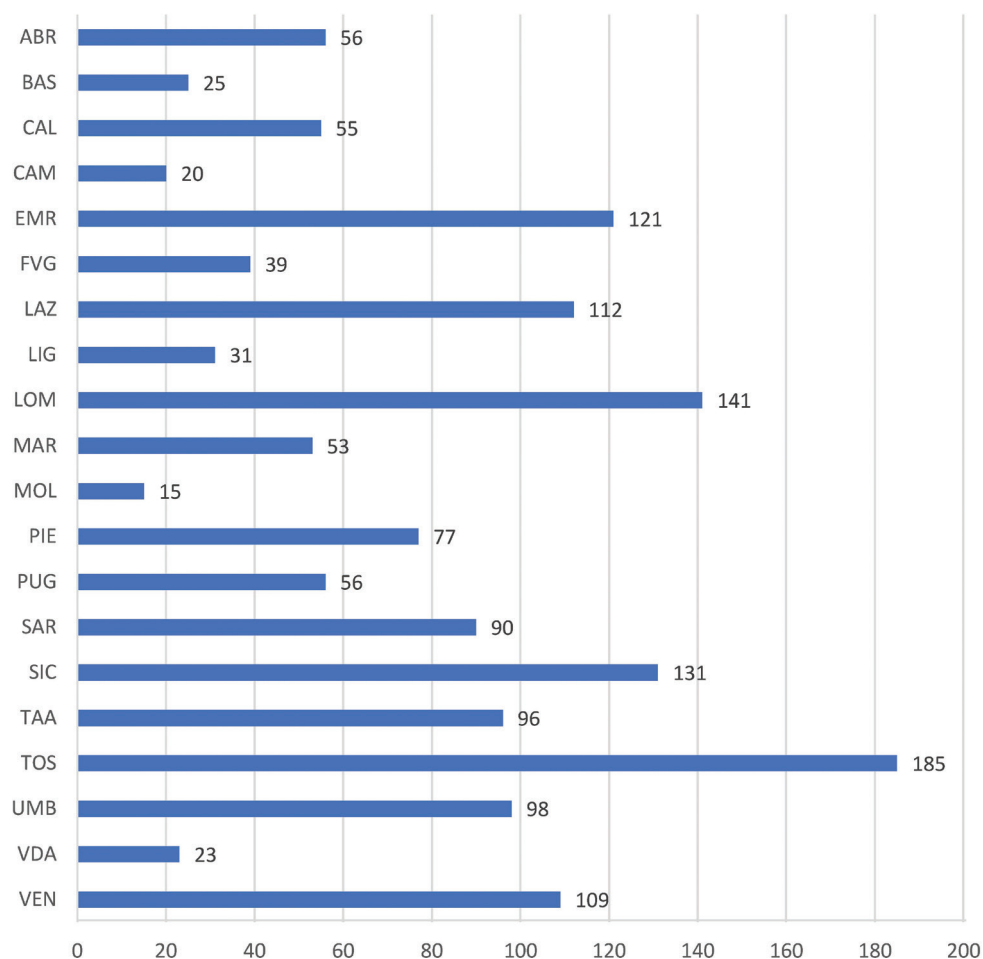


Figure 4. Number of scientific contributions per administrative region of Italy.

rice fields (14) are less represented (Fig. 3). Although papers on rivers, together with those on lakes, are the most frequent over the entire period, those on rivers were overcome by those on bogs in the 1950s, 1960s and 1970s. From the '90s to the present day, papers on rivers become the main ones, surpassing even those on lakes (Fig. 3).

As regards the distribution of studies in the different Italian administrative regions, the greatest number concerns Toscana (185), followed by Lombardia (141) and Sicilia (131) (Fig. 4). Emilia Romagna (121), Lazio (112), and Veneto (109) also exceed 100 papers. Molise (15), Campania (20), Valle D'Aosta (23), and Basilicata (25) are the regions for which the lowest number of papers have been published (Fig. 4).

As shown in Fig. 5, 998 contributions could be mapped to specific areas; the remaining 267 papers refer to areas that are too large, or generic. The contributions were attributed to 593 geographical areas. These areas are well distributed in northern

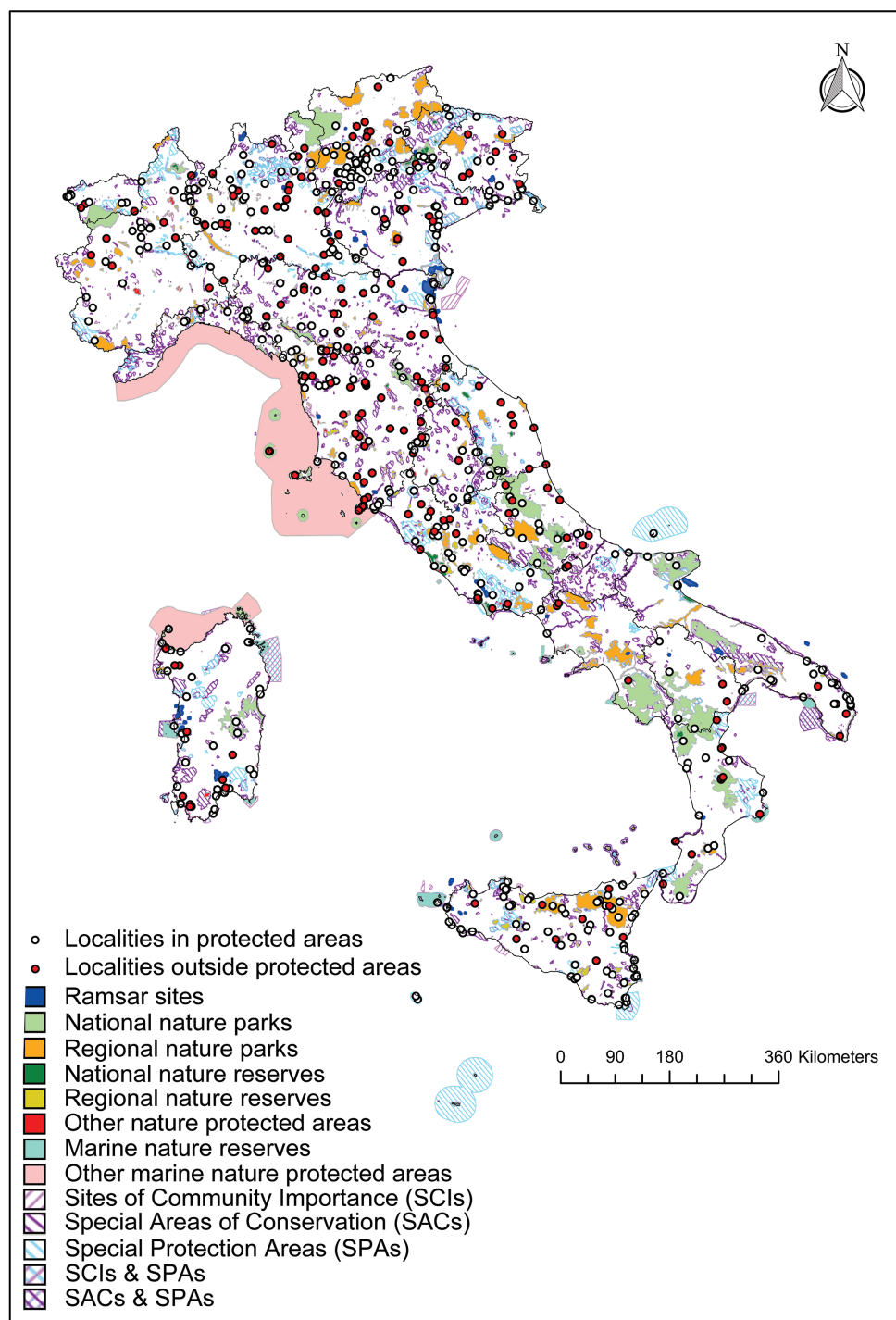


Figure 5. Distribution of scientific contributions for the Italian territory in relation to protected areas.

and central Italy and in Sicilia; the southern part of Piemonte, Campania, Basilicata and the northern part of Puglia record few studies. The most studied area is Lake Trasimeno with 27 papers. Other well investigated areas are the Tiber River (11 papers) and the Valleys of Comacchio (10 papers), Lake Massaciuccoli (9) and the Colfiorito swamp (8). In all other cases there are insufficient data to make diachronic floristic studies.

Almost all of the 57 Ramsar sites recognized in Italy have been investigated with at least one contribution included in the list. There are, in fact, 68 contributions concerning them. Of the 998 mapped contributions, 218 refer to areas without any legal protection. These are mostly areas that fall along the course of rivers or within swampy areas. As shown in Table 1 and Fig. 6, many regions of northern Italy (Emilia Romagna, Friuli Venezia Giulia, Liguria, Lombardia, Piemonte) and Molise and Sicilia have a percentage of cells in which at least one freshwater habitat has been mapped higher than 80%. The regions that show the highest percentages of cells in which falls at least one studied locality are Umbria (29.41%), Trentino Alto Adige (26.71%), Toscana (25.61%), and Lazio (24.06%); those with the lowest percentages are Campania (4.17%), Molise (5.77%), Liguria (12.35%), Calabria (14.52%), and Basilicata (14.55%).

Conclusions

Italian wetlands are among the most threatened habitats, although many of them have been investigated and several fall within protected areas. In recent years, climate change is further worsening the situation by altering the dynamics of perennial humid environments and making temporary ones disappear (Calhoun et al. 2017). Environmental conservation passes through knowledge. Some habitats, like the Tiber river, have been the subject of a greater number of articles, also thanks to their proximity to research centres, but entire areas in southern Italy are still under-investigated. The results of this review highlight the need to intensify botanical research in Italian wetlands, especially in southern Italy and in protected areas, although the situation is already changing. In this year's Congress of the Italian Botanical Society, as many as 12 contributions concerned the theme of freshwater plants and habitats (Chiarucci et al. 2022). Certainly, many investigations not considered here have been carried out but have remained in the so called "grey literature" (thesis, internal documents, forms, etc.). In recent years, the need for researchers to publish in indexed international journals has discouraged studies conducted at the local level; however, data of local interest form the basis of global knowledge on wetlands. Publishing the contents of these documents is necessary to make them easily and freely accessible to the scientific community and the general public. This can be helped by biodiversity databasing and mapping projects in Italy such as Wikiplantbase #ItaliA (<http://bot.biologia.unipi.it/wpb/italia/index.html>), an-Archive (<http://www.anarchive.it>), VegItaly (<http://www.vegitaly.it>) or LISY (<http://www.scienzadellavegetazione.it/sisv/lisy/>).

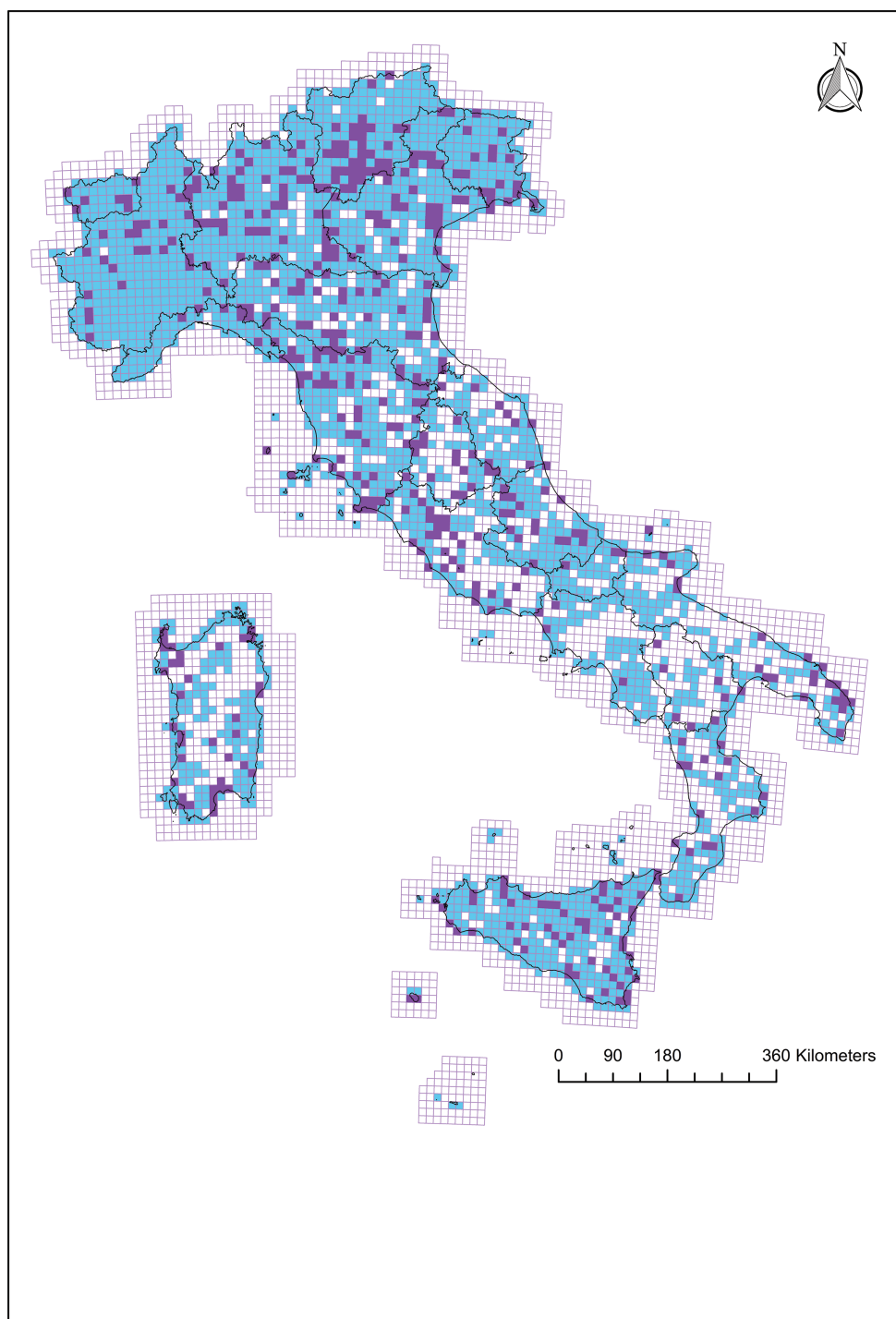


Figure 6. Distribution of the 10-km² cells with at least one freshwater habitat mapped (light blue) and of the cells including at least one studied locality (purple).

The National Biodiversity Future Center was established last June, funded by the National Recovery and Resilience Plan (NRRP) and including a network of 48 partners. It has the purpose of implementing national scientific research on biodiversity. The freshwater biodiversity theme is one of the most heartfelt. In the first three years of activity, research aimed at studying biodiversity at all levels on freshwater environments in Italy will be funded to improve current knowledge levels.

Basic data on biodiversity contextualized within a local socio-economic framework will sustain future management plans for the exploitation of natural resources that take into account the responsible use of aquatic ecosystems and the protection of the biological heritage associated with them. All over the world, the conservation and responsible use of humid environments can act as a driving force for the sustainable development of these realities (Duim van der and Henkens 2007).

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Supplementary material I

List of data references on botanical studies of higher plants in Italian wetlands

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Data type: List of references and metadata (excel file)

Explanation note: List of references and metadata concerning Coordinates, Type of protection, Habitat, Theme and Region.

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Notulae to the Italian flora of algae, bryophytes, fungi and lichens: 14

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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 algal genus *Chara*, for the bryophyte genera *Bryum*, *Grimmia*, *Cephaloziella*, *Hypnum*, *Nogopterium*, *Physcomitrium*, *Polytrichastrum*, *Rhynchostegiella*, *Saelania*, and *Schistostega*, the fungal genera *Cortinarius*, *Lentinellus*, *Omphalina*, and *Xerophorus*, and the lichen genera *Acarospora*, *Agonimia*, *Candelariella*, *Cladonia*, *Graphis*, *Gyalolechia*, *Hypogymnia*, *Lichinella*, *Megalalaria*, *Nephroma*, *Ochrolechia*, *Opegrapha*, *Peltigera*, *Placidium*, *Ramalina*, *Rhizoplaca*, *Ropalospora*, *Strangospora*, *Toniniopsis*, *Usnea*, and *Zahlbrucknerella*.

Keywords

Ascomycota, Basidiomycota, Bryidae, Charophyceae

How to contribute

The text of the records should be submitted electronically to: Cecilia Totti (c.totti@univpm.it) for algae, Marta Puglisi (mpuglisi@unict.it) for bryophytes, Alfredo Vizzini (alfredo.vizzini@unito.it) for fungi, Sonia Ravera (sonia.ravera@unipa.it) for lichens. Each text should be within 1,000 characters (spaces included).

Floristic records

ALGAE

Chara gymnophylla A.Braun (Characeae)

+ **TOS:** Pontremoli (Massa-Carrara), small permanent pond in the south side of Groppo del Vescovo (UTM WGS84: 32T 576818.4923766), 1119 m, 3 September 2021, leg. A. Soldano, det. R. Bolpagni (FI). – Species new for the flora of Toscana.

This species was found growing densely in a rather small (not more than 100 m²) permanent pond, not very far from the border between the provinces of Massa-Carrara and Parma. Despite the high variability of its diagnostic characters, which led many authors to consider this species alternatively as a variety of *Chara vulgaris* L. (Mouronval et al. 2015) or as *Chara contraria* A.Braun ex Kützing (Schneider et al. 2016), *C. gymnophylla* is currently accepted as an independent species (Guiry and Guiry 2019). In Italy, *C. gymnophylla* has been recorded from Veneto, Liguria, Umbria, Lazio, and Sicilia (Bazzichelli and Abdelahad 2009; Ravera et al. 2019).

A. Soldano, R. Bolpagni

BRYOPHYTES

Bryum gemmiparum De Not. (Bryaceae)

+ **TAA:** Sarca river in loc. Le Gere near Dro (Trento) (UTM WGS84: 32T 648544.5092136), on limestone boulders emerging from the water, 127 m, 13 March 2022, *F. Prosser* (ROV BR06881); along Sarca river to the bridge north of Dro (Trento) (UTM WGS84: 32T 648908.5092363), 133 m, 13 March 2022, *F. Prosser* (ROV BR06868). – Species new for the flora of Trentino-Alto Adige.

The presence of the typical propagules, the appearance of the leaves as well as the peculiar ecology make easy to recognize this species (Holyoak 2021). It was never reported in the whole northern Italy after 1968 (Aleffi et al. 2020). At a short distance, and in the same environment, *Orthotrichum cupulatum* Brid. var. *riparium* Huebener was also collected (ROV BR06878). Incidentally, this taxon was recorded for Trentino-Alto Adige based on collections made before 1968 (Aleffi et al. 2020).

F. Prosser

Cephaloziella baumgartneri Schiffn. (Cephaloziellaceae)

+ **TAA:** Above Tempesta (Trento), above the junction of the panoramic path to Torbole, under a protrusion of the slightly humid limestone cliff facing south (UTM WGS84: 32T 644952.5077667), 309 m, 29 January 2022, *F. Prosser* (ROV BR06267). – Species new for the flora of Trentino-Alto Adige.

Although the samples were sterile, their markedly basic growth environment allow a safe identification (Hugonnot and Leica Chavoutier 2021). This species was associated with *Gymnostomum calcareum* Nees & Hornsch. var. *calcareum* (ROV BR06264).

F. Prosser

Grimmia dissimulata E.Maier (Grimmiaceae)

+ **TAA:** Valle delle Gole along the stream (Trento) (UTM WGS84: 32T 661578.5100070), on a limestone cliff, 345 m, 10 April 2022, *F. Prosser* (ROV BR06441). – Species new for the flora of Trentino-Alto Adige.

The rarity of this species in Italy is possibly explained by its recent description (Maier 2001). *Grimmia dissimulata* is morphologically close to *G. trichophylla* Grev., from which it differs mainly for short rectangular basal leaf cells, 1–2 rows of smooth and hyaline cells at the leaf border, one row of guide cells and sometimes a group of hydroids between the guide cells and the substereids. In addition, it usually grows on a basic rather than acidic substrate. Nearly in the same site, *Gymnostomum aeruginosum* Sm. var. *aeruginosum* was collected (ROV BR06586).

F. Prosser

***Hypnum cupressiforme* Hedw. var. *filiforme* Brid. (Hypnaceae)**

+ **SAR:** La Madonnina, Santu Lussurgiu (Oristano) (UTM WGS84 32T 466684.4447104), on *Quercus ilex* L. at height of 1.50 m, 800 m, 10 May 1995, *A. Cogoni* (SA2/a); S'Abba Fittiana, Monte Tonneri, Seui (Sud Sardegna) (UTM WGS84 32T 531894.4416473), on *Quercus ilex* L., 1010 m, 7 May 1996, *A. Cogoni* (SA2/c); Trebina Ledda, Monte Arci, Morgongiori (Oristano) (UTM WGS84 32T 478521.446034), on *Quercus ilex* L. at height of 1.50 m, 742 m, 16 April 2001, *A. Cogoni* (SA2/d); Punta Sebera, Teulada (Sud Sardegna) (UTM WGS84 32T 485635.4322298), on *Arbutus unedo* L., 930 m, 14 April 2002, *A. Cogoni* (SA2/e); Monte Maggiore, Arbus (Sud Sardegna) (UTM WGS84 32T 462811.4382655), on *Arbutus unedo* L. at height of 1.50 m, 700 m, 14 March 2003, *A. Cogoni* (SA2/f); Monte Ortobene (Nuoro) (UTM WGS84 32T 531544.4463138), on *Quercus ilex* L. at height of 1 m, 830 m, 29 May 2003, *A. Cogoni* (SA2/g); Ortachis, Bolotana (Nuoro) (UTM WGS84 32T 0492237.4466648), on *Acer monspessulanum* L. at height of 0.60 m, 940 m, 2 June 2003, *A. Cogoni* (SA2/h); Assemini, Mitza Fanebas (Cagliari), along the river Rio Santa Lucia (UTM WGS84 32T 488988.4331529), on vertical cliffs, 238 m, 25 May 2021, *S. Poponessi*, *A. Cogoni* (SA2/i). – Variety new for the flora of Sardegna.

According to Aleffi et al. (2020), *Hypnum cupressiforme* var. *filiforme* is well distributed in the Italian territory, but not yet recorded for some regions, including Sardegna. It is a Mediterranean-boreal moss, growing on tree trunks and vertical cliffs (Dierßen 2001). This taxon may well just represent an ecological variant, but will be regarded at a varietal level until its position is clarified (Hodgetts et al. 2020).

S. Poponessi, A. Cogoni

***Nogopterium gracile* (Hedw.) Crosby & W.R.Buck (Leucodontaceae)**

+ **LIG:** Portofino Regional Park, Portofino (Genova), on the rock indicating the site “Pietre strette” (UTM WGS84: 32T 514152.4907907), 465 m, 5 June 2022, *M. Tiburtini* (PI 061636). – Species confirmed for the flora of Liguria.

Nogopterium gracile can be usually found on shaded rocks, more rarely on bark and soil. The general appearance is given by numerous, short, curved branches above, which all point to the same direction. Even though this species is widespread in Italy (Aleffi et al. 2020), its most recent record for Liguria dates back to 1902 (Aleffi, pers.

comm.). *Nogopterium gracile* was found growing in a pure patch on the boulder along the pathway where the locality “Pietre Strette” is written with red paint in a deciduous forest. The digitized specimen can be found at <http://erbario.unipi.it/it/erbario/view?id=1865491>.

M. Tiburtini

***Polytrichastrum alpinum* (Hedw.) G.L.Smith (Polytrichaceae)**

+ **SIC**: Dagalotti del Diavolo, near Contrada Galvarina, south-western slope of Mount Etna (UTM WGS84: 33S 496530.4174438), on soil in volcanic rock fissures, 1880 m, 21 June 2022, leg. S. Sciandrello, det. G. Bacilliere, M. Puglisi (CAT). – Species confirmed for the flora of Sicilia.

Polytrichastrum alpinum is a circumpolar boreo-arctic montane species, frequently occurring on soil in cliff crevices, block scree, and forest floors; it is occasionally found on rotten logs. This species is quite rare in southern Italy, where it was mostly reported before 1968 (Aleffi et al. 2020). In Sicilia it was previously found in the Madonie mountains more than a century ago (Bottini 1890; Lojacono Pojero 1890). In Mt. Etna, *P. alpinum* was found at the entrance of a cave, with some individuals of *Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen.

M. Puglisi, G. Bacilliere, S. Sciandrello

***Physcomitrium eurystomum* Sendtn. subsp. *eurystomum* (Funariaceae)**

+ **VEN**: south-west of Pellegrina (Verona) (UTM WGS84: 32T 678818.4995715), in a paddy field, 8 m, 1 October 2021, F. Prosser (ROV BR06644). – Species new for the flora of Veneto.

Confirmed in Italy after 1968 only for Sicilia (Puglisi and Privitera 2018), it was found on the mud of a recently dried up paddy field. There was no previous report for Veneto. It is a declining species, indicated as VU at the European level by Hodgetts et al. (2019).

F. Prosser

***Rhynchostegiella curviseta* (Brid.) Lindb. (Brachytheciaceae)**

+ **TAA**: On the right bank of the Avisio stream west of the confluence with the Rio Molini (Trento) (UTM WGS84: 32T 665420.5113081), on a humid and shady porphyry cliff, 294 m, 26 February 2022, F. Prosser (ROV BR06904); small waterfall of Rio Molin at the confluence with Avisio (Trento), under Verla di Giovo, shady dripping on porphyry (UTM WGS84: 32T 665625.5113116), 306 m, 26 February 2022, F. Prosser (ROV BR06908). – Species confirmed for the flora of Trentino-Alto Adige.

The two populations observed, both fertile, are found on abundant travertine deposit. This species is quite common in Italy (Aleffi et al. 2020), and was previously reported in Trentino-Alto Adige only at Calavino at the end of the 20th century (Venturi 1899).

F. Prosser

***Saelania glaucescens* (Hedw.) Broth. (Ditrichaceae)**

+ **CAL:** Monte Cocuzzo, Mendicino (Cosenza) (UTM WGS84: 33S 598506.4341702), on soil, 1125 m, 30 January 2022, *D. Puntillo* (CLU No. 4532). – Species confirmed for the flora of Calabria.

Saelania glaucescens is recognizable for the striking, glaucous green colour of the leaves, which is caused by a covering of waxy rods on the leaf surface. It is an arctic-montane species, growing on soil in the crevices of basic rocks or in sheltered niches on calcareous crags. It is rare in southern Italy, and in Calabria it was previously reported only from Gioia Tauro (Bottini et al. 1883, under the name *Leptotricum glaucescens* Hampe).

D. Puntillo

***Schistostega pennata* (Hedw.) F.Weber & D.Mohr (Schistostegaceae)**

+ **LAZ:** Grotta Pozzo del Diavolo, Monte Venere, Caprarola (Viterbo) (UTM WGS84: 33T 267802.4691616), on lava rock, at the bottom of the volcanic cave with low light, 814 m, 10 May 2021, *T. Scalise*, *E. Scassellati* (RO, Herb. Iberite). – Species confirmed for the flora of Lazio.

Schistostega pennata is a peculiar moss species well known for its luminescent appearance when growing in very dark places, due to the light reflective properties of the convex cells of its persistent protonema. It is a boreal-temperate species, that can be found in deep shade on acid soil, in dark recesses and in the entrances to caves and mine shafts (Birks and Blockeel 2014). In Italy, *Schistosega pennata* occurs in Valle d'Aosta, Piemonte, Lombardia, Trentino-Alto Adige, Puglia, and with old records, in Liguria (Aleffi et al. 2020); in Lazio, its presence was only generically reported by Brizi (1897). In the new locality, *S. pennata* is present as a protonema, at the bottom of a cave, in association with *Isopterygiopsis pulchella* (Hedw.) Z.Iwats.

M. Iberite, E. Scassellati, M. Aleffi

FUNGI***Cortinarius scaurotraganoides* Rob.Henry (Cortinariaceae)**

+ **LIG:** Sassello (Savona) (UTM WGS84: 32T 461088.4925631), under *Quercus robur* L. and *Pinus sylvestris* L., 519 m, 17 November 2012, *F. Boccardo* (GDOR 2869). – Species new for the flora of Liguria.

Cortinarius scaurotraganoides is mainly characterized by the whitish-cream to ochre brown pileus, sometimes with faint bluish tinges, flesh cream to ochre but orange at the base of the stem and characteristic fruity odour similar to that of *Cortinarius traganus* (Fr.) Fr. (Bidaud et al. 1993; Brandrud et al. 2012). The diffusion of *C. scaurotraganoides* is documented in France and Hungary based on morphological and genetic evidence (Bidaud et al. 1993; Brandrud et al. 2012; Liimatainen et al. 2020), but this species is

also present in Italy (Onofri et al. 2013) and Spain (Brandrud et al. 2012). In Italy, it was reported from Piemonte and Lombardia (Onofri et al. 2013).

F. Boccardo, F. Dovana

***Lentinellus ursinus* (Fr.) Kühner (Auriscalpiaceae)**

+ **CAL**: Botanical Garden, University of Calabria, Rende (Cosenza), on a fallen decaying oak branch under a downy oak (*Quercus pubescens* Willd.) tree at the edge of a mixed deciduous oak coppice stand, *Q. pubescens* as prevailing species (UTM WGS84: 33S 605916.435729), 200 m, 25 October 2021, G. Sicoli, A.B. De Giuseppe, N.G. Passalacqua (CLU F320). – Species new for the flora of Calabria.

A fasciculate cluster of five basidiomata referable to the genus *Lentinellus* Karst. was detected on a partially decayed branch fallen from an oak tree (*Q. pubescens*) standing over it. Pilei were spatulate, less than 5 cm wide, and laterally attached to the wood via a very rudimentary stipe. The above side of the pileus was felty and dull, brown-to-bay and slightly hirsute in the centre, paler and smoother towards an involute margin. The downside showed crowded and irregularly toothed gills producing hyaline, subglobose, finely ornamented and strongly amyloid spores, measuring $3.0\text{--}4.5 \times 2.5\text{--}3.5 \mu\text{m}$. The above characteristics led to identify this saprotrophic fungus as *L. ursinus* (Courtecuisse and Duhem 1995; Segedin 1996; Käärrik 1997). *Lentinellus ursinus* is currently recorded mainly for northern and central Italy, while in southern Italy it has been recorded only in Puglia (Onofri et al. 2013).

G. Sicoli, A.B. De Giuseppe, N.G. Passalacqua

***Omphalina pyxidata* (Bull.) Quél. (Omphalinaceae)**

+ **CAL**: Botanical Garden, University of Calabria, Rende (Cosenza) (UTM WGS84: 33S 605940. 4357174), on the ground in a grassy open space between two oak trees belonging to *Quercus ilex* L. and *Q. pubescens* Willd., 215 m, 3 November 2021, A.B. De Giuseppe, N.G. Passalacqua, G. Sicoli (CLU F321). – Species new for the flora of Calabria.

A dozen sparse pileate and stipitate basidiomata were detected on the ground in a 10m²-wide grassy clearing between a downy oak tree (*Q. pubescens*) and a holm oak tree (*Q. ilex*). Pilei were infundibuliform, vividly brownish, striate at margin and less than 3 cm wide. Stipes were slender, sometimes flexuose, glabrous and more or less concolorous. The hymenophore consisted of pale brown, rather distant and decurrent gills producing hyaline, amygdaloid and smooth spores, measuring $7.5\text{--}8.5 \times 4.5\text{--}5.0 \mu\text{m}$. Cystidia were not observed. The above characteristics led to recognise this fungus as the saprotroph *Omphalina pyxidata* (Lange 1992; Courtecuisse and Duhem 1995; Vizzini et al. 2012). *Omphalina pyxidata* has been mainly observed in northern and central Italy, while records in the south have only been referred to Sicilia (Onofri et al. 2013).

A.B. De Giuseppe, N.G. Passalacqua, G. Sicoli

***Xerophorus olivascens* (Boud.) Vizzini, Consiglio & M. Marchetti (Callistosporiaceae)**

+ **CAL:** Botanical Garden, University of Calabria, Rende (Cosenza) (UTM WGS84: 33S 605966. 4357130), on the ground under the crown of an Atlas cedar tree [*Cedrus atlantica* (Endl.) Manetti ex Carrière], 220 m, 15 November 2021, *N.G. Passalacqua, A.B. De Giuseppe, G. Sicoli* (CLU F322). – Species new for the flora of Calabria.

A group of five small, gregarious collybioid basidiomata were observed on the ground among the dead needles of a planted tree of *Cedrus atlantica*. The youngest pilei were convex and narrowly involute at the edge, the most mature were applanate, slightly depressed, matt, smooth to wrinkled, dark grey-brown in the centre, light greenish at the edge, and 1.5–3.5 cm wide. The lower side of the pileus showed rather distant and emarginated gills, which were green-yellowish and were supported by a concolorous, slender, tapering, flexuose and fibrillose stipe. Spores were amygdaliform, smooth, hyaline, and $9\text{--}11 \times 5\text{--}7\mu\text{m}$ -sized. Based on the above characters and ecology, this fungus had first been described as *Callistosporium olivascens* (Boud.) Bon, more specifically as *C. olivascens* var. *aerinum* (Quél.) Bon, but its current name is *Xerophorus olivascens* (Moser 1986; Courtecuisse and Duhem 1995; Vizzini et al. 2020). In Italy, *X. olivascens* seems to have been reported in the northern and central regions, previously as *Callistosporium olivascens* (Boud.) Bon, but apparently never in the south (Onofri et al. 2013).

N.G. Passalacqua, A.B. De Giuseppe, G. Sicoli

LICHENS***Acarospora similis* H.Magn. (Acarosporaceae)**

+ **EMR:** Parma University campus (Parma), on the woody fence at the Ambolana building (UTM WGS84: 32T 604139.4957548), 70 m, 29 October 2020, leg. *J. Nascimbene*, det. *J. Nascimbene* (BOLO). – Species new for the flora of Emilia-Romagna.

This lignicolous species was rarely collected in Italy where, however, it is perhaps more widespread on worked timber (fences, roofing tiles), from the dry submediterranean to the subalpine belt in relatively nutrient-enriched situations (Nimis 2016).

J. Nascimbene

***Agonimia repleta* Czarnota & Coppins (Verrucariaceae)**

+ **ITA (SAR):** near the road 2 km SW of San Pantaleo, Arzachena (Sassari) (UTM WS84: 32T 537499.4542800), on bark of *Quercus coccifera* L., 40 m, 30 April 2012, *J. Malíček* (PRA). – Species new for the flora of Sardegna.

Agonimia repleta is characterized by a granular-verrucose to minutely squamulose thallus with black, smaller, roughened pyriform perithecia. It is widespread in Europe mainly on bark among mosses, often in riparian habitats. In temperate forests, it is common on bark at bases of deciduous trees, especially beech.

J. Malíček, S. Ravera

***Candelariella boleana* Etayo, Palice & T.Sprib. (Candelariaceae)**

+ **ITA (TOS)**: Pratovecchio (Arezzo), in a beech forest near Croce Gaggi (UTM WGS84: 32T 724258.4854840), on bark of *Fagus sylvatica* L., 1150 m, 19 March 2022, leg. S. Di Natale, E. Bianchi, R. Benesperi, det. S. Di Natale (FI). – Species new for the flora of Italy (Toscana).

Candelariella boleana is an epiphytic species, widespread in southern and central Europe (Nimis et al. 2022) and with a single record from Swiss Alps (Nimis et al. 2018). Its thallus consists of small scattered yellow to greenish-yellow granules. *Candelariella boleana* is the only species known in the genus with orbicular spores, 16–32 per ascus, and can thus be easily distinguished from all other species (Etayo et al. 2009).

S. Di Natale, E. Bianchi, R. Benesperi

***Cladonia foliacea* (Huds.) Willd. (Cladoniaceae)**

+ **VDA**: Arbaz, Challand-Saint-Anselme (Aosta) (UTM WGS84: 32T 401107.5063836), on soil, 1380 m, 15 June 2021, D. Isocrono, S. Ongaro (ORO). – Species confirmed for the flora of Valle d'Aosta.

According to Nimis (2016), *C. foliacea* is a terricolous lichen rather rare in the montane belt in Italy, that has been rediscovered, together with *C. rangiformis* Hoffm., in an open grassland. Its presence in Valle d'Aosta was previously only known in few sites based on literature from the early 20th century (Henry 1911; Vaccari 1914; Cengia Sambo 1928). A bibliographic 50 years old record (Tosco 1973, sub *C. foliacea* var. *alcicornis* and var. *convoluta* Vain.) attested its occurrence in Valli di Cogne in a single locality (bosco di Sylvenoire), recent investigations in the same area found no evidence of it. The exsiccatum from Tosco's collection is kept in VER and has now been proven to be correct.

D. Isocrono, S. Ongaro

***Cladonia rangiformis* Hoffm. (Cladoniaceae)**

+ **VDA**: Arbaz, Challand-Saint-Anselme (Aosta), on soil (UTM WGS84: 32T 401107.5063836), 1380 m, 15 June 2021, Deborah Isocrono, Silvia Ongaro (ORO). – Species new for the flora of Valle d'Aosta

According to Nimis (2016), *Cladonia rangiformis* is one of the most common and abundant species of the genus in Italy. This sample was collected in an open pasture in a dry area.

D. Isocrono, S. Ongaro

***Cladonia rei* Schaer. (Cladoniaceae)**

+ **VEN**: Grave di Ciano, Crocetta del Montello (Treviso) (UTM WGS84: 33T 271077.5080389, 271087.5080257), on calcareous soil in dry grasslands, 131–136 m,

18 February 2022, leg. *J. Nascimbene*, det. *G. Gheza*, *J. Nascimbene* (BOLO). – Species confirmed for the flora of Veneto.

Cladonia rei is a widespread but poorly known species, which is easily overlooked or mistaken for other species due to its highly polymorphic podetia (Gheza and Nimis 2021). Here it was recorded together with *C. chlorophaea* (Sommerf.) Spreng., *C. cryptochlorophaea* Asahina, *C. rangiformis* Hoffm., and *C. symphyocarpa* (Flörke) Fr. in dry grassland patches attributed to the Natura 2000 Habitat 62A0 “Eastern sub-mediterranean dry grasslands (*Scorzoneretalia villosae*)”. This species is widespread in dry grasslands of the western Po Plain (Gheza 2015, 2018, 2020), on both siliceous and carbonatic soils, and is likely to be common also in the eastern Po Plain, in similar habitats. The only previous record in Veneto was from Forcella Franche in the upper Valle del Mis (Cengia Sambo 1934).

G. Gheza, J. Nascimbene

***Graphis pulverulenta* (Pers.) Ach. (Graphidaceae)**

+ **UMB**: Monte Coscerno (Perugia) (UTM WGS84: 33T 329504.4733358), on *Fagus sylvatica* L., 910 m, 25 October 1997, leg. *G. Massari*, *S. Ravera*, det. *S. Ravera* (Herb. Ravera 4679); Amelia (Terni) (UTM WGS84: 33T 293192.4713927), on *Quercus pubescens* Willd., 500 m, 8 March 1999, leg. *G. Massari*, *S. Ravera*, det. *S. Ravera* (Herb. Ravera 2806). – Species new for the flora of Umbria.

+ **LAZ**: Le Chiuse, Ischia di Castro (Viterbo) (UTM WGS84: 32T 717621.4712467), on *Populus* sp., 220 m, 25 August 1993, leg. *A. Alessandrini*, *S. Ravera*, det. *S. Ravera* (PAL); Canale Monterano (Roma) (UTM WGS84: 33T 259460.4668460), on *Corylus avellana* L., 270 m, 7 December 1998, leg. *G. Brezzi*, *S. Ravera*, det. *S. Ravera* (PAL); Bosco di Gattaceca, Monterotondo (Roma) (UTM WGS84: 33T 306274.4658340), on *Carpinus orientalis* Mill., 130 m, 10 February 1999, *G. Rinieri* (Herb. Ravera 3787); Canale Monterano (Roma) (UTM WGS84: 33T 259138.4669049), on *Alnus glutinosa* (L.) Gaertn. along the river Bicione, 175 m, 9 March 2004, leg. *S. Caporale*, *S. Ravera*, det. *S. Ravera* (Herb. Ravera 4640); Canale Monterano (Roma) (UTM WGS84: 33T 259138.4669049), on *Alnus glutinosa* (L.) Gaertn. along the river Mignone, 250 m, 26 March 2004, leg. *S. Caporale*, *S. Ravera*, det. *S. Ravera* (Herb. Ravera 4639). – Species new for the flora of Lazio.

+ **MOL**: Piano di San Vito, Macchia di Isernia (Isernia) (UTM WGS84: 33T 435210.4601697), on *Fraxinus ornus* L., 300 M, leg. *S. Caporale*, *M. Giancola*, *G. Potenza*, *S. Ravera*, det. *S. Ravera* (Herb. Ravera 4865).

Graphis pulverulenta is an epiphytic crustose species of the *G. scripta* group, characterised by apothecia with mostly acute ends and widely exposed white- to grey-pruinose discs. Pending a revision of the Italian material, these units are treated as separate species by Nimis and Martellos (2022). The records listed as “Herb. Ravera” are reported in Nimis and Martellos (2022) *sub G. scripta* (L.) Ach.

S. Ravera

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

+ **MAR:** Pietrarubbia (Pesaro e Urbino) (UTM 33T 289295.4852237), on sandstone calcareous conglomerate, 730 m, 9 April 2022, *F. Santi* (BOLO). – Species new for the flora of Marche.

Gyalolechia fulgida is a crustose-placodioid lichen, found on calcareous rock, with an optimum in the Mediterranean belt (Nimis 2016). The record from San Leo (Rimini), referred to Marche (Nimis and Tretiach 1999), is now to refer to Emilia-Romagna, because the Municipality currently belongs to this administrative Region.

F. Santi, C.M. Giorgi, M. Muscioni

***Hypogymnia farinacea* Zopf (Parmeliaceae)**

+ **LIG:** Slopes of Mount Pietravecchia, along the “Sentiero degli Alpini” (Imperia) (UTM WGS84: 32T 393671.4871558), on *Larix decidua* Mill., 1613 m, 26 June 2022, *P. Giordani*, *D. Locati* (GE). – Species new for the flora of Liguria.

Hypogymnia farinacea is a foliose lichen characterized by a grey upper surface, largely covered by soredia arising from wrinkles. The lower surface is black, rugose, without rhizines. The medulla soon becomes hollow. According to Nimis and Martellos (2022), it is rather common in the coniferous forests of the subalpine belt of the Alps, while it becomes rare in the Apennines. The site of Mount Pietravecchia is the first known site in Liguria, although this species was already known from a stand on the Emilian side of the Ligurian Apennines (Brunialti et al. 2001). On Mount Pietravecchia it grows on the trunk of larch trees in epiphytic communities dominated by *H. physodes* (L.) Nyl., *H. tubulosa* (Schaer.) Hav., *Parmeliopsis ambigua* (Hoffm.) Nyl. and *Brioria* sp. pl.

P. Giordani, D. Giuglia, G. Canali

***Lichinella myriospora* (Zahlbr.) P.P.Moreno & Egea ex M.Schultz (Lichinaceae)**

+ **ITA (EMR):** Foreste Casentinesi National Park, below Passo la Calla, km 33 of the SS 310 (Forlì-Cesena) (UTM WGS84: 32T 722942.4864009), on limestone fragments in dry grassland, 735 m, 9 August 2015, *W. v. Brackel*, *G. v. Brackel* (HBG). – Species new for the flora of Italy (Emilia-Romagna).

This species belongs to a taxonomically difficult group of crustose cyanolichens in the genera *Lichinella* Nyl. and *Psorotichia* A. Massal. Species with thallinocarpia, as our specimen, belong to *Lichinella*. Within this genus, the separation between *Lichinella myriospora* and *Psorotichia suffugiens* (Nyl.) Forssell, the latter not yet recombined but actually belonging to *Lichinella* according to our own unpublished studies, is problematic. Until now it is based only on a stronger development of the thalline web covering and partly separating the hymenium. *Lichinella myriospora* is known from Europe (Croatia, Czech Republic, France, Slovenia, Spain, and Ukraine), Asia (Mongolia and Tukey) and North America (Mexico and USA) (Zahlbruckner 1922; Navarro-Rosinés 1992; Roux et al. 2003; Schultz 2005; Candan and Schultz 2015; Lin and Qiang 2021; Vondrák et al. 2022).

W. v. Brackel, M. Schultz

***Megalaria pulvere* (Borrer) Hafellner & E.Schreiner (Ramalinaceae)**

+ **LOM:** Boschi del Giovetto near Giuadel, Azzone (Bergamo) (UTM WGS84: 32T 586786.5090275), on bark of *Abies alba* Mill. in a moist coniferous forest, 1230 m, 4 January 2022, leg. G. Gheza, det. H. Mayrhofer (BOLO). – Species new for the flora of Lombardia.

Megalaria pulvere is a rare species, previously reported from Italy only once, from Trentino-Alto Adige (Nascimbene et al. 2007). The specimen reported from Lombardia, which was sterile and contained fumarprotocetraric acid, atranorin and zeorin, was collected in an old, moist coniferous stand rich in *Abies alba* Mill., on the same tree with *Ropalospora viridis* (Tønsberg) Tønsberg.

G. Gheza, H. Mayrhofer

***Nephroma tangeriense* (Maheu & A. Gillet) Zahlbr. (Nephromataceae)**

+ **LIG:** Via Groppolo, Sarzana (La Spezia), (UTM WGS84: 32T 577405.4887407), on bark, 1810, leg. A. Bertoloni, det. G. Gheza, G. Celli, J. Nascimbene (BOLO); Via del Martinello, Calice al Cornoviglio (La Spezia) (UTM WGS84: 32T 566204.4894508), on bark of *Castanea sativa* Mill., 1000 m, September 1831, leg. A. Bertoloni, det. G. Gheza, G. Celli, J. Nascimbene (BOLO). – Species new for the flora of Liguria.

+ **EMR:** Lago Calamone, Ventasso (Reggio Emilia) (UTM WGS84: 32T 60219.4914271), at the foot of an old beech, 1409 m, 9 June 2022, leg. G. Gheza, det. G. Gheza, J. Nascimbene (BOLO). – Species new for the flora of Emilia-Romagna.

Nephroma tangeriense is a Mediterranean-Atlantic species, typically found in humid areas (Nimis and Martellos 2022). It was assessed in the Red List of the epiphytic lichens of Italy as “vulnerable” (Nascimbene et al. 2013). This species is easily distinguished from the similar *N. laevigatum* Ach. thanks to the presence of many laminal and marginal phyllidia (Nimis 2021).

G. Gheza, G. Celli, J. Nascimbene

***Ochrolechia frigida* (Sw.) Lynge (Ochrolechiaceae)**

+ **LOM:** Lago Nero del Gavia, Ponte di Legno (Brescia) (UTM WGS84: 32T 614172.5132302), on organic soil in an alpine open habitat with grassland and siliceous rock outcrops near an alpine lake, 2378 m, 18 August 2021, leg. G. Gheza, L. Di Nuzzo, det. H. Mayrhofer (BOLO); between Passo del Gavia and Corno dei Tre Signori, Valfurva (Sondrio) (UTM WGS84: 32T 615195.5133099), on soil in an alpine open habitat, 2659 m, 27 July 2022, G. Gheza, L. Di Nuzzo (BOLO). – Species confirmed for the flora of Lombardia.

Ochrolechia frigida is a crustose lichen typically found on plant debris in high-altitude habitats on acidic substrates (Nimis 2016). It is easily distinguished chemically from similar species as it contains only gyrophoric acid. It was reported previously from Lombardia only from a few localities in Valtellina (Garovaglio 1838; Anzi 1860).

This species was assessed as “Regionally Extinct” in Italy in the recent Red List of terricolous lichens (Gheza et al. 2022); now it should be reassessed, being currently confirmed from the localities reported here.

G. Gheza, L. Di Nuzzo, H. Mayrhofer

***Opegrapha duriei* Mont. (Opegraphaceae)**

+ **CAL:** Porticciolo di Briatico, Briatico (Vibo Valentia) (UTM WGS84: 33S 590296.4286967), on calcareous rock, 8 m., 26 October 2013, *D. Puntillo* (CLU 16797). – Species new for the flora of Calabria.

Opegrapha duriei is a rare halophyte species confined along the Mediterranean and Atlantic coast of North Africa and Portugal (Nimis 1993), occurring in rather shaded and humid habitats. It grows on hard calcareous rocks mostly on steeply north-facing surfaces. It is often associated with *Arthonia meridionalis* Zahlbr. in the *Opegraphetum duriei* Egea & Cl.Roux 1992. In Italy it is reported for some small islands (Tuscan Archipelago, Tremiti Islands, Egadi, and Pelagie Islands), Sardegna, and more rarely for the coasts of Puglia (Nimis and Martellos 2022). In the reported site, this species grows together with the more common *Arthonia calcarea* (Sm.) Ertz & Diederich. and *A. meridionalis*.

D. Puntillo

***Peltigera venosa* (L.) Hoffm. (Peltigeraceae)**

+ **EMR:** Monte Cusna from Roncopianigi, Villa Minozzo (Reggio Emilia) (UTM WGS84: 32T 611548.4906618), on terricolous mosses in a beechwood, 1667 m, May 2022, leg. *C. Vallese*, *M. Prato*, det. *C. Vallese* (BOLO). – Species confirmed for the flora of Emilia-Romagna.

Peltigera venosa is an arctic-alpine to boreal-montane lichen, growing on bare mineral and humus soil above boulders and roadsides (Vitikainen 1994). It is generally most frequent in the Alps (Nimis and Martellos 2022). The specimen reported here was collected in a beechwood in the montane belt of the highest mountain of the Reggiano Apennine. The previous records from Emilia-Romagna date back to the 19th century (Baglietto 1871; Bracciforti 1877; Saccardo and Fiori 1894). Fariselli et al. (2020) attributed to this administrative region a record by Vitikainen (1994) based on a misinterpretation of a map that reports a record from the Oltrepo Pavese (Lombardia), based on Nocca and Balbis (1823).

C. Vallese, G. Gheza, J. Nascimbene

***Placidium lachneum* (Ach.) B.de Lesd. (Verrucariaceae)**

+ **LOM:** trail between Nona and the Gleno Dam, Vilminore di Scalve (Bergamo) (UTM WGS84: 32T 582770.5095739), on soil above siliceous sandstone at the edge of a stream, 1438 m, 9 August 2021, leg. *G. Gheza*, det. *L. Di Nuzzo*, conf. *M. Prieto* (BOLO). – Species confirmed for the flora of Lombardia.

Placidium lachneum is a squamulose lichen found mainly on soil, sometimes also in rock fissures and among mosses, in alpine grasslands. It can be distinguished from other *Placidium* species by the anticlinally arranged cells of the lower cortex, the bacilliform conidia and the prosoplectenchymatous medulla (Prieto et al. 2010). It could be confused with *P. adami-borosi* Szatala, which grows at lower altitudes; however, preliminary molecular analyses do not appear to support the distinction between these two species (Prieto et al. 2012). The peculiar lower cortex is shared with *P. velebiticum* (Zahlbr. ex Zschacke) Breuss, which has oblong conidia and thinner ascospores and rhizohyphae. The only previous record of *P. lachneum* from Lombardia dates back to 1927 (Nimis 1993).

L. Di Nuzzo, G. Gheza, M. Prieto

***Ramalina arsenii* Sérus., van den Boom & Magain (Ramalinaceae)**

+ **ITA (LIG):** Val Trebbia, Fontanigorda, Bosco delle Fate (Genova) (UTM WGS84: 524672.4932641), on basalt outcrops, 900 m, 2 February 2022, *G. Canali, P. Giordani* (GE); Val Trebbia, Fontanigorda, loc. Pianelli (Genova), on basalt outcrops (WGS84: 525370.4932867) m, 3 July 2022, *P. Giordani, D. Locati* (GE). – Species new for the flora of Italy (Liguria).

Ramalina arsenii is a small fruticose lichen, characterized by a pale yellowish green thallus. The erect branches develop from a basal holdfast. In old thalli, the upper part of the branches becomes extensively sorediate underside. This species belongs to a group of species morphologically similar *R. pollinaria* (Westr.) Ach. (Nimis and Martellos 2022). The material was collected from two neighbouring sites in the Ligurian Trebbia Valley, in a mixed forest dominated by *Castanea sativa* Mill., *Quercus cerris* L. and *Acer pseudoplatanus* L.

G. Canali, D. Giuglia, P. Giordani

***Rhizoplaca subdiscrepans* (Nyl.) R.Sant. (Lecanoraceae)**

+ **LOM:** eastern side of the lower Valle del Vò, Schilpario (Bergamo), on siliceous stones in a scree (UTM WGS84: 32T 588525.5098047), 1200 m, 20 April 2022, *G. Gheza* (BOLO). – Species confirmed for the flora of Lombardia.

Rhizoplaca subdiscrepans has been reported scatteredly from the Alps (Nimis et al. 2018), with the only known previous Italian record located above Semogo of Val-didentro (under the name *Squamaria chryssoleuca* var. *lecanorea*: Anzi 1868; Stizenberger 1882). This is the second record from both Italy and Lombardia and the first from the Orobic Alps.

G. Gheza

***Ropalospora viridis* (Tønsberg) Tønsberg (Ropalosporaceae)**

+ **LOM:** Boschi del Giovetto near Giuadel, Azzone (Bergamo) (UTM WGS84: 32T 586786.5090275), on bark of *Abies alba* Mill. in a moist coniferous forest, 1230 m, 4 January 2022, leg. *G. Gheza*, det. *H. Mayrhofer* (BOLO). – Species new for the flora of Lombardia.

Ropalospora viridis is a rare species, previously reported from Italy only once, from Friuli Venezia Giulia (TSB); it is also included in the Red List of the epiphytic lichens of Italy as “data deficient” (Nascimbene et al. 2013). The specimen reported from Lombardia, which contained perlatolic acid, was collected on the same tree with *Megalaria pulvereae* (Borrer) Hafellner & E. Schreiner.

G. Gheza, H. Mayrhofer

***Strangospora moriformis* (Ach.) Stein (Strangosporaceae)**

+ **TOS**: Eremo di Camaldoli, Poppi (Arezzo) (UTM WGS84: 32T 726441.4854718), on bark of conifer *Abies alba* Mill., 1120 m, 11 June 2021, leg. S. Di Natale, L. Di Nuzzo, R. Benesperi, det. S. Di Natale (FI). – Species new for the flora of Toscana.

Strangospora moriformis is an epiphytic crustose species, characterized by an endo-substratic or irregularly granular pale grey thallus. The apothecia are biatorine with a black to black-brown disc and an emerald-green epithecium (Nimis et al. 2022). It is included in the Italian Red List of epiphytic lichens as “near-threatened” (Nascimbene et al. 2013).

S. Di Natale, L. Di Nuzzo, R. Benesperi

***Toniniopsis verrucarioides* (Nyl.) Kistenich, Timdal, Bendiksby & S.Ekman (Ramalinaceae)**

+ **VEN**: Dolomiti Bellunesi National Park, Vette Feltrine, Mt. Pavionet (Belluno) (UTM WGS84: 32T 720600.5108735), on selciferous calcareous rocks, 2070 m, 9 August 2021, leg. J. Nascimbene, det. J. Nascimbene, P.L. Nimis (BOLO). – Species new to the flora of Veneto.

This arctic-alpine to cool-temperate lichen shows a minute squamulose thallus and grows in fissures and crevices of calcareous rocks in upland areas, often on species of *Placynthium* when young (Nimis 2016), as in the case of the record reported here. In general, this species has been rarely poorly collected in Italy and in the Alps (Nimis et al. 2018).

J. Nascimbene, P.L. Nimis

***Usnea intermedia* (A.Massal.) Jatta (Parmeliaceae)**

+ **LIG**: Mendatica (Imperia) (UTM WGS84: 398025.4885189), on *Picea abies* (L.) H.Karst., 26 June 2022, P. Piccardo (GE); Secate (Imperia) (UTM WGS84: 400063.4882795), on *P. abies*, 26 June 2022, P. Piccardo (GE). – Species new for the flora of Liguria.

Usnea intermedia is a fruticose-filamentous lichen characterised by a mostly pendulous thallus. The apothecia are frequent and often well developed with a fibrillose margin. This species is morphologically rather variable and needs further study (Nimis 2016). It is rather common in the subalpine belt of the Alps, while only a few stations are known in the higher areas of the southern Apennines in Abruzzo, Calabria, and

Sicilia. In the two Ligurian Alpine sites reported in this note, the species grows together with other fruticose lichens of the genera *Usnea*, *Pseudevernia* and *Bryoria*.

P. Piccardo, P. Giordani, P.L. Nimis

***Zahlbrucknerella calcarea* (Herre) Zahlbr. (Lichinaceae)**

+ **VEN:** Dolomiti Bellunesi National Park, Vette Feltrine, Mt. Pavionet (Belluno) (UTM WGS84: 32T 720600.5108735), on selciferous calcareous rocks, 2070 m, 9 August 2021, leg. *J. Nascimbene*, det. *J. Nascimbene* & *P.L. Nimis* (BOLO). – Species new to the flora of Veneto.

This cyanolichen with a minutely filamentous thallus is mainly bound to limestone and dolomite, in sheltered seepage tracks on steeply inclined surfaces (Nimis 2016). It was poorly collected in Italy, where it is known so far only from Calabria and Trentino-Alto Adige (Nimis and Martellos 2022). In the Alps, it is currently known mainly from the central-eastern part of the chain (Nimis et al. 2018).

J. Nascimbene, P.L. Nimis

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Global and Regional IUCN Red List Assessments: 14

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Abstract

In this contribution, the conservation status assessment of three vascular plants according to IUCN categories and criteria are presented. It includes the assessment of *Allium ravenii* F.O.Khass., Shomuradov & Kadyrov and *Centaurea seguenzae* (Lacaita) Brullo, Marcenò & Siracusa at global level and *Haloxylon persicum* Bunge ex Boiss. & Buhse at regional level.

Keywords

conservation, extinction risk, IUCN protocol, threats

How to contribute

The text of the global and regional assessments should be submitted electronically to Simone Orsenigo (simone.orsenigo@unipv.it) or to Giuseppe Fenu (gfenu@unica.it); the text, up to 8,000 characters in length (spaces included), must include a distribution map and a picture of the assessed species.

Red List Assessments

Allium ravenii F.O.Khass., Shomuradov & Kadyrov

Global assessment

Taxonomy and nomenclature

Order: Asparagales *Family:* Amaryllidaceae

Allium ravenii F.O.Khass., Shomuradov & Kadyrov, Stapfia 95: 173 (2011).

Common name: Raven's garlic (En).

Geographic distribution range: *Allium ravenii* (Fig. 1) is a rare species, endemic to plains with gypsum soils adjacent to the Eastern Chink, on the eastern border of the Ustyurt plateau in Karakalpakstan (43.96°N, 58.35°E; Uzbekistan). In the past, this locality was considered the southwestern coast of the Aral Sea. The only one small population known to date is located in the district North-Ustyurt botanical geographical region of the Ustyurt plateau (Fig. 2) of the Turan province (Khassanov 2016). Currently, *Allium ravenii* is known only from the *locus classicus*.

Distribution: *Countries of occurrence:* Uzbekistan.

Biology: *Plant growth form:* Perennial (geophyte).

Flowering and fruiting time: flowering from May to June and fruiting from June to July.



Figure 1. *Allium ravenii* in the plains adjacent to the Eastern Chink. Photograph by Kh. Shomurodov.

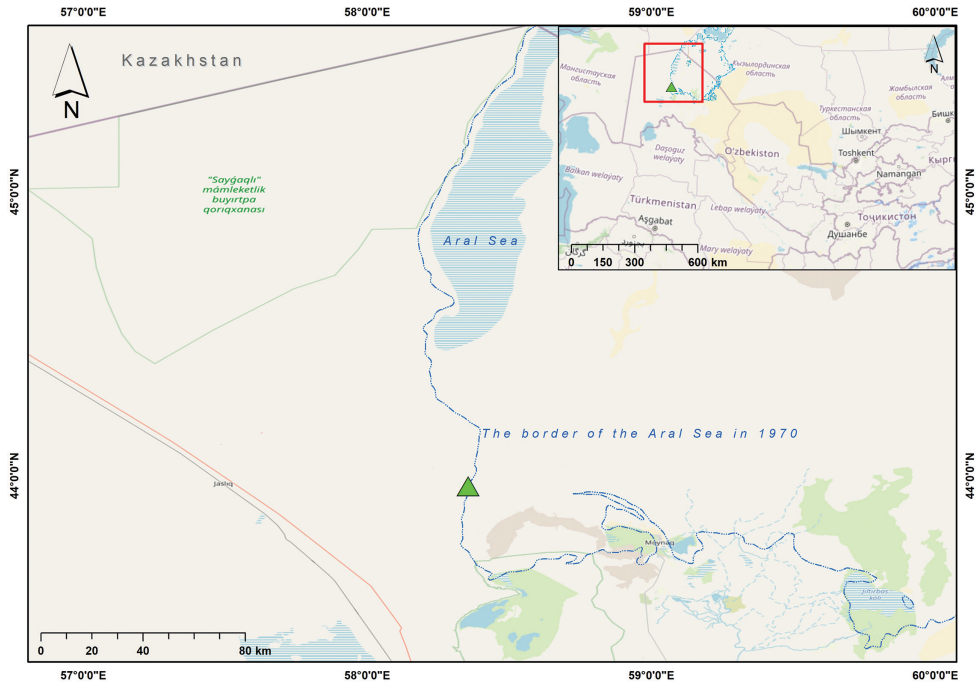


Figure 2. Geographic range and distribution map of *Allium ravenii* in Ustyurt Plateau (Karakalpakstan).

Reproduction: pollination, dispersal mechanism and seed germination have not been studied.

Habitat and ecology: *Allium ravenii* is a geophyte 15–30 cm high (Khassanov et al. 2011), growing on saline plains with gypsum or calcareous soil at an altitude of around 150 m a.s.l., in a windy area with a sharply continental climate. The range of this species is located in an extremely arid zone that is also affected by the effects associated with the drying up of the Aral Sea. The cumulative analysis of the aridity index showed that a single growing trend in the Ustyurt Plateau region is arid warming, accompanied by an increase in moisture deficit, mainly in the spring period of the year (Adilov et al. 2017). This species occurs in community poor in plant species and with low coverage (11–13%) dominated by *Anabasis salsa* (Ledeb.) Benth. ex Volkens, *Anabasis brachiata* Fisch. & C.A.May. ex Kar. & Kir., and *Salsola orientalis* S.G.Gmel.

Population information: continuously updated data on the single population of Raven's garlic are missing. During field research in 2009–2010, about 20 individuals in full bloom were found, while only six plants were recorded during the monitoring expedition in 2015. Probably due to the very dry years (< 75 mm in 2020; data from the Aktumsuk weather station) and the sharp decrease in precipitation in spring, during targeted field studies in the spring of 2020–2021, no individuals were found during the growing season. The declining trend in the number of individuals of this species takes place against the background of the drying of the Aral Sea and the intensification of the process of desertification in the region.

Threats: 2.3 *Livestock farming & ranching and 2.3.1 Nomadic grazing:* The Ustyurt Plateau and the Eastern Chink are used as nomadic pastures for sheep, goats and camels. Moreover, also wild animals like *Saiga tatarica* (Linnaeus, 1766) and *Gazella subgutturosa* (Güldenstädt, 1780) graze during all the year.

3.1 *Oil & gas drilling:* Gas reserves are large on the Ustyurt Plateau and there are several drilling stations around the *Allium ravenii* population.

4.1 *Roads & railroads:* The population was found on the side of the only road that crosses the plateau towards the Aral Sea. This road is intensively and irregularly used for transportation of tourists and special equipment used by geologists. It is easy to see from satellite images that more than 10 new roads have appeared around the population.

11.2 *Droughts:* Aridization processes in Uzbekistan are becoming more intense (Khabibullaev et al. 2022), according to the weather stations “Jaslyk”, “Kungrad”, and “Aktumsuk”, which are closest to the *A. ravenii* population area; in recent years, precipitation has been declining, and the increase in average air temperature has had a positive trend. The drying up of the Aral Sea has a strong influence. In this case, the increase in salt storms will also have a negative impact on the population.

11.3 *Temperature extremes:* An analysis of long-term climatic data showed that the magnitude of air temperature changes has increased significantly both in the cold and in the warm half of the year (Adilov et al. 2017).

CRITERIA APPLIED

Criterion B: **EOO:** 4 km² calculated with GeoCAT (Geospatial Conservation Assessment Tool) software (Bachman et al. 2011).

AOO: 4 km² calculated with GeoCAT software (Bachman et al. 2011).

- a) A single location (unsystematic grazing or climate change).
- b) Continuing decline, observed in extent of occurrence, area of occupancy, extent and quality of habitat, number of mature individuals.
- c) Extreme fluctuations in number of mature individuals.

Criterion C: Population size estimated in about six mature individuals.

- 1) An estimated continuing decline of at least 25% within three years or one generation.
- 2) A continuing decline, observed in numbers of mature individuals and at least 90% of mature individuals in one subpopulation.

Criterion D: Population size estimated in only six mature individuals.

Red List category and Criteria (Global Assessment)

CR	Critically Endangered	B1ab(i,ii,iii,v)c(iv)+2ab(i,ii,iii,v)c(iv)+C1+C2a(i,ii)+D
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Rationale for the assessment: *Allium ravenii* is endemic to the Ustyurt Plateau and currently has a single population with a small number of mature individuals. The

monitoring results of the last decade show that the number of individuals is decreasing, and the quality of the habitat is worsening due to climate change and the ecological crisis of the Aral Sea. In some targeted field trips, no individual was found; however, although failure to find vegetative individuals suggests that this species may meet the criteria for the Extinct (EX) category, the finding of underground parts of several mature individuals in 2015 excludes this category. At the moment, considering the restricted EOO and AOO, and the continuous decline in population size and habitat quality, *Allium ravenii* can be assessed as Critically Endangered (CR) based on criteria B, C, D.

Previous assessment: this species was not evaluated at the global level (IUCN 2022).

Conservation actions: the area where the *A. ravenii* population is distributed is not included in any reserve or protected area. The species is, nonetheless, listed in a national law and in the Red Book of the Republic of Uzbekistan under category 1 (on the brink of extinction) (Kuchkarov et al. 2019). Several important international and local projects are being implemented in the locality to alleviate the problem of the drying up of the Aral Sea and its consequences, and to try to eliminate the ecological crisis (“green covers” in the areas along the Aral Sea, etc.). Within these projects, it is desirable to preserve this endangered species and to create living collections. Through joint projects or articles, it is urgent to make the international community aware of the current status of rare species in Uzbekistan (Kuchkarov et al. 2019).

Conservation actions needed: since it has recently been described and its current distribution may be poorly known, it is necessary to organize targeted field research aimed at searching for new populations of Raven’s garlic. It is desirable to search for new methods of conservation of this plant species by biological and ecological studies, and to forecast the future of the species in the context of bioclimatic modeling, besides exploring the possibility of multiplication and translocation to other suitable areas.

Khabibullo F. Shomurodov, Bekhruz Sh. Khabibullaev, Giuseppe Fenu

Centaurea seguenzae (Lacaita) Brullo, Marcenò & Siracusa

Global assessment

Taxonomy and nomenclature

Order: Asterales *Family:* Asteraceae

Centaurea seguenzae (Lacaita) Domina, Greuter & Raimondo, Israel J. Plant Sci. 64(1–2): 55 (2017) ≡ *C. todaroi* f. *seguenzae* Lacaita, Nuovo Giorn. Bot. Ital., n.s. 22: 246 (1915) ≡ *C. todaroi* subsp. *seguenzae* (Lacaita) Giardina & Raimondo, Boccionea 20(10): 393 (2007) ≡ *C. panormitana* subsp. *seguenzae* (Lacaita) Greuter, Med-Checkl. 2: 126 (2008).

Common name: Fiordaliso di Seguenza (It), Seguenza’s knapweed (En).

Geographic distribution range: *Centaurea seguenzae* (Fig. 3) is endemic to Sicily and its distribution comprises a single population in the Peloritani mountains



Figure 3. *Centaurea seguenzae* (Lacaita) Brullo, Marcenò & Siracusa from *locus classicus* (Capo Tindari, Sicily). Photograph by S. Cambria.

(NE-Sicily; Fig. 4). As with other *Centaurea* species with a comparable stenochorous geographical pattern (e.g., *Centaurea phalacrica* Brullo, Cambria, Crisafulli, Tavilla & Sciandr. and *Centaurea valdemonensis* Domina, Di Grist., Barone; Brullo et al. 2021; Domina et al. 2022), in Sicily, *C. seguenzae* is confined to a narrow outcrop facing the Tyrrhenian Sea. In fact, this taxon grows exclusively on the rocky slopes of Capo Tindari, near the town of Patti (Messina province). It is spread across windy, rocky ridges close to the sea at an altitude up to 300 m a.s.l. on lithosols composed of Mesozoic marbles and calcium-silicate feldspars. Bioclimatically, according to Pesaresi et al. (2017), this area falls into the lower thermomediterranean thermotype and an upper dry ombrotpe.

Distribution: *Countries of occurrence:* Italy (Sicily).

Biology: *Plant growth form:* perennial (chamaephyte).

Chromosome number: $2n = 18$ (Viegi et al. 1972).

Phenology: flowering from May to June, fruiting from July to August.

Reproduction: there is no available detailed information.

Habitat and ecology: *Centaurea seguenzae* grows on coastal rocky cliffs exposed to the wind and is endemic to the Tyrrhenian part of the Peloritani mountains. The habitat in which it grows is mainly characterized by chasmophytes, such as *Erucastrum virgatum* C.Presl, *Dianthus rupicola* Biv. subsp. *aeolicus* (Lojac.) Brullo & Miniss., *Lomelosia cretica* (L.) Greuter & Burdet, *Sedum dasyphyllum* L. and *Teucrium*

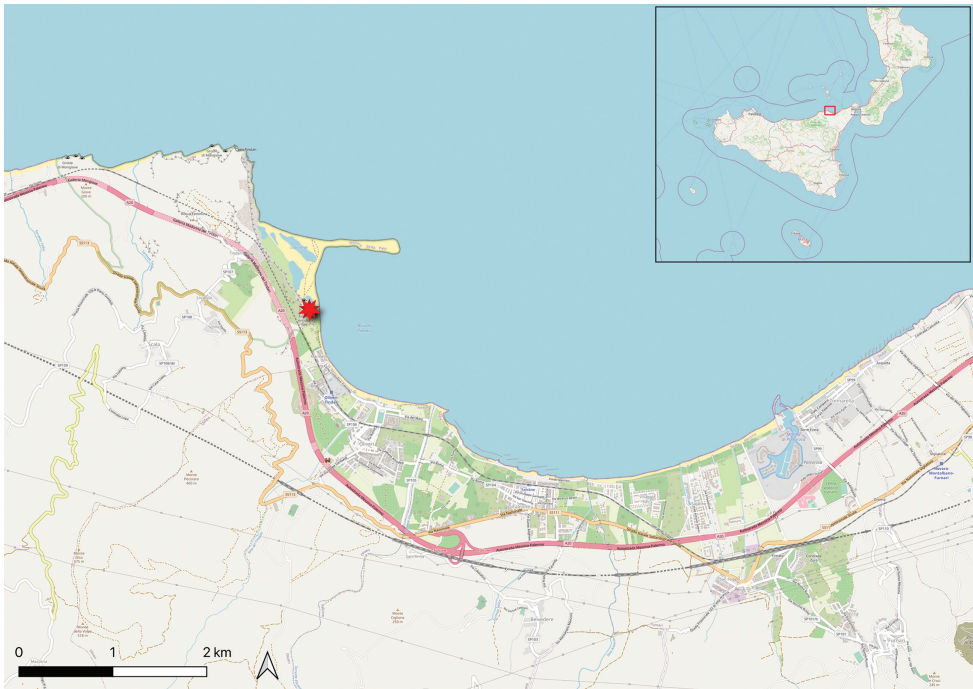


Figure 4. Geographic range and distribution map of *Centaurea seguenzae* (Lacaita) Brullo, Marcenò & Siracusa in Sicily (WGS84/Pseudo-Mercator map coordinate reference system).

flavum L. From a phytosociological point of view, the plant community belongs to the *Erucastretum virgati* Brullo & Marcenò, 1979 (*Asplenietea trichomanis* class). This species is also considered characteristic of the sub-association *centauretosum seguenzae* Brullo & Marcenò, 1979 (Brullo et al. 1998).

Population information: The existing population of *Centaurea seguenzae* comprises only a single stand. There is no detailed information available on population dynamics. A rough count of the currently known population of Capo Tindari showed a total of more than 250 mature individuals. However, because the cliffs where the plants grow are generally inaccessible, the total number of individuals might be underestimated. Based on direct observation, the overall trend in population size and number of mature individuals has not shown a significant decrease in the last few years.

Threats: *7.1 Fire and fire suppression:* the relatively inaccessible habitat faces threats of potential fires that can result from natural causes, human-caused accidents, or deliberate acts of arson. In fact, the Messina province, as well as the surrounding territories of Patti and Tindari, are periodically impacted by arson.

8.1 Invasive non-native/alien species: the rocky cliffs on which *C. seguenzae* grows are invaded by a large population of *Opuntia ficus-indica* (L.) Mill., which restricts the growing environment of the species. Currently, the lack of targeted management has led to a decrease of suitable sites for *C. seguenzae*, causing an uncontrolled spread of *O. ficus-indica* and, at the same time, a continuous decline of the habitat quality.

10.3 Landslides: the rocky cliffs are high susceptible to landslides and natural erosion; Capo Tindari is subject to continuous detachment of single blocks and also to the formation of small and massive landslides, like the one in the spring of 2009 near the Verde lagoon (Privitera and Torre 2011).

CRITERIA APPLIED:

Criterion B: **EOO:** 4 km²

AOO: 4 km² calculated with GeoCAT (Geospatial Conservation Assessment Tool) software (Bachman et al. 2011).

- a) Number of locations: the species is exclusively found in one location, and the two major threats are the occurrence of invasive alien species and landslides.
- b) Decline in quality of the habitat (iii).

Red List category and Criteria (Global Assessment)

CR	Critically Endangered	B1ab(iii)+2ab(iii)
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Rationale for the assessment: *Centaurea seguenzae* is a narrow endemic to Sicily. Specifically, it grows on the vertical cliffs of Capo Tindari, and several threats are expected to have a negative impact on the population dynamics in the near future. Despite the small size of the population and the location of most individuals in inaccessible areas, the population is threatened by the occurrence of invasive alien species and landslides, which determine a continuous decline in habitat quality and population area. Considering that the Area of Occupancy (AOO) is 4 km² this species may be assessed as Critically Endangered (CR) at the global level according to criterion B.

Previous assessment: This plant was previously assessed as Near Threatened at the global level (NT; Orsenigo et al. 2018; Rossi et al. 2020).

Conservation actions: The population falls within a Special Area of Conservation (SAC) belonging to the Natura 2000 network, namely “Laguna di Oliveri - Tindari” (code ITA030012). In addition, *Centaurea seguenzae* was one of the target species of the SiMaSeed project funded by the Interreg Italy-Malta 2014–2020 programme (Priority Axis III – Protecting the environment and promoting the efficient use of resources. Specific Objective 3.1). Genetic material, both living plants and seeds, are preserved *ex situ* at the seed bank of Catania University (BGS-CT); so far, over 8,000 seeds were stored (accession number SiMaSeed/CT/19/370).

Conservation actions needed: To better understand the reproductive biology and population trend of the species and to analyze the effects of human activities on the population, particularly those located in tourist areas, it is advisable to conduct further research and implement a monitoring program. Moreover, in order to protect the native growth habitat of the species, management of invasive alien plant species is urgently required.

Haloxylon persicum Bunge ex Boiss. & Buhse

Regional assessment (Iraq)

Taxonomy and nomenclature*Order*: Caryophyllales *Family*: Amaranthaceae

Haloxylon persicum Bunge ex Boiss. & Buhse, Nouv. Mém. Soc. Imp. Naturalistes Moscou 12: 189 (1860) = *Anabasis saxaul* Fisch. ex Ulbr. Nat. Pflanzenfam., ed. 2 [Engler & Prantl] 16c: 572, in syn. (1934) = *Arthrophytum arborescens* Litv. Trav. Mus. Bot. Acad. Petersb. 11: 44 (1913).

Common name: White Saksaul (En), Ghada (Arabic).

Geographic distribution range: *Haloxylon persicum* (Fig. 5) is a small tree, widespread in arid areas extending from Egypt to China. It is an Irano-Turanian species that apparently originated in Central Asia, where it is an important component of the desert vegetation (Mandaville 1986). In Iraq, only two small populations are present, located in the southern desert within the administrative borders of Al-Muthanna Governorate (Fig. 6). The first site (Busayyah) includes the largest number of trees, which form a 45-km-long strip in an approximately north-south direction, ca. 100 km south of Al-Nasiriya City, the capital of Dhi Qar Governorate. The second one (Qusair site) is located about 72 km southwest of the center of Dhi Qar Governorate, and 20 km south of Hammar Marsh.

Distribution: *Countries of occurrence:* Afghanistan, China, Egypt, Iran, Iraq, Jordan, Kazakhstan, Pakistan, Palestine, Qatar, Saudi Arabia, Tajikistan, Turkmenistan, United Arab Emirates, Uzbekistan.

Biology: *Plant growth form:* Tree (nanophanerophyte).

Flowering and fruiting time: *Haloxylon persicum* flowers from March to April.

Reproduction: no information on pollination and dispersal strategies is available. This species can reproduce vegetatively. In the laboratory, the optimum temperature for seed germination is 20–25 °C (100% germination), and each further increase in temperature decreases the percentage of germination (Al-Khalifah and Shanavaskhan 2007).

Habitat and ecology: *Haloxylon persicum* is a xerophytic desert plant native to sandy deserts in Central Asia, the Middle East, Afghanistan, north-western China, and Near Eastern deserts (Al-Khalifah and Shanavaskan 2007). It is often selected for the restoration of vegetation cover in arid and semiarid regions and deserts of the Irano-Turanian region, including Iran, Iraq, and Afghanistan (Abdi et al. 2019). The mean life span of *H. persicum* is between 15 and 25 years. This species tolerates high temperature and droughts and can be used for livestock feed and firewood, sand dunes stabilization, soil conservation, carbon sequestration, and erosion control in arid lands (Loni et al. 2017; Abdi et al. 2019). In Iraq, both sites are characterized by sandy dunes that are colonized by only a few plants, the most important of which is *Calligonum comosum* L'Hér. There are no temporary water courses in the two areas and the main source of water is rain, which has an annual rate of 93 mm. The plant is distributed in small, scattered groups, and to the best of our knowledge there are no plants cultivated *ex situ* in Iraq.



Figure 5. *Haloxylon persicum* at Busayyah site (Iraq). Photograph by Mohammad K. Mohammad.

Population information: There is no information on population size and trend at a global level for this widespread species. Currently, it is declining in parts of its range (Oldfield 2020) as in Iraq, where only two small populations remain. Until recently, this plant was very common in this country (Thalen 1979) and a dramatic decline in the number of individuals was observed only in the last decade. This sudden drop was caused by a change in the Bedouin tribal customs and traditions; in fact, while in the past the Bedouins used branches or stems of this plant for their fuel needs thereby safeguarding the trees, currently there are groups of people cutting the roots of *Haloxylon persicum* to smoke the hookah. Large (adult) trees are preferred by collectors. During the last monitoring, only 1,222 juvenile plants were counted in Iraq, 356 of them in the population near the Hammar Marsh and the remaining 866 in the second population.

Threats: *2.3 Livestock farming & ranching:* Camel, sheep and goat grazing is one of the most powerful threats to *Haloxylon persicum* both for nomadic owners (*2.3.1 nomadic grazing*) and the local farmers (*2.3.2 small-holder grazing, ranching or farming*).

4.1 Roads & railroads: the main routes for the local residents of the Bussiyya Village pass beneath *H. persicum* stands; although the traffic is light, the routes are not paved and, since the soil surface is very fragile, the traffic causes dense dust that damages the trees.

5.2 Gathering terrestrial plants - 5.2.1: intentional use: intensive logging is one of the major threats: *H. persicum* wood is one of the finest types of firewood as it burns

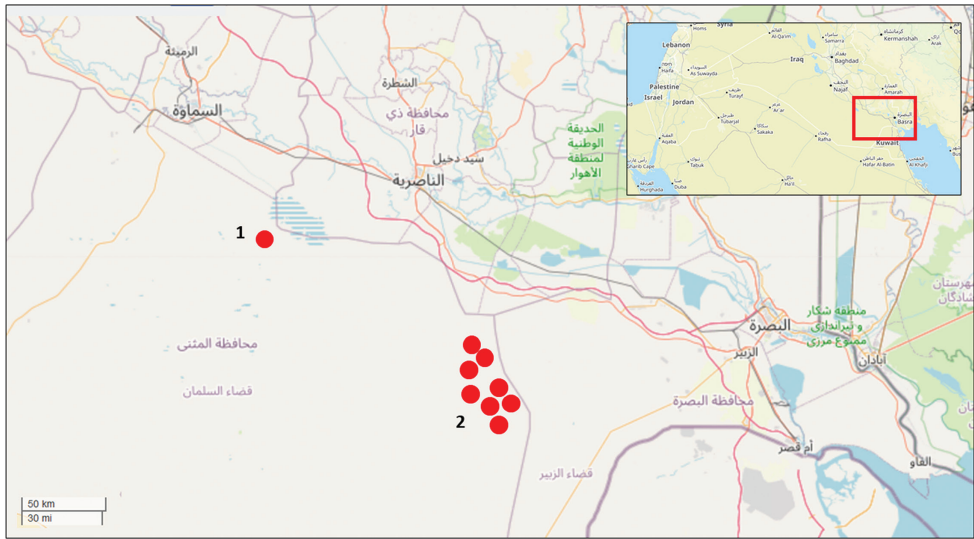


Figure 6. Geographic range and distribution map of *Haloxylon persicum* in Iraq: 1 – Qusair site, located about 20 km south of Hammar Marsh; 2 – Busayyah site, located 100 km south of Al-Nasiriya City.

for a longer time than other types, consequently it is targeted by firewood traders for private use in hookah smoking.

6.1 Recreational activities: during the winter Gulf festivals, local residents camp in the area causing damage to the *H. persicum* trees. In addition, tourists usually go to the area with off-road vehicles, causing habitat degradation; they also cut the plants for firewood and other camping purposes.

11.2 Droughts: the whole area has experienced three consecutive years of severe drought; the driest region of Iraq is located near Nasiriya, which is only about 72 km from the study area.

11.3 Temperature extremes: The southern desert regions of Iraq are known for severe continental climatic extremes. The hottest temperature measured from 1949 to March 2022, 53.8 °C, was reported by the Basrah Airport weather station, not far from the population's growth area. The lowest temperature, reported by the weather station of Samawa (6 m a.s.l.), was -13.8 °C in January 2020. The combination of these extreme temperatures is expected to have a negative effect on the *Haloxylon persicum* populations.

CRITERIA APPLIED:

Criterion B: **EOO:** 1,084.96 km² calculated with GeoCAT (Geospatial Conservation Assessment Tool) software (Bachman et al. 2011).

AOO: 136 km² calculated with GeoCAT software (Bachman et al. 2011).

a) Iraqi populations are highly fragmented.

b) Continuing decline, observed in extent of occurrence, area of occupancy, extent and quality of habitat, number of locations and subpopulations, and number of mature individuals.

Criterion C: the Iraqi population, in continuous decline, currently does not include any mature individual, but it is composed of 1,222 juvenile plants; no subpopulation has more than 1,000 mature plants.

Criterion D: the Iraqi population includes no mature individual.

Red List category and Criteria (Regional Assessment)

CR	Critically Endangered	C2a(i) + D
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Rationale for the assessment: *Haloxylon persicum* is a widespread tree in arid areas from Egypt to China. Currently, it is declining in parts of its range as in Iraq, where only two small populations remain. In recent years, the Iraqi population has experienced a dramatic decline in the number of mature individuals mainly caused by indiscriminate withdrawal. Currently, there are only 1,222 juvenile plants split into two fragmented populations, exposed to severe threats. Climate change is projected to further reduce the available habitat of this restricted species. According to criteria C and D, *Haloxylon persicum* can be assessed as Critically Endangered (CR) at a regional level.

Previous assessment: this species was evaluated as Least Concern (LC) at the global level (Oldfield 2020). At a regional level, *Haloxylon persicum* is recorded as Vulnerable in China and Jordan, and Endangered in Egypt (BGCI 2018). It was also assessed as Endangered in the UAE at a National Red List Workshop held in 2019.

Conservation actions: there are currently no protection or conservation measures in place for this species in Iraq.

Conservation actions needed: Research and monitoring programmes are recommended in order to investigate the population dynamics of this species. In addition, as proposed for other threatened plants in the area (Mohammad et al. 2022), *in situ* and *ex situ* conservation measures are suggested for potential plant translocation programmes, with the goal to increase the low number of individuals in the population. In addition, an awareness programme for the local population (especially young people) should accompany all these measures.

Note: The issue of conservation for this plant is mainly social, legal, and linked to tribal customs and traditions. In interviews, local resident said that *H. persicum* may reach up to 5 m in height, and can provide shade for up to four camels under its canopy; the present juvenile plants are from 0.4–0.7 m to *ca.* 1.6 m tall. Loggers cut the stem close to the ground, then tie a rope around the root system and pull it by car, thus compromising also the plant's vegetative reproduction. The roots are used in the hookah because they burn for a long time and give a pleasant smell.

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***Candolleomyces cladii-marisci* (Psathyrellaceae), a new combination**

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Psathyrella cladii-marisci Sicoli, N.G. Passal., De Giuseppe, Palermo, Pellegrino, D. Deschuyteneer & Voto is a species of Psathyrellaceae recently described from southern Italy and reported also from Belgium. This species was placed in the genus *Psathyrella* (Fr.) Quél. based on morphological characters including small-medium size, greyish and pale clay to deep brown, thin, fragile, non-deliquescent basidiomata with lamellae as hymenophore, smooth, truncated and dark basidiospores, and versiform hymenial cystidia intermingled with sphaeropedunculate and clavate cells along the gill edge.

However, the suite of characters cited by the authors to support this placement defines an overly broad and now-superseded concept of the genus. A recent work led to a refinement of the concept of *Psathyrella* on the basis of morphological and molecular evidence (Wächter and Melzer 2020). According to this study, *Psathyrella* s.l. was further divided into three genera (*Britzelmayria* D. Wächt. & A. Melzer, *Candolleomyces* D. Wächt. & A. Melzer and *Olotia* D. Wächt. & A. Melzer) and some of the species which had formerly been placed in the genus *Psathyrella* have been transferred to other new genera.

While reporting two new rare species of *Candolleomyces* from China, Yan (Bau & Yan 2021) proposed a new combination for *Psathyrella cladii-marisci* based on a molecular (ITS) analysis: *Candolleomyces cladii-marisci* (G. Sicoli, N.G. Passalacqua, A.B. De Giuseppe, A.M. Palermo & G. Pellegrino) J.Q. Yan comb. nov. Moreover, a new record of *C. cladii-marisci* was recently reported from Thailandia based on a morphological and molecular (ITS and LSU) identification (Bhunjun et al. 2022). However,

the new combination was referred to the name *P. cladium-mariscii* Sicoli, N.G. Passal., De Giuseppe, Palermo & Pellegrino (Sicoli et al. 2019a), which was invalidly published because the protologue had not included the citation of the identifier issue for the name by a recognized repository (Turland et al. 2018: Art. F.5.1), thus rendering invalid the new combination, too. Recently, the name was validly published by Sicoli et al. (2022), also integrating the first invalid description with some corrections (Sicoli et al. 2019b), and including further details from the second new detection from Europe (Deschuyteneer et al. 2020).

Here, we transfer the validly published name to *Candolleomyces* and make the new combination.

***Candolleomyces cladii-marisci* (Sicoli, N.G. Passal., De Giuseppe, Palermo, Pellegrino, D. Deschuyteneer & Voto) N.G.Passal. & Sicoli, comb. nov.**

Psathyrella cladii-marisci Sicoli, N.G. Passal., De Giuseppe, Palermo, Pellegrino, D. Deschuyteneer & Voto Mycological Observations 3: 44 (2022)[Basionym].

Type. ITALY. Calabria, Cosenza, Rende, Orto Botanico Università della Calabria. 39°21'25.05"N, 16°13'44.57"E, 220 m a.s.l., marsh at the base of cut culms of a *Cladium mariscus* (L.) Pohl plant, transplanted from Lago dell'Aquila (Laureana di Borrello, Reggio Calabria, southern Italy) at the corner of a concrete tank maintained full of water, 10 April 2018, Antonio Biagio De Giuseppe & Giovanni Sicoli (holotype CLU F302).

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Notulae to the Italian alien vascular flora: 14

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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, confirmations, and status changes for Italy or for Italian administrative regions. Nomenclatural and distribution updates, published elsewhere, and corrections are provided as Suppl. material 1.

Keywords

Alien species, floristic data, Italy, nomenclature

How to contribute

The text for the new records should be submitted electronically to Lorenzo Lastrucci (lorenzo.lastrucci@unifi.it). The corresponding specimen along with its scan or photograph has to be sent to FI Herbarium: Museo di Storia Naturale (Botanica), Sistema Museale di Ateneo, Via G. La Pira 4, 50121 Firenze (Italy). Those texts concerning nomenclatural novelties (typifications only for accepted names), exclusions, and confirmations should be submitted electronically to Gabriele Galasso (gabriele.galasso@comune.milano.it). Each text should be within 1,000 characters (spaces included).

Floristic records

Abies nordmanniana (Steven) Spach subsp. *nordmanniana* (Pinaceae)

+ (CAS) **TAA**: Trento (Trento), fraz. Meano (WGS84: 46.133649°N, 11.124639°E), radura boschiva di un bosco termofilo a roverella, 455 m, 17 October 2021, *G. Bonari* (FI). – Casual alien species new for the flora of Trentino-Alto Adige.

This species occurs with an individual in a thermophilous oak forest of Adige Valley. The other herbarium specimens from bottom-valley sites testify for the use of this species in afforestation since many years and support the limited spread of this species at sites [e.g., Ala (Trento), fraz. Serravalle all'Adige, sentiero per loc. Fortini (WGS84: 45.815032°N, 11.018794°E), esemplari sparsi (piantati) nel bosco di pino nero, 400 m, 7 January 2005, leg. *F. Prosser* sub *Abies cephalonica*, rev. *F. Prosser* 2021 (ROV)]. Furthermore, this species is cultivated as Christmas tree in Val Sugana (*G. Bonari* pers. obs.) and sometimes planted in gardens (e.g., in Calamento valley, *G. Bonari* pers. obs.). This species can be distinguished from similar ones for having non-resinous buds, glabrous branches and non-prickly needles.

G. Bonari, F. Prosser

Acacia dealbata Link (Fabaceae)

+ (NAT) **UMB**: Orvieto (Terni), loc. Tordimonte, lungo la strada SP98 (WGS84: 42.682246°N, 12.193114°E), margine stradale, 314 m, 20 February 2022, leg. *M.*

Mugnai, M. Vinci, det. *M. Mugnai, L. Lazzaro, G. Ferretti* (FI). – Naturalized alien species new for the flora of Umbria.

Several adult individuals along the provincial road originated from seeds produced by nearby trees. We observed a substantial spreading of the species with individuals at different growth stages occurring along the road.

M. Mugnai, L. Lazzaro

***Acacia pycnantha* Benth. (Fabaceae)**

+ (INV) **SAR**. – Status change from naturalized to invasive alien for the flora of Sardegna.

Acacia pycnantha was commonly used for afforestation and reforestation in Sardegna. Although less common in coastal areas, this species is showing similar invasive behavior to *A. saligna* (Labill.) H.L.Wendl. in several inland areas (up to ca. 500 m a.s.l.) but also in a few sites along the coast (e.g., at the edges of a *Pinus* plantation, WGS84: 40.466866°N, 9.775060°E).

M. Fois, A. Cuenca-Lombraña, G. Brundu, V. Lozano

***Achillea filipendulina* Lam. (Asteraceae)**

+ (CAS) **SAR**: Capoterra (Cagliari), Rio Santa Lucia (WGS84: 39.1702743°N, 8.9973075°E), banco fluviale, 3 m, 5 July 2022, *A.P. Lecis, L. Podda, A. Lallai* (FI, CAG). – Casual alien species new for the flora of Sardegna.

A group of four flowering individuals was found along the riverbank, probably originated from seeds of plants growing nearby.

A.P. Lecis, L. Podda, A. Lallai

***Amaranthus viridis* L. (Amaranthaceae)**

+ (CAS) **MOL**: Isernia (Isernia), Via J.F. Kennedy 92 (WGS84: 41.59408°N, 14.23302°E), margine stradale, 463 m, 29 July 2021, leg. *A. Hussain*, det. *A. Hussain, P. Fortini, D. Iamónico* (FI, IS No. IS-1003, RO). – Casual alien species new for the flora of Molise.

A few individuals were found.

A.N. Hussain, P. Fortini, D. Iamónico

***Anethum graveolens* L. (Apiaceae)**

+ (CAS) **PUG**: Rocchetta Sant'Antonio (Foggia), loc. Santuario della Madonna del Pozzo (WGS84: 41.091227°N, 15.444830°E), margine stradale/coltivi, 452 m, 6 July 2022, *G. Buccomino* (FI). – Casual alien species new for the flora of Puglia.

G. Buccomino

***Bignonia capreolata* L. (Bignoniaceae)**

+ (CAS) **ITALIA (LOM)**: Milano (Milano), piazza d'Armi, tra Via delle Forze Armate, Via della Rovere e Via G. Mazzarino (WGS84: 45.462558°N, 9.118055°E), margine incolto, 124 m, no exp., 24 May 2022, leg. G. Galasso, R. Gentili, L.A. Quaglini, det. G. Galasso (FI, MSNM barcode MSNM51826). – Casual alien species new for the flora of Italy (Lombardia).

Bignonia capreolata is a species native to SE-North America (Britton and Brown 1913). One sterile individual was found.

G. Galasso, R. Gentili, L.A. Quaglini

***Broussonetia papyrifera* (L.) Vent. (Moraceae)**

+ (INV) **LAZ.** – Status change from naturalized to invasive alien for the flora of Lazio.

In Ferentino (Frosinone), we found several sites where this species is widespread and colonizes ruderal areas and abandoned fields, even forming dense thickets (e.g., WGS84: 41.679429°N, 13.256788°E; 41.704276°N, 13.265966°E; 41.689602°N, 13.256781°E). We therefore propose its status change from naturalized to invasive alien.

E. Fanfarillo, T. Fiaschi

***Campanula portenschlagiana* Schult. (Campanulaceae)**

+ (CAS) **LAZ**: Jenne (Roma), centro storico (WGS84: 41.886577°N, 13.168036°E), vecchi muri, 815 m, 15 November 2021, leg. L. Rosati, det. L. Rosati, L. Cancellieri (FI). – Casual alien species new for the flora of Lazio.

L. Rosati, L. Cancellieri

***Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone (Poaceae)**

+ (CAS) **ITALIA (CAL)**: Catanzaro (Catanzaro), Parco della Biodiversità Mediterranea (WGS84: 38.922443°N, 16.580986°E), muro di contenimento in cemento da cui fuoriesce una perdita d'acqua, 404 m, 18 March 2022, A. Capuano (FI). – Casual alien species new for the flora of Italy (Calabria).

This species, identified according to Maire (1952) and Wipff (2003), has been used to create a small lawn in a nearby area. *Cenchrus clandestinus* is native to humid highlands of central and eastern Africa. It has been introduced as pasture and ornamental grass to temperate and subtropical regions of America and Australia, where it shows adaptations to different environmental conditions (Fraser et al. 2017). It usually reproduces by vegetative propagation by rhizomes (Arango Gaviria et al. 2019).

A. Capuano

***Centaurea diluta* Aiton (Asteraceae)**

+ (NAT) **PUG**: Gravina (Bari), agro di Gravina, al bordo del vulcanello (WGS84: 40.702861°N, 16.429033°E), incolto, 210 m, 27 April 2022, *M. Terzi, F.S. D'Amico* (FI). – Naturalized alien species new for the flora of Puglia.

Centaurea diluta is present along an uncultivated strip, near the border between Puglia and Basilicata. This species was also found close to the border on the Basilicata side (Galasso et al. 2021).

M. Terzi, F.S. D'Amico

***Chloris gayana* Kunth (Poaceae)**

+ (CAS) **CAL**: Catanzaro (Catanzaro), Parco della Biodiversità Mediterranea (WGS84: 38.920250°N, 16.581116°E), pendio erboso incolto, 403 m, 16 February 2022, *A. Capuano* (FI). – Casual alien species new for the flora of Calabria.

The few observed individuals have been uprooted in order to prevent a future colonisation.

A. Capuano

***Chrysanthemum morifolium* (Ramat.) Hemsl. (Asteraceae)**

+ (CAS) **ITALIA (VEN)**: Verona (Verona), presso la città di Verona in Lungadige Cangrande, lungo la sponda dell'Adige, tra il fiume e l'argine murato (WGS84: 45.44243142°N, 10.98234527°E), sponda erbosa periodicamente inondata, un esemplare in fiore ben radicato nel terreno, 51 m, 15 December 2021, leg. *F. Menini*, det. *F. Menini, G. Galasso* (FI). – Casual alien species new for the flora of Italy (Veneto).

This species was reported as alien by several authors (Goiran 1900; Puccini 1950), but only cultivated or escaped within gardens (Galasso et al. 2018).

F. Menini, G. Galasso

***Cornus sericea* L. subsp. *sericea* (Cornaceae)**

+ (CAS) **VEN**: Roana (Vicenza), fraz. Camporovere, imbocco sentiero boschivo per il Tanzerloch (WGS84: 45.882409°N, 11.475303°E), margine boschivo al limitare di prato da sfalcio, 1030 m, 24 August 2022, *S. Tasinazzo* (FI). – Casual alien species new for the flora of Veneto.

A surface of 2 m² was occupied by a clump of non blooming individuals, already observed in August 2021.

S. Tasinazzo

***Dysphania pumilio* (R.Br.) Mosyakin & Clemants (Amaranthaceae)**

+ (NAT) **VEN**: Chioggia (Venezia), Ca' Lino (WGS84: 45.162913°N, 12.298620°E), orto, -1 m, 30 October 2021, *S. Tasinazzo* (FI); *ibidem*, Ca' Zadra (WGS84:

45.152445°N, 12.296484°E), coltivo, -1 m, 30 October 2021, *S. Tasinazzo* (*Herb. S. Tasinazzo*); *ibidem*, 26 September 2022, *S. Tasinazzo* (*Herb. S. Tasinazzo*). – Naturalized alien species new for the flora of Veneto.

S. Tasinazzo

***Ehrharta erecta* Lam. (Poaceae)**

+ (CAS) **CAL**: Catanzaro (Catanzaro), Parco della Biodiversità Mediterranea (WGS84: 38.918430°N, 16.580912°E), dentro alcune siepi e aiuole in posizione semiombraggiata, ca. 388 m, 10 February 2022, *A. Capuano* (FI); *ibidem*, Via Piave (WGS84: 38.913589°N, 16.585429°E), lungo il marciapiede, nelle aiuole sotto alcuni alberi e in un giardino incolto, 352 m, 2 August 2022, *A. Capuano* (FI). – Casual alien species new for the flora of Calabria.

Several individuals were observed.

A. Capuano

***Eragrostis pectinacea* (Michx.) Nees (Poaceae)**

+ (NAT) **CAL**: Santa Sofia d'Epiro (Cosenza), loc. Faudano, nei pressi del Fiume Crati (destra idrografica) (WGS84: 39.589711°N, 16.264669°E), fossato e ambiente umido a margine strada, 70 m, 17 July 2012, leg. *L. Bernardo*, *A. Soldano*, *D. Puntillo*, det. *F. Verloove* (FI, CLU No. 26304, *Herb. A. Soldano* No. 16014). – Naturalized alien species new for the flora of Calabria.

A. Soldano, L. Bernardo, F. Verloove

***Erythranthe guttata* (DC.) G.L.Nesom (Phrymaceae)**

+ (CAS) **VEN**: Zevio (Verona), loc. Ponte Perez, lungo la sponda destra del Fiume Adige (WGS84: 45.37996092°N, 11.13532127°E), greto ghiaioso/sabbioso del fiume, un esemplare in antesi, 27 m, 24 May 2022, *F. Menini* (FI); Belfiore (Verona), loc. Lorosi, lungo la sponda sinistra del Fiume Adige (WGS84: 45.37091748°N, 11.18414264°E), greto ghiaioso/sabbioso del fiume, 27 m, 24 June 2022, *F. Menini* (VER); Verona (Verona), loc. Porto San Pancrazio, lungo la sponda destra del Fiume Adige (WGS84: 45.42776403°N, 11.01548551°E), sponda melmosa del fiume, 46 m, 28 June 2022, *F. Menini* (VER). – Casual alien species new for the flora of Veneto.

F. Menini, S. Andreatta

***Eschscholzia californica* Cham. subsp. *californica* (Papaveraceae)**

+ (CAS) **BAS**: Lauria (Potenza), fraz. Pecorone (WGS84: 40.072333°N, 15.857557°E), bordo strada, 778 m, 18 June 2020, leg. *A. Montesano* (FI). – Casual alien species new for the flora of Basilicata.

A. Montesano, S. Fascetti, L. Rosati

***Fatoua villosa* (Thunb.) Nakai (Moraceae)**

+ (CAS) **ITALIA (SAR)**: Pula (Cagliari), fraz. Santa Margherita di Pula (WGS84: 38.968344°N, 8.965075°E), aree marginali nei pressi di serre e vivai, 15 m, 17 June 2022, *G. Bacchetta*, *G. Loi*, *G. Calvia* (FI, CAG). – Casual alien species new for the flora of Italy (Sardegna).

Fatoua villosa is an annual herb native to East Asia, Pacific islands, and Australia (Zhekun and Gilbert 2003) and reported for Europe only in Corsica (Puddu et al. 2016). A few individuals have been observed.

G. Bacchetta, G. Loi, G. Calvia

***Graptopetalum paraguayense* (N.E.Br.) Walther subsp. *paraguayense* (Crassulaceae)**

+ (CAS) **LAZ**: Sant'Angelo Romano (Roma), Via Roma all'altezza del civico 82/a (WGS84: 42.036886°N, 12.714044°E), parete calcarea sul bordo della strada, 350 m, 18 January 2022, *M. Giardini* (FI). – Casual alien species new for the flora of Lazio.

In Sant'Angelo Romano, at least three luxuriant individuals grow spontaneously on a limestone wall, probably originated from specimens cultivated in the balconies above. Similarly, it is possible to explain the presence of *Sedum palmeri* S. Watson and *Aloë maculata* All. subsp. *maculata* in the same site.

M. Giardini

***Hertia cheirifolia* (L.) Kuntze (Asteraceae)**

+ (CAS) **ITALIA (LOM)**: Bergamo (Bergamo), Via San Martino della Pigrizia, muro sul lato NW (WGS84: 45.702992°N, 9.648287°E), muro, 331 m, SE, 27 February 2022, *E. Banfi* (FI, MSNM barcode MSNM51577). – Casual alien species new for the flora of Italy (Lombardia).

A description of the plant is given by Iamonico and El Mokni (2021) along with the species' typification. It is native to Algeria and Tunisia and, since a few decades, it is the object of floricultural trade at least in Bergamo, where attempts at cultivation in flowerbeds in the Lower City have not had the same success as the plant growing spontaneously on the wall of the Upper City (Luca Mangili, pers. comm.).

E. Banfi, G. Galasso

***Honorius nutans* (L.) Gray (Asparagaceae)**

+ (CAS) **TOS**: Cavriglia (Arezzo), lungo strada SP408 di Montevarchi tra C. Olivacci e Tribolino (WGS84: 43.509780°N, 11.481830°E), margine di querceto ceduo, 100 m, 26 March 2022, *L. Pinzani* (FI, *Herb. L. Pinzani*). – Casual alien species confirmed for the flora of Toscana.

Honorius nutans was last reported in Toscana by Baroni (1908). At the site, this species forms a small population consisting of 20 mature individuals.

L. Pinzani

***Hydrangea macrophylla* (Thunb.) Ser. (Hydrangeaceae)**

+ (NAT) **VEN.** – Status change from casual to naturalized alien for the flora of Veneto.

In Veneto *Hydrangea macrophylla* is considered as casual alien in Vicenza province (Masin and Scortegagna 2012; Argenti et al. 2019). A new population was found in 2008 in Sedico (Belluno): fraz. Peron (CFCE: 9838/2), margin of road, 400 m, 7 July 2008, C. Argenti (RO, *Herb. C. Argenti*). Subsequent field surveys (up to July 2022) confirmed the occurrence of this population and led to discover further two populations in Borgo Valbelluna (Belluno), fraz. Cordellon and in Gosaldo (Belluno), fraz. Zavat. The species regularly produces abundant flowers and it is able to sustain itself. We consider *H. macrophylla* as naturalized in Veneto.

D. Iamónico, C. Argenti

***Juglans nigra* L. (Juglandaceae)**

+ (CAS) **MAR:** Apecchio (Pesaro e Urbino), fraz. Serravalle di Carda (WGS84: 43.537994°N, 12.503523°E), vegetazione arbustiva su suolo calcareo legata alla dinamica di rinaturalizzazione di un frutteto abbandonato, 680 m, 28 August 2022, leg. G. Mei, E. Ligato, S. Tassone, det. G. Mei (FI, *Herb. G. Mei*). – Casual alien species new for the flora of Marche.

A couple of young individuals originated from seed, about 30 cm tall, were observed in an uncultivated area occupied by disturbed vegetation dominated by shrubs and lianose plants. Nearby there is a walnut tree, about 10 m tall, residual of an old planting.

G. Mei, S. Tassone, E. Ligato

***Lepidium virginicum* L. subsp. *virginicum* (Brassicaceae)**

+ (NAT) **SAR:** Palau (Nord-Est Sardegna), loc. Porto Pollo (WGS84: 41.189607°N, 9.321279°E), duna fissa con *Ephedra distachya* e *Armeria pungens*, presente in una vasta area del sistema dunale e lungo le cunette stradali, 23 m, 2 June 2022, G. Brundu, V. Lozano (FI, *Herb. UniSS-Agraria*). – Naturalized alien species new for the flora of Sardegna.

This species was observed also on the eastern coast of Sardegna, in a dusty parking area (WGS84: 40.479964°N, 9.808424°E).

G. Brundu, V. Lozano

***Ligustrum lucidum* W.T.Aiton (Oleaceae)**

+ (INV) **LAZ.** – Status change from naturalized to invasive alien for the flora of Lazio.

In recent years, the rapid colonization by *Ligustrum lucidum* from seeds has been observed in several sites in the Rome metropolitan area (e.g., WGS84: 41.914809°N, 12.471324°E; 41.919734°N, 12.474257°E), particularly along the river Tevere, on monuments and in archaeological sites (Celesti-Grapow and Ricotta 2020).

L. Celesti-Grapow, F. Emili

+ (CAS) **BAS**: Potenza (Potenza), Fiume Basento (WGS84: 40.628475°N, 15.808076°E), lungo le sponde, 665 m, 25 June 2022, leg. *L. Rosati*, det. *L. Rosati*, *G. Potenza*, *S. Fascetti* (FI, HLUC No. 13881). – Casual alien species new for the flora of Basilicata.

Several flowering individuals were observed within the patches of a *Salix alba* L. riparian forest.

G. Potenza, L. Rosati, S. Fascetti

***Lobelia erinus* L. (Campanulaceae)**

+ (CAS) **SAR**: Villanovaforru (Sud Sardegna), ambiente urbano (WGS84: 39.632595°N, 8.865828°E), crepe dei muri e marciapiedi, 328 m, 8 June 2022, *F. Mascia*, *L. Podda*, *G. Bacchetta* (FI, CAG). – Casual alien species new for the flora of Sardegna.

Some individuals were found inside the village.

F. Mascia, L. Podda, G. Bacchetta

***Magnolia grandiflora* L. (Magnoliaceae)**

+ (CAS) **LOM**: Gardone Riviera (Brescia), Piazza P. Scarpetta, di fronte al municipio (WGS84: 45.621831°N, 10.561928°E), aiuola, 116 m, no exp., 15 April 2022, leg. et det. *M. Merli*, conf. *G. Galasso* (FI). – Casual alien species new for the flora of Lombardia.

M. Merli, G. Galasso

***Melia azedarach* L. (Meliaceae)**

+ (CAS) **LOM**: Milano (Milano), Parco del Ticinello (WGS84: 45.421100°N, 9.182687°E), boschina spontanea, 107 m, no exp., 15 June 2022, *G. Galasso* (FI, MSNM barcode MSNM51916, MSNM51917). – Casual alien species new for the flora of Lombardia.

G. Galasso

***Mesembryanthemum ×vascosilvae* (Gideon F.Sm., E.Laguna, Verloove & P.P.Ferrer) L.Sáez & Aymerich (Aizoaceae)**

+ (CAS) **CAM**: Positano (Salerno), arcipelago de Li Galli, Isola del Gallo Lungo (WGS84: 40.582144°N, 15.443412°E), margini della pineta su rupi calcaree

marittime, ca. 20 m, 30 June 2022, *E. Del Guacchio*, *R. Vallariello*, *L. Paino*, *C. Guidone* (FI). – Casual alien nothospecies new for the flora of Campania.

Massively planted as ground cover along paths on this islet and escaped. Formally described only in recent times (Smith et al. 2020, sub *Aptenia*), this overlooked hybrid is widely cultivated throughout Italy, nowadays more than its parental *Mesembryanthemum cordifolium* L.f. The repeated indications for Campania of the latter species (Capri Island) (Del Guacchio and La Valva 2017) need to be verified.

E. Del Guacchio, R. Vallariello, G. Galasso

***Narcissus Jonquilla* and *Apodanthus Daffodil* Group (Division 7) (Amaryllidaceae)**

+ (CAS) **VEN**: San Giovanni Ilarione (Verona), loc. Castello, a S della chiesa di San Giovanni Battista (WGS84: 45.52671016°N, 11.23706344°E), argine boscato, una decina di cespi, 295 m, 7 March 2022, leg. *F. Menini*, det. *E. Banfi* (FI, VER No. SA926). – Casual alien cultivar group new for the flora of Veneto.

The collected plants showed the characteristics of the cultivar ‘Sweetness’.

F. Menini, E. Banfi, G. Galasso

***Oenothera speciosa* Nutt. (Onagraceae)**

+ (CAS) **SAR**: Masainas (Sud Sardegna), loc. Sa Reina (WGS84: 39.044167°N, 8.623333°E), incolti, 38 m, 29 April 2021, *A. Pisano*, *G. Bacchetta*, *A. Lallai* (FI, CAG). – Casual alien species new for the flora of Sardegna.

Some specimens have been found growing in the pastures near houses.

A. Pisano, G. Bacchetta, A. Lallai

***Oxalis purpurea* L. (Oxalidaceae)**

+ (CAS) **CAL**: Palmi (Reggio Calabria), Contrada Sant’Elia (WGS84: 38.332833°N, 15.839583°E), bordo sentiero in terra battuta, 550 m, 14 April 2022, leg. *G. Posillipo*, det. *V.L.A. Laface*, *C.M. Musarella*, *G. Posillipo*, *G. Spampinato* (FI, REGGIO). – Casual alien species new for the flora of Calabria.

The very small observed population occupies an area of approximately 5 m². In addition to Sicilia, it is naturalized in Campania, but only within the Portici Botanical Garden (Stinca and Motti 2009).

V.L.A. Laface, C.M. Musarella, G. Posillipo

***Pachysandra terminalis* Siebold & Zucc. (Buxaceae)**

+ (CAS) **VEN**: Verona (Verona), Borgo Trento, Via IV Novembre lungo il marciapiede (WGS84: 45.44454303°N, 10.98968109°E), interstizio alla base del muro di un’abitazione, frammista a *Parietaria judaica*, 60 m, 21 March 2022, *F. Menini* (FI). – Casual alien species new for the flora of Veneto.

F. Menini, S. Andreatta

***Parthenocissus inserta* (A.Kern.) Fritsch (Vitaceae)**

+ (INV) **TOS.** – Status change from casual to invasive alien for the flora of Toscana.

On the ancient wall of the city of Pisa we found many plants covering a large area [sulle mura nei pressi della Torre Piezometrica (WGS84: 43.72034°N, 10.40914°E), invasiva sulle mura, 25 m, 21 May 2022, *F. Roma-Marzio 1798* (PI No. 061324)]. Many plants were also observed along the railroad tracks about 5 km from the railway station of Pisa in the direction of Firenze. Furthermore, after a revision of the specimens preserved in PI, it is also reported in the Regional Park of Migliarino-San Rossore-Massaciuccoli [Pisa (Pisa), Parco di Migliarino-San Rossore-Massaciuccoli, Tenuta di Tombolo al Bosco dell'Ulivo (WGS84: 43.60451°N, 10.35298°E), ambienti salmastri e sinantropici, 0–5 m, 9 June 2018, *Partecipanti all'escursione Wikiplantbase #Migliarino-San Rossore-Massaciuccoli* (PI No. 021484)]. In our opinion, most of the regional data concerning *Parthenocissus quinquefolia* (L.) Planch. (Peruzzi and Bedini 2013 [onwards]; Roma-Marzio et al. 2016) could be referred to *P. inserta*. Accordingly, we consider the status of invasive species as more appropriate for *P. inserta* in Toscana.

F. Roma-Marzio

***Paspalum dasyleurum* Kunze ex É.Desv. (Poaceae)**

+ (NAT) **LOM.** – Status change from casual to naturalized alien for the flora of Lombardia.

Abundant and frequent in Bergamo, Via Ghisleni Mazzola [(WGS84: 45.699891°N, 9.646808°E), margine erboso, 262 m, no exp., 23 July 2022, *E. Banfi* (FI, MSNM barcode MSNM52003, MSNM52004, MSNM52005)].

E. Banfi, G. Galasso

***Phlox caespitosa* Nutt. (Polemoniaceae)**

+ (CAS) **ITALIA (ABR):** L'Aquila (L'Aquila), loc. Palombara (WGS84: 42.342290°N, 13.429072°E), margine stradale, 666 m, 13 April 2020, leg. *F. Bartolucci*, det. *F. Bartolucci*, *F. Conti* (FI, APP No. 66130). – Casual alien species new for the flora of Italy (Abruzzo).

The collected specimen was identified following Wherry (1955) and Brown (2000). A few plants have been observed from 2019 to today, growing spontaneously along the roadside.

F. Bartolucci, F. Conti

***Phyllostachys viridis* (R.A.Young) McClure (Poaceae)**

+ (NAT) **LOM.** – Status change from casual to naturalized alien for the flora of Lombardia.

In several small woods in Milano [Boscoincittà (WGS84: 45.482703°N, 9.094525°E), robinieto, 131 m, no exp., 2 June 2022, leg. *G. Galasso*, det. *E. Banfi*

♂ *G. Galasso* (MSNM barcode MSNM51900, MSNM51901, MSNM51902, MSNM51903, MSNM51904); Parco del Ticinello, lungo la Roggia Ticinello, pressi di Cascina Campazzino (WGS84: 45.419655°N, 9.187769°E), boschetto su sponda di roggia, 108 m, no exp., 15 June 2022, leg. *G. Galasso*, det. *E. Banfi* & *G. Galasso* (MSNM barcode MSNM51918)] and Bergamo [Via San Sebastiano, lato a monte (WGS84: 45.710874°N, 9.635844°E), pendio erboso stradale, 380 m, NW, 17 June 2022, *E. Banfi* (MSNM barcode MSNM51922); Via Castagneta, lato a monte (WGS84: 45.718273°N, 9.656700°E), margine erboso stradale, 290 m, NE, 24 June 2022, *E. Banfi* (MSNM barcode MSNM51923)], crop residues expand widely within the undergrowth or along the edges.

E. Banfi, G. Galasso

***Picea orientalis* (L.) Peterm. (Pinaceae)**

+ (CAS) **PIE**: Torino (Torino), Collina di Torino, versante N presso il Colle della Maddalena (WGS84: 45.030659°N, 7.717236°E), bosco misto di latifoglie in prossimità di un piccolo nucleo artificiale di *Picea orientalis*, 658 m, 21 January 2022, *M. Lonati*, *G. Nota*, *D. Barberis* (FI). – Casual alien species new for the flora of Piemonte.

Numerous seedlings are present at this site below the canopy of broadleaf trees. Indeed, this species is markedly shade-tolerant in its juvenile stages.

M. Lonati, G. Nota, D. Barberis

***Platycladus orientalis* (L.) Franco (Cupressaceae)**

+ (NAT) **ABR**. – Status change from casual to naturalized alien for the flora of Abruzzo.

Abundant, sexually reproducing individuals were found on the vertical walls of the Spanish Fort, in the urban area of L'Aquila [(WGS84: 42.354040°N, 13.403478°E), muri, 730 m, 18 June 2022, *E. Fanfarillo*, *L. de Simone* (SIENA)].

E. Fanfarillo, L. de Simone

***Pseudotsuga menziesii* (Mirb.) Franco (Pinaceae)**

+ (CAS) **PIE**: Valchiusa (Torino), Meugliano, Lago di Meugliano (WGS84: 45.475756°N, 7.791080°E), aree boscate in prossimità di un rimboschimento artificiale a *Pseudotsuga menziesii*, 748 m, 16 May 2022, *S. Ravetto Enri*, *A. Mainetti*, *M. Pittarello* (FI). – Casual alien species new for the flora of Piemonte.

The spontaneous reproduction of this species has been observed in many Italian administrative regions in recent (Bartolucci et al. 2019) and former (Ciancio et al. 1981) times. In Piemonte, several young individuals (less than 1-m high) have been observed under the canopy cover of a plantation established in the 1930s.

S. Ravetto Enri, A. Mainetti, M. Pittarello

***Quercus palustris* Münchh. (Fagaceae)**

+ (NAT) **ITALIA (LOM)**. – Status change from casual to naturalized alien for the flora of Italy (Lombardia).

Having had the opportunity to easily access the area of the former Piazza d'Armi in Milano, it was possible to verify that the population of *Quercus palustris* (Galasso et al. 2021) occurring there can be considered naturalized.

G. Galasso

***Sarcococca confusa* Sealy (Buxaceae)**

+ (CAS) **ITALIA (ABR)**: Teramo (Teramo), Via dei Tribunali, fioriere sul bordo stradale, in zona ombrosa (WGS84: 42.658055°N, 13.708008°E), ca. 260 m, 10 November 2021, *N. Olivieri* (FI). – Casual alien species new for the flora of Italy (Abruzzo).

Sarcococca confusa is quite widespread in cultivation as ornamental in shady areas. Some young plants were identified according to McKean (2011).

N. Olivieri

***Senecio angulatus* L.f. (Asteraceae)**

+ (NAT) **MOL**: Termoli (Termoli), Via Corsica in prossimità dell'incrocio con Via Sant'Elena (WGS84: 41.991205°N, 14.999781°E), incolto sul bordo strada, 31 m, 4 January 2022, *M. Lonati, M. Probo* (FI). – Naturalized alien species new for the flora of Molise.

This species is widespread in Termoli, also occurring in some uncultivated areas near the medieval village.

M. Lonati, M. Probo

***Setaria adhaerens* (Forssk.) Chiov. (Poaceae)**

+ (NAT) **VEN**: Venezia (Venezia), Isola di Sant'Erasmo, 50 m a NE della chiesa (WGS84: 45.459477°N, 12.410954°E), orto, 0 m, 31 October 2021, *S. Tasinazzo* (FI); *ibidem*, Lido (WGS84: 45.364906°N, 12.337115°E), orto, 0 m, 14 October 2022, *S. Tasinazzo* (*Herb. S. Tasinazzo*); Cavallino-Treporti (Venezia), Via Sette Casoni (WGS84: 45.466540°N, 12.503309°E), campo di asparagi in stadio post-culturale, 0 m, 6 November 2021, *S. Tasinazzo* (*Herb. S. Tasinazzo*). – Naturalized alien species new for the flora of Veneto.

Some specimens were found on sandy soil.

S. Tasinazzo

***Sisyrinchium rosulatum* E.P.Bicknell (Iridaceae)**

+ (NAT) **TOS**: Lucca (Lucca) (WGS84: 43.8457678°N, 10.5153513°E), prati umidi, 14 m, 13 May 2022, *S. Maccherini, L. de Simone, E. Fanfarillo* (FI, SIENA). – Naturalized alien species new for the flora of Toscana.

Numerous fructifying adult individuals were found in an urban mowed grassland dominated by *Agrostis stolonifera* L. subsp. *stolonifera* and *Lolium perenne* L.

S. Maccherini, L. de Simone, G. Bacaro

***Solanum carolinense* L. (Solanaceae)**

+ (NAT) **LAZ.** – Status change from casual to naturalized alien for the flora of Lazio.

In Lazio, this species was first recorded in Roma in 2015 as a casual alien (Olivieri 2015). The new populations [Fumone (Frosinone), Vicinale Pozzi (WGS84: 41.73029511°N, 13.26961270°E), margine stradale, 621 m, 8 August 2022, *E. Fanfarillo* (SIENA); Alatri (Frosinone), strada SR155 (WGS84: 41.736187°N, 13.344255°E), 416 m, 9 August 2022, *E. Fanfarillo* (SIENA)] appear well-established, especially the one in Alatri, which was also observed in the past two years.

E. Fanfarillo

***Solanum sisymbriifolium* Lam. (Solanaceae)**

+ (NAT) **CAL:** Crotone (Crotone), lungo la strada SS106, in loc. Passovecchio, nei pressi della cartiera (WGS84: 39.106411°N, 17.097683°E), formazioni prative ruderali, 7 m, 28 September 2021, leg. *G De Fine*, det. *N.G. Passalacqua* (FI). – Naturalized alien species new for the flora of Calabria.

N.G. Passalacqua, G. De Fine

***Toxicodendron radicans* (L.) Kuntze subsp. *radicans* (Anacardiaceae)**

+ (NAT) **ITALIA (TOS):** Impruneta (Firenze), ai Sassi Neri nei pressi della fonte della Caldaia, lungo il fosso di Narbi (WGS84: 43.683644°N, 11.271573°E), bosco mesofilo e ambienti rocciosi umidi su serpentino, 230 m, 15 June 2022, leg. *G. Astuti*, *A. Cutroneo*, *F. Roma-Marzio*, *R. Vangelisti*, det. *F. Roma-Marzio*, *G. Astuti* (FI, PI Nos. 061456, 061458). – Status change from casual to naturalized alien for the flora of Italy; naturalized alien species new for the flora of Toscana.

In Italy, this species is reported as casual alien only in Trentino-Alto Adige (Galasso et al. 2018), based on two old records by Gelmi (1893) and Biasioni (1930). Accordingly, the Tuscan population is the only recent record for Italy and the first case reported as naturalized species. Special attention is recommended with this species, commonly known as poison ivy, which in North America is causing serious allergic contact dermatitis to millions of people every year (Kim et al. 2019).

G. Astuti, F. Roma-Marzio, R. Vangelisti

***Trigonella foenum-graecum* L. (Fabaceae)**

+ (NAT) **SAR.** – Status change from casual to naturalized alien for the flora of Sardegna.

The species was frequently found in marginal segetal habitats (fields of cereal crops, such as barley and oats) and in arid meadows of therophyte communities, mainly on

sandy-clayey substrates (Baràdili, Oristano; Collinas and Villanovaforru, Sud Sardegna). The populations are clearly established since some time in the territories and are to be related to intentional (cultivation of fenugreek for zootechnical purposes) or unintentional (cereal seed contamination) historical introductions.

F. Mascia, G. Bacchetta, M. Fois

***Triticum ×requienii* Ces., Pass. & Gibelli nothosubsp. *requienii* (Poaceae)**

+ (CAS) **TOS**: Asciano (Siena), loc. Biancane di Leonina (WGS84: 43.295584°N, 11.452733°E), calanchi, 225 m, 31 May 2022, leg. et det. *L. Pinzani*, *A. Stinca*, conf. *E. Banfi* (FI, IT, *Herb. L. Pinzani*). – Casual alien nothospecies new for the flora of Toscana.

Triticum ×requienii was first reported for Italy by Raimondo et al. (2010), under the name *×Aegilotriticum triticoides* van Slageren, in Sicilia, then by Ardenghi and Polani (2016) in Lombardia. In Asciano, a few individuals of this nothotaxon have been observed within the therophytic plant communities of the clay flows at the base of the gullies (locally called ‘Biancane’).

L. Pinzani, A. Stinca, E. Banfi

***Tulipa gesneriana* L. subsp. *gesneriana* (Liliaceae)**

+ (CAS) **TOS**: Bagno a Ripoli (Firenze), loc. Candeli, tra Lasi e La Massa (WGS84: 43.764465°N, 11.340489°E), oliveto, 72 m, 16 April 2022, *L. Pinzani* (FI). – Casual alien species confirmed for the flora of Toscana.

This species forms a population consisting of a few scattered flowering individuals, distributed within an olive grove.

L. Pinzani

***Wisteria sinensis* (Sims) DC. (Fabaceae)**

+ (NAT) **PIE**: Giffenga (Biella), sponde del Torrente Cervo, a monte del guado tra Giffenga e Buronzo (WGS84: 45.49035°N, 8.24381°E), vegetazione alloctona sulle sponde e greto del Torrente Cervo, 176 m, 3 October 2021, *A. Selvaggi* (FI, *Herb. A. Selvaggi*); Carignano (Torino), sponda sinistra Fiume Po, presso imbarco Società canottieri Padus (WGS84: 44.90794°N, 7.69109°E), vegetazione alloctona sulle sponde del Fiume Po, 230 m, 17 July 2022, *A. Selvaggi* (FI, *Herb. A. Selvaggi*). – Naturalized alien species confirmed for the flora of Piemonte.

Previously recorded in Piemonte only in “Vignole Borbera, in luogo abbandonato” (Carrega and Silla 1995) and in the Natural Reserve of “Garzaia di Valenza” (Ostellino 1987), without any indication of the degree of naturalization. A couple of specimens escaped from cultivation have been also reported on the outskirts of Cherasco (Cuneo) (Rota and Cavallo 2012).

A. Selvaggi

***Yucca gloriosa* L. (Asparagaceae)**

+ (NAT) **SAR.** – Status change from casual to naturalized alien for the flora of Sardegna.

A dense population originating from clonal growth and formed by several shrubs was found in Porto Torres (Sassari), close to the Rio Mannu estuary (WGS84: 40.835207N, 8.391014E). Other small naturalized populations were found on sand dunes at Is Arenas [San Vero Milis (Oristano), WGS84: 40.059102°N, 8.466568°E] and in coastal areas of the island of San Pietro [e.g., Carloforte (Sud Sardegna), spiaggia La Caletta, WGS84: 39.117101°N, 8.257647°E].

G. Riviuccio, G. Brundu, S. Bagella

Nomenclatural and distribution updates from other literature sources

Nomenclatural, status, and distribution updates, and corrections to Galasso et al. (2018) and subsequent updates summarised in the Portal to the Flora of Italy (2022) are provided in Suppl. material 1.

G. Galasso, F. Bartolucci

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Supplementary material I

Supplementary data

Authors: Gabriele Galasso, Fabrizio Bartolucci

Data type: Species data

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

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Notulae to the Italian native vascular flora: 14

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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, confirmations, and status changes to the Italian administrative regions. Nomenclatural and distribution updates, published elsewhere, and corrigenda are provided as Suppl. material 1.

Keywords

Endemic taxa, Floristic data, Italy

How to contribute

The text for the new records should be submitted electronically to Lorenzo Lastrucci (lorenzo.lastrucci@unifi.it). The corresponding specimen 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), exclusions, and confirmations should be submitted electronically to: Fabrizio Bartolucci (fabrizio.bartolucci@gmail.com). Each text should be within 1,000 characters (spaces included).

Floristic records of native taxa

Arabis auriculata Lam. (Brassicaceae)

+ **EMR**: Montecopiolo (Rimini), versante SE del Monte San Marco (WGS84: 43.848287°N, 12.347453°E), prati con roccia calcarea affiorante, 1100 m s.l.m., 30 April 2022, *T. Bruschi*, *M. Magrini*, *L. Menghi*, *L. Polverelli* (FI). – Species new for the flora of Emilia-Romagna.

M. Magrini, L. Menghi, L. Polverelli

Cytisus infestus (C.Presl) Guss. subsp. *infestus* (Fabaceae)

+ **PIE**: Alto (Cuneo), sotto Strada Provinciale 216, arbusteti misti a roverella e gine-strella (WGS84: 44.110861°N, 7.994028°E), 730 m, 19 September 2021, *M. Lonati*, *G. Nota*, *D. Barberis* (FI). Species new for the flora of Piemonte.

Some fully developed individuals were found in a scrubland dominated by Mediterranean species, mainly *Osyris alba* L., recently reported for the same study area (Bartolucci et al. 2020).

M. Lonati, G. Nota, D. Barberis

Dracunculus vulgaris Schott (Araceae)

+ **UMB**: Perugia (Perugia), Monte di Lacugnano, esposizione SW (WGS84: 43.098312°N, 12.331790°E), ambiente aperto e cespugliato della macchia mediterranea con affioramenti rocciosi, substrato calcareo, 440 m s.l.m., 25 May 2021, *C. Longo*, *S. Vitale*, *P. Salerno* (UTV No. 38891). – Species confirmed for the flora of Umbria.

This species, recorded in the past in Umbria at Colle della Trinità (Batelli 1888) and at Isola Maggiore, Lake Trasimeno (Cicioni 1895), is currently considered as doubtfully occurring in Umbria (Bartolucci et al. 2018). The population identified at Parco di Monte Lacugnano, consists of about ten plants distributed on a surface of approximately 4,000 m².

C. Longo, S. Vitale, P. Salerno

Elatine hexandra (Lapierre) DC. (Elatinaceae)

+ **C SAR**: Vena Limbara, Calangianus (Sassari), (WGS84: 40.862781°N, 9.262080°E), margini dei laghetti di cava e zone umide limitrofe, 500 m, 26 August 2022, *G. Calvia*, *A. Lallai* (FI, CAG). – Cryptogenic species new for the flora of Sardegna.

Elatine hexandra is a holarctic species, typical of temporarily flooded sites, which is widespread in western and north-western Europe, but becomes rare eastwards, in southern and eastern European countries (Popiela et al. 2011). In Italy, this species is recorded as cryptogenic for Piemonte, Lombardia, Veneto, and Emilia-Romagna (Bartolucci et al. 2018). In the Mediterranean islands, this species was previously recorded only for Corsica, where it has been considered native (Fichot et al. 2015; Delage and Hugot 2020). We report its presence in an area of northern Sardinia where it colonises the shores of several semi-natural lakes formed after the abandonment of granite quarries.

G. Calvia, A. Lallai

***Erodium alnifolium* Guss. (Geraniaceae)**

+ **MAR:** Monte Grimano Terme (Pesaro e Urbino), loc. Seriole (WGS84: 43.872045°N, 12.463668°E), sentiero sterrato, 587 m, 16 June 2022, *F. Santi* (FI). – Species new for the flora of Marche.

F. Santi

***Erodium salzmannii* Delile (Geraniaceae)**

+ **TOS:** Scarlino (Grosseto), Podere il Bersagliere (WGS84: 42.871241°N, 10.997414°E), pratelli aridi, 45 m, 30 April 2022, leg. *L. Pinzani*, det. *L. Peruzzi*, *L. Pinzani* (FI, *Herb. Pinzani*). – Species confirmed for the flora of Toscana.

Erodium salzmannii was ascertained so far only for Sardegna, while it has been doubtfully reported for Toscana (Bartolucci et al. 2018) based on a single record for the island of Elba (Carta et al. 2018 and literature cited therein). Our finding represents the first record for peninsular Italy.

L. Pinzani, L. Peruzzi

***Euphorbia segetalis* L. (Euphorbiaceae)**

+ **EMR:** Lugo (Ravenna) (WGS84: 44.410317°N, 11.931492°E), ambienti ruderali, 12 m s.l.m., 23 January 2022, leg. *T. Fiaschi*, det. *T. Fiaschi*, *E. Fanfarillo* (FI, SIENA). – Species new for the flora of Emilia-Romagna.

Euphorbia segetalis is a Mediterranean species considered native in many administrative regions of peninsular Italy and in Liguria, while it is recorded as a regional alien in Friuli Venezia-Giulia and Lombardia (Bartolucci et al. 2018). Given its synanthropic character as a weed of crops and ruderal sites (Fanfarillo et al. 2020), we consider it native in Emilia-Romagna.

T. Fiaschi, E. Fanfarillo, C. Angiolini

***Ferulago galbanifera* (Mill.) W.D.J.Koch (Apiaceae)**

+ **PUG:** Gravina in Puglia (Bari), Parco Nazionale dell'Alta Murgia loc. Pulicchio di Gravina, pratelli steppici su rupi calcaree (WGS84: 40.905522°N, 16.424333°E),

553 m, 12 May 2018, leg. *G. Buccomino*, det. *G. Buccomino*, *R.P. Wagensommer* (FI); *ibidem*, 4 July 2022 (fruit), leg. *G. Buccomino*, det. *G. Buccomino*, *R.P. Wagensommer* (FI); Candela (Foggia) loc. Pietra Longa sperone roccioso in prossimità della Strada Provinciale 99 (WGS84: 41.121125°N, 15.496817°E), 354 m, 6 July 2022, leg. *G. Buccomino*, det. *G. Buccomino*, *R.P. Wagensommer* (FI). – Species confirmed for the flora of Puglia.

Ferulago galbanifera was reported as no longer recorded by Bartolucci et al. (2018) based on the records of Palanza (1900) and Bianco (1962) in Pulicchio di Gravina. We hereby confirm the occurrence of this species with few individuals, growing together with *Athamanta sicula* L. and *Anisantha rubens* (L.) Nevski. In Puglia it is also present and very abundant on the rocky spur of Pietra Longa (Candela).

G. Buccomino, R.P. Wagensommer

***Hypecoum imberbe* Sm. (Papaveraceae)**

+ **BAS:** Matera (Matera), Piano di Trasano - Conca d'Aglio, margini di campo di cereali (WGS84: 40.65247312°N, 16.65746037°E), 500 m, 3 May 2022, *A. Selvaggi*, *G. Salerno* (FI, *Herb. Selvaggi*). – Species new for the flora of Basilicata.

G. Salerno, A. Selvaggi

***Ipomoea imperati* (Vahl) Griseb. (Convolvulaceae)**

+ **CAM:** Bacoli (Napoli), spiaggia in corrispondenza del Lago Fusaro (WGS84: 40.829972°N, 14.048093°E), dune embrionali, 0 m, 16 October 2018, *M. De Matteis Tortora* et *S. Gaudino* (NAP barcode NAP0000611); Bacoli (Napoli), Lido “Papel Beach” (WGS84: 40.830894°N, 14.0408081°E), 0 m, limite della zona afittica a ridosso dello stabilimento balneare, 14 September 2022, *E. Del Guacchio*, *M. De Matteis Tortora*, *B. Menale*, *M. Spina* (*Herb. Del Guacchio*); Pozzuoli (Napoli), spiaggia in corrispondenza del Monte di Cuma, arenile (WGS84: 40.849032°N, 14.047468°E), 1 m, 26 September 2018, *M. De Matteis Tortora*, *L. Pellegrini*, *S. Gaudino* (NAP barcode NAP0000612); *ibidem*, 14 September 2022, *E. Del Guacchio* et *M. De Matteis Tortora* (*Herb. Del Guacchio*). – Status change and species confirmed for the flora of Campania.

This species is widespread along the tropical and subtropical coasts of the world (WCSP 2022), and it is usually regarded as native to Europe and Italy (e.g., POWO 2022). Data from Cennamo et al. (2013) strongly support its native status in Italy. In addition, this species was first described for the surroundings of Naples since the end of the 16th century, where it later became extinct (Migliorato 1896). The other localities discovered by M. Tenore and G. Gussone in Ischia Island disappeared in the 1970s, and an ancient indication for the island of Capri is doubtful (Ricciardi 1998). The new localities are the northernmost of the range; sadly, the first listed site has been destroyed, whereas the other two are constituted by a single or few individuals.

M. De Matteis Tortora, E. Del Guacchio, P. Caputo

***Lagurus ovatus* L. subsp. *nanus* (Guss.) Messeri (Poaceae)**

+ **SAR:** La Maddalena (Sassari), Abbatoggia (WGS84: 41.247864°N, 9.401394°E), 2 m, 13 June 2022, *M. Fois*, *A. Cuena-Lombrana*, *G. Bacchetta* (FI, CAG); Budoni (Nuoro), Pineta Sant'Anna (WGS84: 40.698212°N, 9.723101°E), 1 m s.l.m., 14 June 2022, *M. Fois*, *G. Bacchetta* (CAG). – Subspecies new for the flora of Sardegna.

M. Fois, *A. Cuena-Lombrana*, *G. Bacchetta*

***Maresia nana* (DC.) Batt. (Brassicaceae)**

+ **ABR:** Marina di Vasto (Chieti), Lido del Sole 57 (WGS84: 42.342290°N, 13.429072°E), margine stradale e terreno sabbioso, 3 m, 31 March 2022, leg. *D. C. Palermo*, det. *D. C. Palermo*, *D. Longo*, *F. Bartolucci*, *F. Conti* (APP No. 66131, FI). – Species confirmed for the flora of Abruzzo.

This species was reported by Zodda (1954) for Pineto and never confirmed thereafter.

D.C. Palermo, *D. Longo*, *F. Bartolucci*, *F. Conti*

***Mentha microphylla* K.Koch (Lamiaceae)**

+ **CAL:** Condofuri (Reggio Calabria), Amendolea (WGS84: 37.986869°N, 15.896327°E), bordo strada vicino a una fonte, 158 m, 21 August 2022, leg. *F. D'Aleo*, det. *F. D'Aleo*, *V.L.A. Laface*, *C.M. Musarella*, *G. Spampinato* (REGGIO, FI). – Species confirmed for the flora of Calabria.

This species was first reported in Calabria by Pignatti (1982) and recently regarded as no longer recorded by Bartolucci et al. (2018).

F. D'Aleo, *V.L.A. Laface*, *C.M. Musarella*

***Ornithogalum kochii* Parl. subsp. *monticola* (Jord. & Fourr.) Peruzzi (Asparagaceae)**

+ **EMR:** Monte Bosco della Torre (Parma), prato arido di cresta (WGS84: 44.778404°N, 9.902368°E), 525 m, 2 May 2017, leg. *M. Adorni*, det. *L. Peruzzi* (FI). – Subspecies new for the flora of Emilia-Romagna.

M. Adorni

***Orobanche pubescens* d'Urv. (Orobanchaceae)**

+ **CAL:** Cirò (Crotone), località Favare (WGS84: 4360737°N, 675456.00°E), 300 m a ovest della centrale su *Trifolium repens*, 361 m, 26 April 2022, leg. *G. De Fine*, det. *N.G. Passalacqua* et *G. Domina* (FI). – Species confirmed for the flora of Calabria.

This species was reported by Domina and Peruzzi (2010) based on a specimen housed in FI collected by Fiori (08 July 1899) on Monti di Paola (Cosenza).

N.G. Passalacqua, *G. De Fine*, *G. Domina*

***Prunus avium* (L.) L. (Rosaceae)**

+ **MAR.** – Status change from naturalized to native for the flora of Marche.

+ **UMB.** – Status change from naturalized to native for the flora of Umbria.

In Italy, this species is generally considered as a native plant, except for Marche, Umbria, Sicily, and Sardinia where it was reported as alien (Bartolucci et al. 2018; Stinca et al. 2021). The status of naturalized alien for populations in Umbria and Marche is not sustainable. In fact, there are no natural, geographical, or environmental barriers nor geo-pedological discontinuities allowing to consider these populations differently from those of the surrounding regions.

G. Mei, A. Stinca

***Ranunculus rionii* Lager (Ranunculaceae)**

+ **FVG:** Staranzano (Gorizia), zona deltizia del fiume Isonzo (WGS84: 74.5067862°N, 16.383342°E) (OGU 10247/1), pozze temporanee fungenti da morfologie di impluvio, incluse in lembi di prateria sortumosa in contatto con gli ambienti acquitrinosi subsalsi della foce fluviale, 0 m s.l.m., 5 May 2021, G. Bertani (FI). – Species new for the flora Friuli Venezia-Giulia.

G. Bertani

***Scorzonera laciniata* L. subsp. *laciniata* (Asteraceae)**

+ **PUG:** Agro di Gravina in Puglia (Bari), substrato limoso-argilloso del vulcanello di Gravina in Puglia (WGS84: 40.702918°N, 16.428803°E), 210 m s.l.m., 27 April 2022, M. Terzi, F.S. D'Amico (FI). – Subspecies confirmed for the flora of Puglia.

This taxon was recorded for Puglia by Béguinot (1910 sub *S. laciniata* subsp. *tenorei*) and Fiori (1928 sub *S. laciniata* var. *tenorei*) and later regarded as doubtfully occurring in this administrative region by Bartolucci et al. (2018).

M. Terzi, F.S. D'Amico

***Securigera cretica* (L.) Lassen (Fabaceae)**

+ **TOS:** Massarosa (Lucca) prima della Chiesa di Pieve a Elici, salendo (WGS84: 43.885224°N, 10.334922°E), uliveti, 130–150 m circa, 20 April 2022, B. Pierini (FI); San Casciano in Val di Pesa (Firenze), tra Villa il Poggiale e Castellaccio (WGS84: 43.664830°N, 11.162710°E), oliveto, 275 m, 25 April 2022, L. Pinzani (FI, *Herb. Pinzani*); Empoli (Firenze) antico meandro dell'Arno tra Arnovecchio e Fabbiana (WGS84: 43.729975°N, 10.985395°E), prati mesofili, 20 m, 15 May 2022, L. Peruzzi (FI). – Species new for the flora of Toscana.

B. Pierini, L. Pinzani, L. Peruzzi

***Sedum caespitosum* (Cav.) DC. (Crassulaceae)**

+ **CAM:** Padula (Salerno), presso Volta Cammino (WGS84: 43.304500°N, 15.639680°E), strada sterrata, 480 m, 23 Apr 2022, *L. Pinzani* (FI). – Species confirmed for the flora of Campania.

To the best of our knowledge, *S. caespitosum* was reported for Naples by De Rosa (1906). The species forms a small population along a country road.

L. Pinzani, A. Stinca

***Sporobolus virginicus* (L.) Kunth (Poaceae)**

+ **LIG:** Pietra Ligure (Savona), lungomare a valle della ferrovia (WGS84: 44.143735°N, 8.274991°E), margine erboso, 5 m, no exp., 29 August 2022, *G. Galasso* (FI, MSNM barcode MSNM52009). – Species confirmed for the flora of Liguria.

G. Galasso

***Tofieldia calyculata* (L.) Wahlenb. (Tofieldiaceae)**

+ **LAZ:** Amatrice (Rieti), Monti della Laga, Loc. Fosso Pelone (WGS84: 42.635833°N, 13.394444°E), within a system of temporary flooded ponds along a stream bank NNW, 1650 m a.s.l., 22 July 2022, *F. Di Pietro, R. Di Pietro* (FI, HFLA). – Species new for the flora of Lazio.

F. Di Pietro, R. Di Pietro

***Ulmus laevis* Pallas (Ulmaceae)**

+ **VDA:** Châtillon (Aosta), destra idrografica Dora Baltea, area alluvionale, sotto Ussel (WGS84: 45.74430834°N, 7.63023532°E), 432 m, 24 July 2022, *A. Selvaggi* (FI, AO); Saint-Vincent (Aosta), fraz. Tensoz, sx idrografica della Dora Baltea, bosco alluvionale (WGS84: 45.74347847°N, 7.64188723°E), 424 m, 6 August 2022, *A. Selvaggi* (FI, *Herb. Selvaggi*); Saint-Vincent (Aosta), fraz. Toux, sx idrografica della Dora Baltea, a monte ponte autostrada, bosco alluvionale (WGS84: 45.74406°N, 7.63454°E), 425 m, 6 August 2022, *A. Selvaggi* (FI, *Herb. Selvaggi*). – Species new for the flora of Valle d'Aosta.

Ulmus laevis is considered by Bartolucci et al. (2018) as a cryptogenic species in Piemonte and as naturalized alien elsewhere in Italy. As recently proposed by Torre et al. (2022), the native and relictual presence of the species in Piemonte and Lombardia has been definitely proven. The presence of *U. laevis* in alluvial woods along the Dora Baltea river is documented in Piemonte (R. Benetti and A. Selvaggi, pers. obs.). For this reason, its presence in Valle d'Aosta in alluvial woody areas along the Dora Baltea, consistent with the natural habitat of the species, should be considered native and relictual, too.

A. Selvaggi

***Valerianella echinata* (L.) DC. (Valerianaceae)**

+ **BAS**: Matera (Matera), Piano di Trasano - Conca d'Aglio, margini di campo di cereali (WGS84: 40.65247312°N, 16.65746037°E), 500 m, 3 May 2022, *A. Selvaggi*, *G. Salerno* (FI, *Herb. Selvaggi*). – Species new for the flora of Basilicata.

A. Selvaggi, G. Salerno

***Viola canina* L. subsp. *canina* (Violaceae)**

+ **CAL**: Serra S. Bruno (Vibo Valentia), contrada Chiusa della Madonna (WGS84: 38.56782°N, 16.32388°E), incolto erboso, ai bordi di un orto, terreno leggermente acido Ph 6, derivante dal disfacimento dei graniti, 820 m, 22 May 2022, leg. *G. Pisani*, det. *G. Pisani*, *F. Conti* (APP Nos 66134, 66135, FI). – Species confirmed for the flora of Calabria.

This record is new to southern Italy and represents the southernmost finding in Italy.

G. Pisani, F. Conti

Floristic records of regional alien taxa***Allium schoenoprasum* L. subsp. *schoenoprasum* (Amaryllidaceae)**

+ (CAS) **CAM**: Altavilla Silentina (Salerno), loc. Cerrelli, base di un muretto in cemento lungo la SP 174 (WGS84: 40.52963°N, 15.10561°E), 55 m, 19 June 2022, *E. Del Guacchio* et *E. Del Guacchio* (FI, *Herb. Del Guacchio*). – Casual alien species new for the flora of Campania.

The collected specimens derived from a single large clump, doubtless originated by seed dispersion.

E. Del Guacchio

***Barbarea verna* (Mill.) Asch. (Brassicaceae)**

+ (CAS) **VEN**: San Giovanni Lupatoto (Verona): località Fossa Contarina, Pontoncello, lungo la sponda sx del fiume Adige (WGS84: 45.38077973°N, 11.06688125°E), depositi ghiaioso/sabbiosi del fiume, un solo esemplare, 33 m, 2 May 2022, leg. *F. Menini*, det. *F. Menini*, *F. Prosser* (FI). – Casual regional species new for the flora of Veneto.

F. Menini, F. Prosser, S. Andreatta

***Bellevalia romana* (L.) Sweet (Asparagaceae)**

+ (CAS) **TAA**: Levico Terme (Trento), scarpata incolta lungo la strada S.P. 11 di Levico Terme per Vetriolo (WGS84: 46.021434°N, 11.301593°E), 759 m a.s.l., esposizione S, 10 April 2022, *F. Valentini* (FI). – Casual regional species new for the flora of Trentino-Alto Adige.

F. Valentini, F. Prosser, G. Bonari

***Buxus sempervirens* L. (Buxaceae)**

+ (CAS) **PUG**: Bitonto (Bari), Bosco Marinelli, nei pressi di Palombaio, Bosco a *Quercus pubescens* (WGS84: 41.076209°N, 16.581418°E), 200 m, 07 May 2022, leg. G. Pazienza, det. L. Forte, G. Pazienza, V. Cavallaro (FI, BI Nos. 56937, 56938, 56939). – Casual regional alien species new for the flora of Puglia.

Buxus sempervirens is confirmed for southern Italy only in Campania, while is reported as doubtfully occurring in Basilicata (Bartolucci et al 2018). It was introduced at Bosco Marinelli in the 19th century, as testified by a specimen in BI [Bitonto (Bari), 28 March 1898, A. Palanza (BI No. 46639)] and by Sallustio (1950). This species currently occurs, scattered in a *Q. pubescens* wood, also with young individuals clearly born from seed.

G. Pazienza, L. Forte, V. Cavallaro

***Capparis sicula* Veill. (Capparaceae)**

+ (CAS) **LOM**: Milano (Milano), Parco del Ticinello, Cascina Campazzo, muro esterno sul lato S (WGS84: 45.426468°N, 9.181718°E), muro, 109 m, SSE, 15 June 2022, G. Galasso (FI); *ibidem*, 3 July 2022, G. Galasso (MSNM barcodes MSNM51987, MSNM51988). – Casual regional alien species confirmed for the flora of Lombardia.

Capparis sicula was doubtfully reported by Cesati (1844) and by Rota (1853) for the walls of Bergamo, where it was, thereafter, no longer observed. Only a single very luxuriant individual was found.

G. Galasso

***Cynara cardunculus* L. subsp. *cardunculus* (Asteraceae)**

+ (CAS) **TAA**: Torcegno (Trento), a monte di Auseri (WGS84: 46.067450°N, 11.455435°E; CFE: 9934/2), margine stradina, un paio di esemplari sterili avventizi, 750 m, 14 May 2020, leg. F. Prosser, I. Lopresti, det. F. Prosser (FI). – Casual regional alien species new for the flora of Trentino-Alto Adige.

F. Prosser

***Euphorbia pterococca* Brot. (Euphorbiaceae)**

+ (CAS) **LOM**: Bergamo (Bergamo), Via San Sebastiano (WGS84: 45.712196°N, 9.640030°E), spigolo tra la strada e il muro, 410 m, S, 16 June 2022, E. Banfi (FI, MSNM barcode MSNM51881). – Casual regional alien species new for the flora of Lombardia.

Only a single individual was found.

E. Banfi

Narcissus pseudonarcissus* L. subsp. *pseudonarcissus

+ (CAS) **CAL**: Molochio (Reggio Calabria), Strada Provinciale, Trepitò (WGS84: 38.287534°N, 16.043408°E), bordo strada, 965 m, 2 May 2022, leg. A. Morabito, det. V.L.A. Laface, A. Morabito, C.M. Musarella, G. Spampinato (FI, REGGIO).

The few individuals observed probably escaped cultivation or were thrown among the waste materials of nearby gardens where they are commonly cultivated as ornamental plants.

V.L.A. Laface, A. Morabito, G. Spampinato

***Vicia pannonica* Crantz subsp. *pannonica* (Fabaceae)**

+ (CAS) **LAZ**: Anagni (Frosinone), in Via Ciammotte (WGS84: 41.713301°N, 13.198894°E), margine di campi, 250 m, 14 May 2022, leg. E. De Santis, det. E. De Santis, F. Bartolucci (APP Nos 66132, FI, MSNM). – Casual regional alien species new for the flora of Lazio.

E. De Santis, F. Bartolucci

Nomenclatural and distribution updates from other literature sources, and corrigenda

Nomenclatural, distribution and status updates, and corrigenda to Bartolucci et al. (2018) and subsequent updates summarised in the Portal to the Flora of Italy (2022) are provided in Suppl. material 1.

F. Bartolucci, G. Galasso

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Supplementary material I

Supplementary data

Authors: Fabrizio Bartolucci, Gabriele Galasso

Data type: Species data

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

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***Ramaria barenthalensis* a new record from western Himalayas, Azad Jammu and Kashmir, Pakistan**

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Abstract

The genus *Ramaria* is globally distributed, inhabiting different substrates. In the present study, samples of *R. barenthalensis* were collected during a fungal survey from Neelum valley AJK, Pakistan. Identification was carried out through combined morpho-anatomical and molecular data from nrITS region, which confirmed the identification as *R. barenthalensis*. The taxon is a new record for fungi of AJK, Pakistan.

Keywords

Coral fungi, ITS, Mushrooms of Kashmir, Neelum valley, nrDNA, *Ramaria*

Introduction

Ramaria species are cosmopolitan in distribution and grow on living and dead hardwood, tree trunks, partially decomposed organic matter, and under conifers as mycorrhizal species (Marr and Stuntz 1973; Kuo 2009; Dorje et al. 2016). They are commonly known as coralloid fungi, due to colored and much branched basidiocarps. They grow in very diverse habitats and form a mycelial mat in soil beneath the sporocarps (Kumar and Gautam 2017). This genus comprises more than 200 species distributed

worldwide (Ghosh et al. 2021). *Ramaria flava* (Schaeff.) Quél. and *R. stricta* (Pers.) Quél., are common edible coralloid fungi (Krupodorova and Sevindik 2020). *Ramaria* species have been identified through scanning electron microscopy and molecular techniques by Martin et al. (2020). Internal transcribed spacer (ITS) restriction length polymorphism was observed among *Ramaria* species and used as a diagnostic tool for characterization (Nouhra et al. 2005). The regions of Azad Jammu & Kashmir are enriched in terms of macro-fungal diversity.

Ramaria abietina (Pers.) Quél., *R. aurea* (Schaeff.) Quél., *R. apiculata* (Fr.) Donk, *R. botrytis* (Pers.) Bourdot, *R. flava* (Schaeff.) Quél., *R. flavescentoides* Hanif & Khalid, *R. formosa* (Pers.) Quél., *R. pallida* (Schaeff.) Ricken, *R. soluta* (P. Karst.) Corner and *R. stricta* (Pers.) Quél. have previously been reported from Pakistan (Ahmad et al. 1997; Khalid 2022). Previously, only *Ramaria stricta* (Pers.) Quél. has been reported from AJK, based on morpho-anatomical characters (Gardezi 2005). In current study, *R. barenthalensis* is reported as new record from Neelum valley and AJK, Pakistan to increase the knowledge about its distribution and phylogeny.

Materials and methods

Sampling sites description

The study area state of Azad Jammu and Kashmir lies between longitude 73–75°E and latitude 33–36°N and comprises an area of 13,297 km² (Khan 2008). Neelum valley is the largest district of AJK having an area of 13,297 km². The climate is temperate (Average -2.0 °C) with very cold winter, moderate summers (Average temp. 37.0 °C) and average rainfall 165 cm, annually. This area is mostly hilly, and covered with dense forests of conifers. Soil is loamy to sandy loam, helping in better growth of forests. The main vegetation of the area includes *Pinus wallichiana* A.B.Jacks., *Abies pindrow* (Royle ex D.Don) Royle, *Cedrus deodara* (Roxb.) G.Don, *Aesculus indica* (Wall. ex Cambess.) Hook. and shrubs like *Viburnum grandiflorum* Wall. ex DC., *Indigofera heterantha* Wall. ex Brandis and *Betula jacquemontii* Spach.

Collection and micro-morphological characterization

Fresh basidiomata were collected from selected sites in Neelum valley, AJK, Pakistan, during 2019–2020 through consecutive field surveys (Fig. 1). Photography with proper tags and field notes of collected specimens were made during field visits in fresh conditions. Specimens were air-dried and preserved in polythene zipper bags for further studies. All studied specimens were deposited in the LAH Herbarium of Institute of Botany, University of the Punjab, Lahore.

Slides were mounted in 5% KOH (w/v) and 1% Congo red to study anatomical features, examined by using a light microscope (MX4300H, Japan) at 100× magnification: size and shape of basidiospores, basidia, cystidia and other structures. For

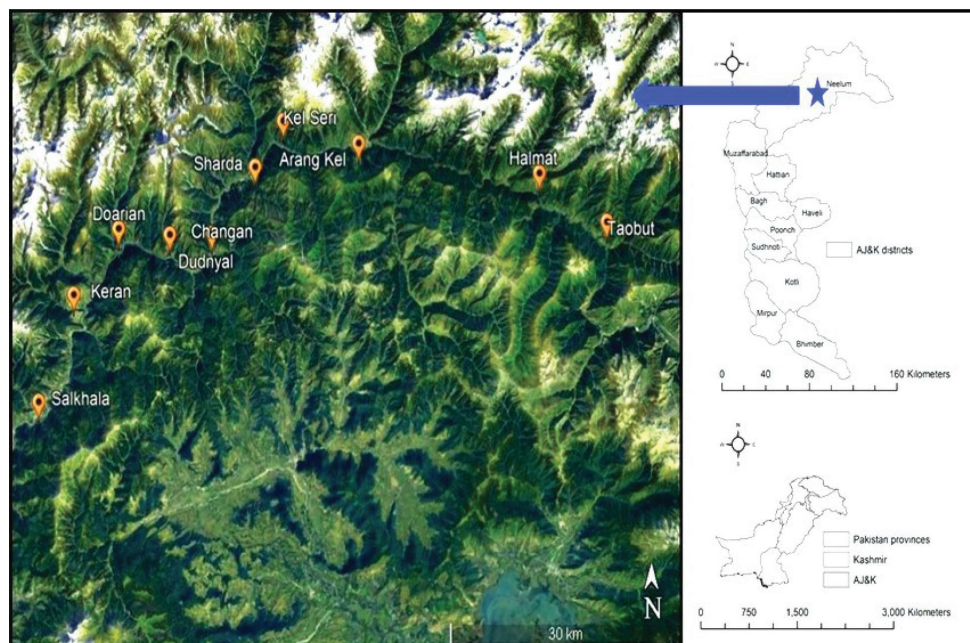


Figure 1. Map of collection site Neelum valley, AJK, Pakistan.

basidiospores and other structures at least 50 measurements were made and fungal specimen names with authorities were retrieved from Index Fungorum (<http://www.indexfungorum.org>).

DNA extraction, sequencing and phylogenetic analysis

DNA was extracted from dried samples using a modified CTAB method as proposed by Bruns (1995). Amplification of the ITS nrDNA region was carried out using universal primer sequences (ITS1/ITS4), ITS1F (5'-CTT GGT CAT TTA GAG GAA GTA A-3') and ITS4 (5'-TCC TCC GCT TAT TGA TAT GC-3') (White et al. 1990; Gardes and Bruns 1993). PCR products were sent to TsingKe, China for sequencing. The newly generated sequence was deposited in GenBank under accession number ON209680.

Consensus sequence was generated using the molecular tool BioEdit ver. 7.2.5 (Hall 1999). Most similar sequences were retrieved from NCBI using BLAST (<https://www.ncbi.nlm.nih.gov/guide/>) for the construction of a phylogenetic tree. Online MUSCLE tool (<https://www.ebi.ac.uk/Tools/msa/muscle>) was used for alignment of all the sequences. Maximum likelihood analysis was performed on CIPRES (Miller et al. 2010) using the RAxML-HPC2 with 1000 bootstrap replicates (Stamatakis 2014). Figtree ver. 1.4.2. software was used for phylogenetic tree visualization and exported to Adobe illustrator for final editing.

Results

Taxonomy

Ramaria barenthalensis Franchi & M.Marchetti, Riv. Micol. 61: 199 (2019)

Figure 2

Description. **Basidiomata** 5–12 cm in height, 4–9 cm wide with a well-developed branched mycelium. **Branches** vertically oriented, furcated, elongated to flattened, smooth, light brown when young and dark brown at maturity. **Base** variable, sometimes reduced, and well-developed, whitish to brown. **Flesh** whitish to light brown and soft. **Odor** is not distinctive and pleasant. **Basidiospores** [50/5/2] 6.5–9 × 3–4.6 μm, elliptical to ovoid, roughened. **Basidia** 45–59 × 7.5–9 μm, sterigmate. **Cheilocystidia** 46–62 × 7–8.5 μm, elongated. Clamp-connections are present. Trama hyphae are thick-walled with clamps. Hyphae in basal tomentum are smooth, with a tapering base (Fig. 2). Comparisons in morpho-anatomical characteristics with other described species of *Ramaria* are also given (Table 2).

Table 1. ITS dataset (Fig. 3) used in the current study on genus *Ramaria*. Our newly generated sequence shown in boldface.

Species	Strain	Location	Substrate	GenBank Accession Number
<i>Ramaria</i> sp.	SD125.4	USA	Fir forest	DQ365646
<i>Ramaria</i> sp.	OSC 81622	USA	Fir forest	EU652343
<i>R. flavobrunnesens</i>	AY102864	USA	Fir forest	AY102864
<i>R. barenthalensis</i>	AMB17386	Spain	mixed forest	MK493039
<i>R. barenthalensis</i>	AMB17381	Spain	<i>Abies</i> and <i>Picea</i> forest	MK493038
<i>R. barenthalensis</i>	T40	Kashmir	Dead hardwood of conifers	ON209680
<i>R. edwinii</i>	ALV11173	Spain	<i>Abies</i> and <i>Picea</i>	MK493034
<i>Ramaria</i> sp.	RAM2	Srinagar J&K	<i>Abies</i> forest	MH930937
<i>Ramaria</i> sp.	OSC 73311	USA	<i>Abies</i> and <i>Picea</i> mix wood forest	KP658154
<i>Ramaria</i> sp.	OSC 144044	USA	<i>Abies</i> and <i>Picea</i> mix wood forest	KF206335
<i>Ramaria</i> sp.	MHM312	Mexico	NA	EU569259
<i>Ramaria</i> sp.	NVE 367	Amazonia	NA	KF937356
<i>Ramaria</i> sp.	OSC 115803	USA	NA	KP658139
<i>Ramaria</i> sp.	DB215-08/5	USA	NA	KT968608
<i>R. flava</i>	AMB n. 17484	Italy	<i>Abies</i> and <i>Picea</i>	MK581224
<i>R. flava</i>	AMB 17393	Italy	<i>Abies</i> and <i>Picea</i>	MK493035
<i>R. flava</i>	AMB n. 17481	Italy	Mix forest type	MK557953
<i>R. flava</i>	MA-Fungi 48072	Spain	<i>Abies</i> and <i>Picea</i>	AJ408367
<i>R. flava</i>	ZT Myc 55613	Italy	NA	KY626146
<i>R. pseudoflava</i>	AMB 17390	Italy	NA	MK493045
<i>R. pseudoflava</i>	AMB 17392	Italy	NA	MK493046
<i>R. pseudoflava</i>	AMB 17391	Italy	NA	MK493044
<i>R. flava</i>	MA-Fungi 48061	Spain	<i>Abies</i> and <i>Picea</i>	AJ408364
<i>Ramaria</i> sp.	OSC 61837	USA	Mix forest	DQ365602
<i>Ramaria</i> sp.	OSC 134657	USA	Mix forest	JX310403
<i>R. magnipes</i>	WTU-F-063057	USA	Mix forest	MK169351
<i>R. magnipes</i>	WTU 063057	Italy	Fir forest	MK493040
<i>R. gracilis</i>	OSC 134659	USA	<i>Abies</i> and <i>Picea</i> mix wood forest	JX310399
<i>R. gracilis</i>	OSC 112168	USA	<i>Abies</i> and <i>Picea</i> mix wood forest	KY354745
<i>Hysterangium cnassinahis</i>	OSC 4860	USA	<i>Abies</i> and <i>Picea</i> mix wood forest	MN809540

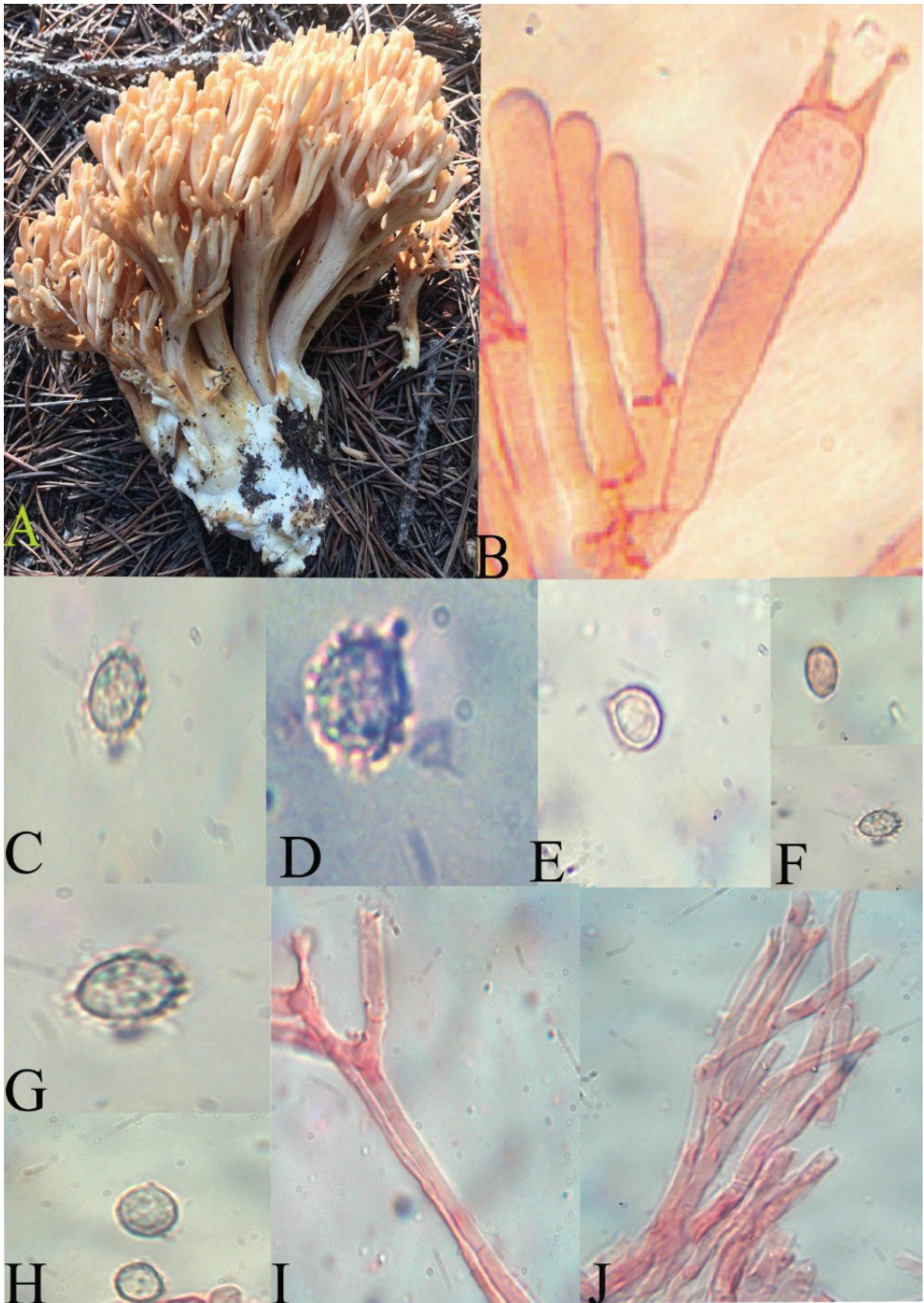


Figure 2. **A** Basidiomata of *Ramaria barenthalensis* (TS-40) **B** basidia and basidiole **C–H** basidiospores **I** clamp connections **J** trama hyphae. Scale bars: 3.6 cm (**A**); 12 μ m (**B**); 6.7 μ m (**C–H**); 13 μ m (**I**); 12.8 μ m (**J**).

Table 2. Morphoanatomical comparisons of different *Ramaria* species with *R. barenthalesis*.

	<i>Ramaria abietina</i>	<i>R. subaurantiaca</i>	<i>R. stricta</i>	<i>R. flava</i>	<i>R. flaccida</i>	<i>R. flavescens</i>	<i>R. apiculata</i>	<i>R. formosa</i>	<i>R. barenthalesis</i>
Basidiomata	Basidiomata up to 12 cm high, 4.5–8 cm in width, erect, branched, tips pointed with glabrous surface.	Basidiomata have densely crowded branches and sometimes with a fused base. Orange to brownish.	Mature Fruit bodies branched, 4–12 cm high, 4–8 cm wide. Branches with tapered and pointed ends, mostly erect and slender.	Basidiomata 10.5–20 cm in length with a width of 7–15 cm having numerous densely crowded branches.	Mycelium, multi branched, slender and less or more weak.	Basidiomata branched and large up to 18.8 cm; clamps are present.	Basidiomata much branched 4–9 cm tall, fan shaped, rounded, tips.	Basidiomata up to 20 cm high and multi branched mycelium.	5–12 cm high, 4–9 cm wide with a well-developed branched mycelium. Vertically oriented, furcated, elongated to flattened, smooth.
Color	Light pink to pinkish buff, pale yellow to light brown tips, darkened when bruised.	A persistent light brown to light yellow color from early stage of development to final stage of maturity.	Surface glabrous, pinkish-buff, tips of branches pale-yellow, buff brown when bruised.	Brown to light yellow more dark to ochraceous with age.	tips of branches tan to gold, no color change on bruising.	Branches yellowish-brown when young, pale to pinkish brown at maturity.	Branches Brown-light to yellow brown.	Branches Light brown. The flesh is white to yellowish.	Light brown when young and dark brown at maturity. Clamp connections present.
odor	Slightly aromatic and bitter		Aromatic	Pleasant	Pleasant	Not known	Not known	Pleasant	Distinctive
Stipe	Sometime less developed and reduced. Up to 1–2 cm in length, 0.5–1.5 cm wide, color changes to light-brown on bruising.	1–2.5 cm in length, 0.5–1.5 cm in width, sometimes absent. When present, pallid and tomentose with a tough context, light-brown on bruising.	Reduced and sometime developed up to 2 cm, flesh whitish to light brown.	Stipe, 50–80 mm long with a width of 40–50 mm. Base of stipe, whitish, pale-yellow to reddish brown on bruising.	Medium stipe 1.5–2 cm high and whitish.	Stipe large, 2.5–6.6 cm with a width of 1.5–2 cm, whitish.	Stipe large, 1.5–4 cm with a width of 1–1.5 cm, whitish.	Stipe large, 2–4.5 cm with a width of 1.5–1.8 cm, light brown-whitish.	Stipe variable in length and width, sometimes reduced to well-developed. Flesh whitish to brown.
Spores	6.5–9.5 µm in diameter, ellipsoidal, slightly warted.	Spores 7–8.5 µm, ellipsoidal.	Elliptical, rough, rusty-yellowish 7.5–10.5 × 3.5–4.5 µm, clamp connections present.	pale elliptical and roughened, 10.5–17.5 × 4–6.5 µm.	Pale elliptical less to more roughened, 9–14.5 × 3–4.5 µm.	Thick walled, minute and rough outer surface, cyanophilous warts, ellipsoidal, tips squared, 7–10×3.5–5 µm.	less to more roughened, with cyanophilous warts; ellipsoidal with a squared tip; 7–10×4–5 µm.	slightly roughened, with cyanophilous warts; ellipsoidal and squared tip; 7.5–9×3–3.5 µm.	6.5–9 × 3–4.6 µm, elliptical to ovoid, roughened.
Edibility	Edible	Edible	Edible on choice	Edible	Edible on choice sometimes laxative	Edible	Not known	Not known	Edible when young
Taste	Pleasant	Taste mild to pleasant	bitter	Taste mild to pleasant	Pleasant	Pleasant	Taste mild to pleasant	Bitter/mild	Pleasant

Ecology	<i>Ramaria abietina</i>	<i>R. subaurantiaca</i>	<i>R. stricta</i>	<i>R. flava</i>	<i>R. flaccida</i>	<i>R. flavescens</i>	<i>R. apiculata</i>	<i>R. formosa</i>	<i>R. barenthalensis</i>
	Solitary and gregarious, on hardwood and tree trunks of conifers.	Solitary and in small groups on hardwood and logs, soil and decomposed organic matter.	Growing in groups, under conifers and mixed vegetation, on dead wood and on ground.	Solitary and gregarious. Fruiting season varies from late summer to autumn.	Grow on the ground. In mixed forest and hardwoods. Late autumn.	Solitary to gregarious, on decomposed hardwood in association with rotten conifer needles.	Gregarious, on soil with decomposed organic matter and conifer needles.	Gregarious, on soil with decomposed organic matter and conifer needles.	Gregarious and sometime alone, on fallen tree turns of coniferous and other mixed vegetation during late summer.
References	(Petersen 1969; Sultan et al. 1997)	(Petersen 1989; Ahmad et al. 1997)	(Petersen and Olexia 1967; Petersen 1969; Ahmad et al. 1997)	(Petersen 1969; Ahmad et al. 1997)	(Ahmad et al. 1997)	(Ahmad et al. 1997)	(Ahmad et al. 1997)	(Kuo 2005)	Present study
	Basidiomata of different species of <i>Ramaria</i>								

Ecology. In mixed coniferous forest, associated with *Abies pindrow* and *Betula jacquemontii*, solitary or scattered and gregarious, common in the temperate zone of AJK, Pakistan.

Material examined. PAKISTAN, Neelum valley (Azad Jammu and Kashmir) collected from a mixed coniferous forest on decayed hardwood, in late summers, 1524 m a.s.l, August 2020, Tariq Saiff Ullah, TS-40.

Phylogeny

The newly generated ITS sequence of Pakistani *Ramaria* (T40) specimen, yielded a fragment of 702 base pairs. In initial BLAST search results, our sequence showed 99.33% similarity with *R. barenthalensis* MK493039, with 98% query cover, and 0.0 E value. The phylogram comprised 30 sequences and *Hysterangium crassirh* Zeller & C.W. Dodge was chosen as an out-group taxon. The final aligned dataset consist of 421 conserved sites, 256 were variable, 167 were informative and 86 were singletons. Our sequence *Ramaria barenthalensis* (T40) grouped with *R. barenthalensis* (MK493038 and MK493029) with strong bootstrap value (Fig. 3).

Discussion

In present study, a specimen of genus *Ramaria* was studied on the basis of morpho-anatomical and molecular approach. Our study is consistent with the original specimen description given by Franchi and Marchetti (2019). In phylogram, our specimen grouped in the same clade with *R. barenthalensis* (MK493038 and MK493039) with a strong bootstrap value.

The analyzed sample of *R. barenthalensis* (T-40) has similar morphological features, but with slight differences in basidiomata to other previously described species of *Ramaria* (Agerer et al. 1996). Few species of genus *Ramaria*: *R. apiculata*, *R. flava* (Schaeff.) Quél., *R. flavescens* (Schaeff.) R.H.Petersen, *R. flavescetoides*, *R. formosa*, *R. pallida* (Schaeff.) Ricken, and *R. subaurantiaca* Corner, have been reported from the regions of Jammu and Kashmir, in India and Pakistan based on morphological features (Ahmad et al. 1997; Nasim et al. 2008; Sharma et al. 2015; Hanif et al. 2019). Morpho-anatomical features are insufficient to identify a mushroom species. Fifteen species of *Ramaria* were identified and characterized by Martin et al. (2020) using combined morphological and molecular data. In conclusion, *R. barenthalensis* is recorded as a new coralloid fungus to the state of Jammu and Kashmir, Pakistan based on morpho-anatomical and molecular characterization. This fungal species could be used as a source of food and medicines after biochemical characterization.

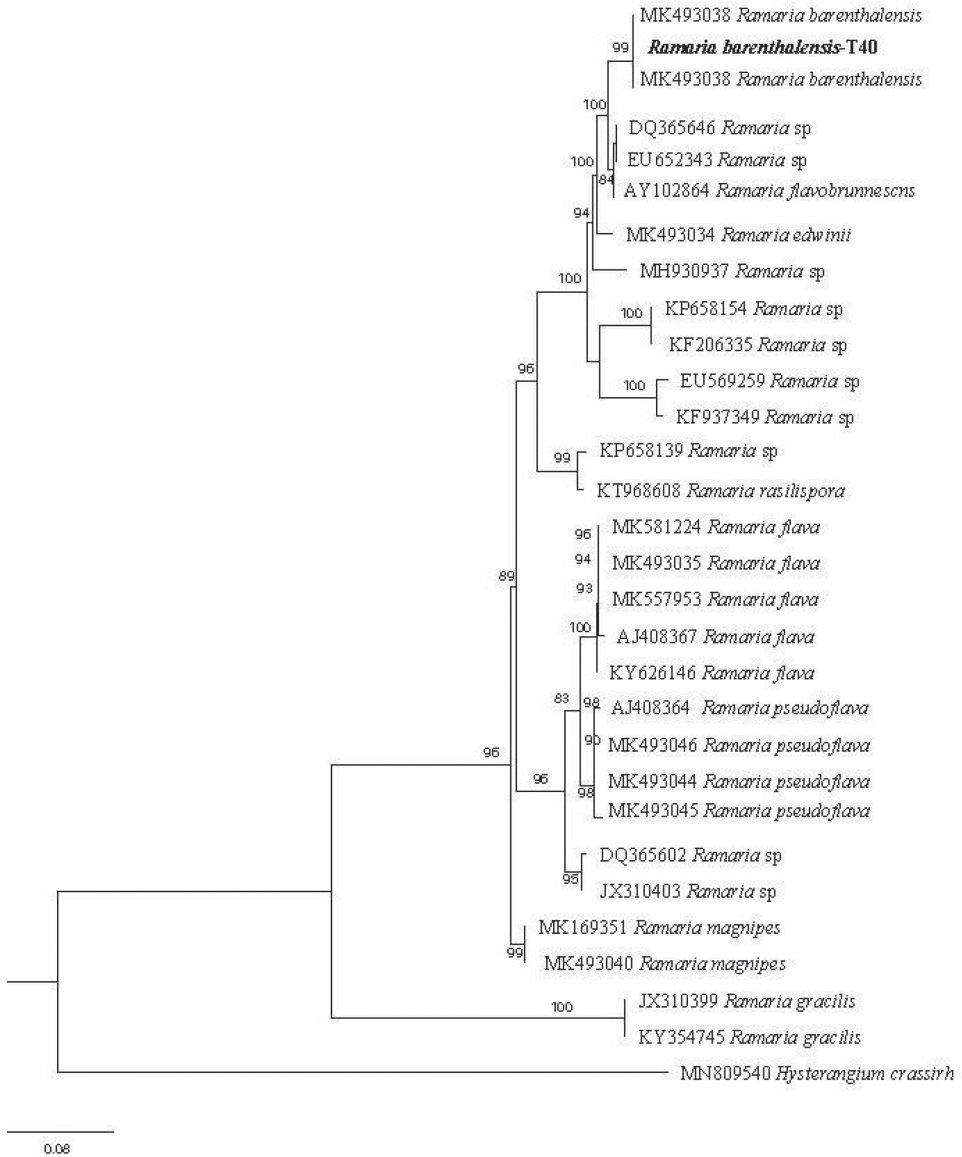


Figure 3. Molecular Phylogenetic tree of *Ramaria barenthalensis* (ON209680) by maximum likelihood method based on ITS sequences. The sequence generated in this study represents in bold.

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