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RESEARCH ARTICLE

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Contribution to the floristic knowledge of eastern Irpinia and Vulture-Melfese area (Campania and Basilicata, southern Italy)

Adriano Stinca[1], Giuseppina Chianese[2], Giuseppe D'Auria[3], Simonetta Fascetti[4], Maria Ravo[5], Vito Antonio Romano[4], Giovanni Salerno[6], Giovanni Astuti[7], Fabrizio Bartolucci[8], Liliana Bernardo[9], Gianmaria Bonari[10], Daniela Bouvet[11], Laura Cancellieri[12], Emanuela Carli[13], Giuseppe Caruso[14], Immacolata Catalano[15], Gennaro Domenico Cennamo[16], Giampiero Ciaschetti[17], Fabio Conti[8], Romeo Di Pietro[18], Paola Fortini[19], Carmen Gangale[20], Maria Rita Lapenna[4], Edda Lattanzi[21], Rossella Marcucci[22], Simonetta Peccenini[23], Riccardo Pennesi[24], Enrico Vito Perrino[25], Lorenzo Peruzzi[7], Francesco Roma-Marzio[26], Anna Scoppola[12], Agnese Tilia[27], Mariacristina Villani[22], Leonardo Rosati[4]

1 *Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche, Università della Campania Luigi Vanvitelli, Via A. Vivaldi 43, 81100 Caserta, Italy* **2** *Centro Museale "Musei delle Scienze Agrarie" MUSA, Università di Napoli Federico II, Via Università 100, 80055 Portici (Napoli), Italy* **3** *Servizio Fitosanitario, Area Decentrata Agricoltura Lazio Sud, Regione Lazio, Via C. Romagnoli 25, 04100 Latina, Italy* **4** *Scuola di Scienze Agrarie, Forestali, Alimentari ed Ambientali, Università della Basilicata, Via Ateneo Lucano 10, 85100 Potenza, Italy* **5** *Genomix4Life S.r.l., Università di Salerno, Via S. Allende 1, 84081 Baronissi (Salerno), Italy* **6** *Via O. Coccanari 14, 00019 Tivoli (Roma), Italy* **7** *Dipartimento di Biologia, Università di Pisa, Via Derna 1, 56126 Pisa, Italy* **8** *Centro Ricerche Floristiche dell'Appennino (Università di Camerino - Parco Nazionale del Gran Sasso e Monti della Laga), Località San Colombo, 67021 Barisciano (L'Aquila), Italy* **9** *Dipartimento di Biologia, Ecologia e Scienze della Terra, Università della Calabria, Via P. Bucci snc, 87036 Arcavacata di Rende (Cosenza), Italy* **10** *Department of Botany and Zoology, Masaryk University, Kotlářská 2, 61137 Brno, Czech Republic* **11** *Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino, Viale P.A. Mattioli 25, 10125 Torino, Italy* **12** *DAFNE, Dipartimento di Scienze Agrarie e Forestali, Università della Tuscia, Via San Camillo de Lellis snc, 01100 Viterbo, Italy* **13** *Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Piazzale A. Moro 5, 00185 Roma, Italy* **14** *Istituto Tecnico Agrario "Vittorio Emanuele II", Via V. Cortese 1, 88100 Catanzaro, Italy* **15** *Dipartimento di Scienze e Tecnologie, Università di Napoli Parthenope, Centro Direzionale Isola C4, 80143 Napoli, Italy* **16** *Laboratorio Fitopatologico, UOD Fitosanitario Regionale, Regione Campania, Via Don Bosco 9/E, 80141 Napoli, Italy* **17** *Ufficio Botanico, Parco Nazionale della Majella, Via Badia 28, 67039 Sulmona (L'Aquila), Italy* **18** *Dipartimento di Pianificazione, Design, Tecnologia dell'Architettura, Sapienza Università di Roma, Via Flaminia 72, 00196 Roma, Italy* **19** *Dipartimento di Bioscienze e Territorio, Università del Molise, Contrada Fonte Lappone, 86090 Pesche (Isernia), Italy* **20** *Museo di Storia Naturale e Orto Botanico, Università della*

Calabria, Loc. Polifunzionale, 87036 Arcavacata di Rende (Cosenza), Italy **21** *Via V. Cerulli 59, 00143 Roma, Italy* **22** *Centro di Ateneo Orto Botanico, Università di Padova, Via Orto Botanico 15, 35123 Padova, Italy* **23** *Dipartimento di Scienze dell'Ambiente, della Terra e della Vita, Università di Genova, Corso Europa 26, 16136 Genova, Italy* **24** *Herbarium Camerinensis (CAME) - Scuola di Bioscienze e Medicina Veterinaria, Università di Camerino, Via Pontoni 5, 62032 Camerino (Macerata), Italy* **25** *Istituto Agronomico Mediterraneo di Bari, Via Ceglie 9, 70010 Valenzano (Bari), Italy* **26** *Sistema Museale di Ateneo, Orto e Museo Botanico, Università di Pisa, Via L. Ghini 13, 56126 Pisa, Italy* **27** *Museo Erbario, Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Piazzale A. Moro 5, 00185 Roma, Italy*

Corresponding author: *Adriano Stinca* (adriano.stinca@unicampania.it; adriano.stinca@unina.it)

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Abstract

In order to improve the floristic knowledge of the Italian territory, we report the inventory of the taxa collected during the annual field trip of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society held in 2015 in eastern Irpinia and Vulture-Melfese area (South Italy). The investigated territories are located in southern Apennines, along the border between the Campania and Basilicata administrative regions. These areas are scarcely known in terms of vascular flora. The floristic samplings were performed in 19 sites selected as representative of the local environmental diversity as regards to climate, litho-morphology and land-use.

The research led to the identification of 4,137 specimens of vascular plants, belonging to 815 species and subspecies, 399 genera, and 85 families. Among these taxa, 42 were endemic to Italy, 38 were included in the IUCN Red List of the Italian Flora, 28 were alien and 5 were cryptogenic in Campania and/or Basilicata administrative regions. Two taxa, *Aquilegia coerulea* (casual alien, native to North America) and *Lolium ×boucheanum* (native), were found to be new for Italy. On the basis of the available floristic literature the first one is also to be considered new for the European flora. At regional scale, we have found 18 taxa new for the Campania and 15 new for the Basilicata region. Finally, 10 taxa were confirmed for Campania. Data obtained during this study, confirmed the important role of a collaborative approach among botanists and the great relevance of these territories for plant diversity.

Keywords

alien species, botanists, endemics, herbaria, Italian vascular flora, new floristic records, plant diversity, southern Apennines

Introduction

The floristic knowledge of a territory is of considerable importance for scientific purposes and for conservation (Carli et al. 2018). In particular, the information concerning the endemic plants, such as their distribution and threats, are key elements for driv-

ing national conservation strategies (Brundu et al. 2017, Orsenigo et al. 2018). Wild vascular plants were recently used in some areas of Central-South Italy to evaluate the long-term changes in the floristic composition of vegetation of mountain ecosystems (Calabrese et al. 2018, Frate et al. 2018) and for risk assessment and management of soils polluted by industrial processes (Visconti et al. 2018). In the last two decades, the activities of the working group for Floristics, Systematics and Evolution of the Italian Botanical Society have greatly improved the knowledge about the vascular flora of some scarcely known areas of the Italian territory by using a collaborative approach (Peccenini et al. 2007, 2010, Peruzzi et al. 2011, Bouvet et al. 2018, Bartolucci et al. 2019a). This has been particularly fruitful in the southern part of Italian Peninsula (Conti et al. 2006, 2007, Santangelo et al. 2010, Bernardo et al. 2012, Wagensommer et al. 2014, Domina et al. 2015, Rosati et al. 2017, in press). Herein, we present the results of the floristic field excursion held in 2015 in eastern Irpinia and Vulture-Melfese area in southern Apennines (Italy). This research aims at improving the floristic knowledge of these areas which are located at the boundary between the administrative regions of Basilicata and Campania. According to Scoppola and Blasi (2005) and Blasi et al. (2011) these areas were included among those for which the available floristic data were absent or particularly scarce.

Materials and methods

Study area

The study area includes territories located within the border between the Campania and the Basilicata administrative regions in southern Italy (Fig. 1) falling within the administrative provinces of Avellino (municipalities of Aquilonia, Bisaccia, Monteverde and Trevico) and Potenza (municipalities of Atella, Bella, Melfi, San Fele and Rionero in Vulture). The administrative border between the two regions is represented by the Ofanto River, which separates the eastern Irpinia (Campania region) from the Vulture-Melfese area (Basilicata region). The altitude ranges from 275 m a.s.l. of Ofanto River, to 1407 m a.s.l. at the top of Mt. Santa Croce. From a climatic and biogeographic point of view, the investigated area is respectively intermediate between the Mediterranean and the Temperate region at the crossroads between the Apennine-Balkan, Italo-Tyrrhenian and Adriatic provinces (Rivas-Martínez et al. 2004).

Based on meteorological data retrieved from the station located at Monticchio Bagni (Rionero in Vulture, province of Potenza, 652 m a.s.l., Suppl. material 1: S1), the mean annual rainfall is 815 mm, and it is concentrated in the autumn-winter period with a maximum in November and a minimum in August. The annual average temperature is 13.7 °C, with the hottest months in summer (July-August) and the coldest in winter (December). The thermo-pluviometric diagram (Spicciarelli 2013, Suppl. material 1: S1) highlights a Mediterranean climate characterized by two months of summer drought period.

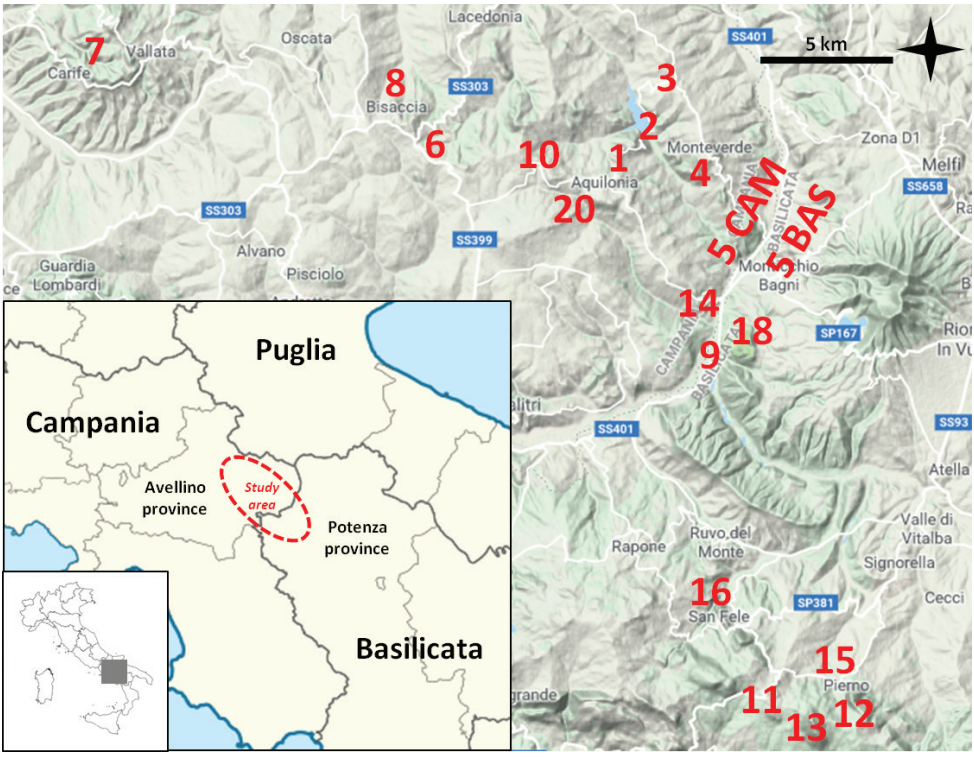

Figure 1. Location of study area and sampling sites (for details, see Suppl. materials 1: S2 and S3_1–S3_8).

The substrates of the study area are mainly composed of pelitic sediments (Flysch Rosso, Flysch Galestrino) and marginally of arenaceous sediments (Flysch Numidico), shaped in a hilly-mountainous landscape deeply dissected by the Ofanto River (Schiattarella et al. 2016). The Triassic-Tertiary units of the Lagonegrese Basin, here represented by thick flyschoid sediments overthrusted on previous carbonatic formations, occur only in the western part of the study area (Mt. Pierno).

The vascular flora of Irpinia and surrounding areas, was only partially explored between the end of the 19th and the beginning of the 20th century by Trotter (1905a, 1905b, 1906a, 1906b, 1908, 1909, 1910, 1913), Baccarini (1891), and Ferraris (1900, 1906).

Floristic survey

The research was coordinated by group of organisers (A. Stinca, L. Rosati, G. Chianese, G. D'Auria, S. Fascetti, M. Ravo, V. A. Romano and G. Salerno) who draw up the final floristic list with the contribution of all participants to the study. In order to maximize the identifiable taxonomic diversity within the surveyed area, 19 sites

of collection were selected as representative of the local diversity in terms of climate, litho-morphology, and land-use (Suppl. material 1: S2 and S3_1–S3_8). Some of these sites were included in protected areas, such as Natura 2000 sites or Vulture Regional Park (Suppl. material 1: S2). The aforementioned sites were intensively sampled during the period 3–6 June 2015 by 35 researchers (Suppl. material 1: S4). Further investigations were carried out only by the organizers on 18 December 2014, 22 April 2015, 13 and 27 May 2015 (Suppl. material 1: S2). In order to avoid destructive collections the sampling of the orchids was limited to very few individuals and more often substituted or supplemented by photographs. The floristic list was prepared in accordance to the protocol already used in previous contributions (e.g., Rosati et al. 2017, Bouvet et al. 2018, Bartolucci et al. 2019a). The taxonomic identification was carried out at first by the single collectors using standard floras (e.g., Tutin et al. 1968, 1972, 1976, 1980, 1993, Pignatti 1982) and other works (e.g., Christensen 1992, Whittemore 1997). Subsequently, the most critical specimens were revised during two specific workshops held at Portici (Library of Agriculture and Department of Agricultural Sciences of the University of Naples Federico II; 19 partecipants: L. Bernardo, L. Cancellieri, G. Chianese, G. Ciaschetti, F. Conti, G. D'Auria, R. Di Pietro, S. Fascetti, P. Fortini, C. Gangale, E. Lattanzi, S. Peccenini, E.V. Perrino, M. Ravo, F. Roma-Marzio, L. Rosati, G. Salerno, A. Scoppola, A. Stinca and A. Tilia) and Barisciano (Apennine Floristic Research Center; 10 partecipants: F. Bartolucci, L. Cancellieri, G. Ciaschetti, F. Conti, S. Fascetti, R. Pennesi, L. Rosati, G. Salerno, A. Scoppola and A. Stinca), on 3–5 March 2016 and 4–5 April 2016, respectively (Suppl. material 1: S5). Herbarium specimens belonging to the following critical groups were sent to specialists for revision: *Anchusella* and *Echium* (L. Cecchi, Florence), *Aquilegia* (E. Nardi, Florence), *Orobanche* (G. Domina, Palermo), *Pilosella* (G. Gottschlich, Tübingen), and Poaceae (E. Banfi, Milan). Finally, some doubtful specimens were also verified with the recent Flora d'Italia (Pignatti et al. 2017a, 2017b, 2018, 2019).

In the floristic list, taxa are alphabetically ordered. Nomenclature and taxa delimitation follow the checklist of Italian vascular flora (Bartolucci et al. 2018a, Galasso et al. 2018a) and recent updates (Bartolucci et al. 2018b, 2018c, 2019b, Galasso et al. 2018b, 2018c, 2019), with the exception of varieties and native hybrids which were not considered in the above-mentioned works. For some taxa one or more synonyms (preceded by the following symbols: "≡" for homotypic synonyms, i.e. for nomenclatural synonyms; "=" for heterotypic synonyms, i.e. for taxonomic synonyms; "–" for misapplied names) were reported in brackets to enhance understanding of the nomenclature updating. For each taxon, we reported the site of collection (using the codes given in Suppl. material 1: S2) and the herbaria where the specimens were deposited. For each taxon identified, at least one exsiccatum was prepared to be preserved in a public (Suppl. material 1: S6_1, acronyms follow to Thiers 2019) or private (Suppl. material 1: S6_2) herbarium.

Results

After the research, 4,137 specimens of vascular plants were identified, including 6 Orchidaceae documented only by digital photographs. These were classified in 814 species and subspecies, belonging to 399 genera and 85 families (Suppl. material 1: S7 and S8), together with 4 hybrids (*Crataegus* ×*media* Bech., *Lolium* ×*boucheanum* Kunth, *Medicago* ×*varia* Martyn and *Vitis* ×*koberi* Ardenghi, Galasso, Banfi & Lastrucci), and 1 cultivar of *Viola tricolor* L. subsp. *tricolor*.

Forty-two taxa (5.2% of the total flora detected, Table 1) were found to be endemic to Italy (Peruzzi et al. 2014, 2015, Bartolucci et al. 2018a), while 28 taxa (3.4%) were found to be alien for the study area (Bartolucci et al. 2018a, Galasso et al. 2018a).

Five taxa (0.6% of the total flora), *Brassica nigra* (L.) W.D.J.Koch, *Gladiolus italicus* Mill., *Melissa officinalis* L. subsp. *officinalis*, *Oxalis corniculata* L. and *Papaver rhoeas* L. subsp. *rhoeas*, were considered cryptogenic in the investigated area (Bartolucci et al. 2018a, Galasso et al. 2018a).

Forty-three units (5.3% of the total flora) were found to be new floristic records. In particular, *Aquilegia coerulea* E.James (casual alien) and *Lolium* ×*boucheanum* Kunth (native) are recorded for the first time in Italy.

As reported below, 18 and 15 taxa were found to be new for the regional flora of Campania (Table 2) and Basilicata (Table 3), respectively.

This research also allowed to confirm 10 taxa for the flora of Campania (Table 4).

Table 1. List of Italian endemic taxa surveyed in the eastern Irpinia and Vulture-Melfese area.

Acer cappadocicum Gled. subsp. *lobelii* (Ten.) A.E.Murray	*Koeleria lucana* Brullo, Giusso & Miniss.
Achillea rupestris Huter, Porta & Rigo subsp. *calcarea* (Huter, Porta & Rigo) Greuter	*Leontodon intermedius* (Fiori) Huter, Porta & Rigo
Aristolochia clusii Lojac.	*Linaria purpurea* (L.) Mill.
Armeria macropoda Boiss.	*Luzula sylvatica* (Huds.) Gaudin subsp. *sicula* (Parl.) K.Richt.
Artemisia campestris L. subsp. *variabilis* (Ten.) Greuter	*Myosotis sylvatica* Hoffm. subsp. *elongata* (Strobl) Grau
Campanula fragilis Cirillo subsp. *fragilis*	*Ononis oligophylla* Ten.
Carduus corymbosus Ten.	*Ophrys lucana* P.Delforge, Devillers-Tersch. & Devillers
Carduus nutans L. subsp. *perspinosus* (Fiori) Arènes	*Ophrys tenthredinifera* Willd. subsp. *neglecta* (Parl.) E.G.Camus
Centaurea centauroides L.	*Ornithogalum etruscum* Parl. subsp. *etruscum*
Cerastium tomentosum L.	*Ornithogalum exscapum* Ten.
Crocus biflorus Mill.	*Polygala nicaeensis* Risso ex W.D.J.Koch subsp. *peninsularis* Arrigoni
Crocus imperati Ten.	*Potentilla calabra* Ten.
Dianthus carthusianorum L. subsp. *tenorei* (Lacaita) Pignatti	*Pulmonaria vallarsae* A.Kern. subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi
Dianthus vulturius Guss. & Ten. subsp. *vulturius*	*Scorzonera hispanica* L. subsp. *neapolitana* (Grande) Greuter
Digitalis micrantha Roth ex Schweigg.	*Scorzonera villosa* Scop. subsp. *columnae* (Guss.) Nyman
Drymochloa drymeja (Mert. & W.D.J.Koch) Holub subsp. *exaltata* (C.Presl) Foggi & Signorini	*Silene italica* (L.) Pers. subsp. *sicula* (Ucria) Jeanm.
Echinops siculus Strobl	*Siler montanum* Crantz subsp. *siculum* (Spreng.) Iamonico, Bartolucci & F.Conti
Erysimum apenninum Peccenini & Polatschek	*Stipa austroitalica* Martinovský subsp. *austroitalica*
Euphorbia corallioides L.	*Thymus picentinus* (Lacaita) Bartolucci
Klasea flavescens (L.) Holub subsp. *cichoracea* (L.) Greuter & Wagenitz	*Tragopogon cupanii* Guss. ex DC.
Knautia calycina (C.Presl) Guss.	*Viola aethnensis* (Ging. & DC.) Strobl subsp. *splendida* (W.Becker) Merxm. & Lippert

Table 2. List of taxa new for Campania.

Achillea nobilis L. subsp. *nobilis*	*Mantisalca duriaei* (Spach) Briq. & Cavill.
Aquilegia coerulea E.James (casual alien)	*Medicago ×varia* Martyn
Aristolochia clusii Lojac.	*Medicago glutinosa* M.Bieb.
Bromus hordeaceus L. subsp. *longipedicellatus* Spalton	*Medicago muricoleptis* Tineo
Bromus hordeaceus L. subsp. *molliformis* (J.Lloyd ex Billot) Maire & Weiller	*Ophrys funerea* Viv.
Cachrys libanotis L.	*Papaver pinnatifidum* Moris
Festuca stricta Host subsp. *trachyphylla* (Hack.) Patzke ex Pils	*Philadelphus coronarius* L. (casual alien)
Ficaria verna Huds. subsp. *verna*	*Rosa deseglisei* Boreau
Lolium ×boucheanum Kunth (casual alien)	*Viola tricolor* L. subsp. *tricolor* cv. (casual alien)

Table 3. List of taxa new for Basilicata.

Achillea nobilis L. subsp. *nobilis*	*Pilosella ziziana* (Tausch) F.W.Schultz & Sch.Bip.
Aristolochia rotunda L. subsp. *rotunda*	*Polycarpon tetraphyllum* (L.) L. subsp. *tetraphyllum*
Bromus hordeaceus L. subsp. *longipedicellatus* Spalton	*Rosa deseglisei* Boreau
Koeleria pyramidata (Lam.) P.Beauv.	*Ruscus hypoglossum* L.
Lathyrus inconspicuus L.	*Saxifraga stolonifera* Curtis (casual alien)
Melissa officinalis L. subsp. *officinalis* (cryptogenic)	*Sonchus asper* (L.) Hill subsp. *glaucescens* (Jord.) Ball
Ornithogalum etruscum Parl. subsp. *etruscum*	*Thymus ×korbii* Ronniger. nothosusbp. *korbii*
Orobanche teucrii Holandre	

Table 4. List of taxa confirmed for Campania.

Catananche lutea L.	*Phalaris truncata* Guss. ex Bertol.
Chaerophyllum nodosum (L.) Crantz	*Rubia tinctorum* L. (casual alien)
Echinaria capitata (L.) Desf.	*Rumex thyrsoides* Desf.
Neslia paniculata (L.) Desv. subsp. *thracica* (Velen.) Bornm.	*Sclerochlo a dura* (L.) P.Beauv.
Phalaris aquatica L.	*Scorzonera hispanica* L. subsp. *neapolitana* (Grande) Greuter

Discussion

Data obtained shows that the eastern Irpinia and Vulture-Melfese area hosts a rich and interesting vascular flora. Except for *Aristolochia clusii*, *Digitalis micrantha*, *Ononis oligophylla* and *Ophrys tenthredinifera* subsp. *neglecta*, all the other Italian endemic taxa recorded are currently included in the IUCN Red List of the Italian Flora (Rossi et al. 2013, Orsenigo et al. 2018) together with the non-endemic *Orchis provincialis* Balb. ex Lam. & DC. (38 taxa, 4.7% of the total flora). As regards *Thymus picentinus*, the specimens collected during this study allowed Bartolucci and Mráz (2016) to confirm the occurrence of this taxon in Basilicata and to re-evaluate its taxonomic status.

Among the non-native plants, 18 taxa were neophyte and 8 were considered invasive in at least one of the administrative regions considered (*Ailanthus altissima*, *Amaranthus retroflexus*, *Crepis sancta* subsp. *nemausensis*, *Dysphania ambrosioides*, *Erigeron sumatrensis*, *Paspalum distichum*, *Robinia pseudoacacia* and *Veronica persica*).

A small population of *Aquilegia coerulea*, a neophyte native to North America (Whittemore 1997), was found in Aquilonia (Campania, Avellino province) in anthropogenic environments. These individuals much likely derived from nearby cultivated plants seeds. Based on our floristic literature research (e.g., Nardi 2017), this record is the first for

the European flora. *Lolium* ×*boucheanum*, that is the natural hybrid between *Lolium perenne* L. and *L. multiflorum* Lam., it was collected in a marginal area of Monteverde (Campania, Avellino province) and is reported for the first time in Italy. As far as *Bromus hordeaceus* subsp. *longipedicellatus*, before this study its Italian distribution was restricted to Lombardia and Sardegna (Bartolucci et al. 2018a). Our findings of this taxon in Campania and Basilicata (Table 2 and Table 3) are therefore to be considered the first records for the peninsular Italy. Likewise, the discovery of *Medicago glutinosa* in Campania (Table 2) confirms its presence in southern Italy. Indeed, this species was reported only for Lombardia, Veneto, Liguria and Toscana, while was no longer recorded for Emilia-Romagna, and is considered doubtful in Umbria, Marche and Calabria (Bartolucci et al. 2018a).

Saxifraga stolonifera too is currently recorded in Lombardia and Veneto, while it is no longer recorded in Liguria (Galasso et al. 2018a). Therefore, our record from Basilicata (Table 3) is the first for the peninsular Italy.

In addition to the 11 taxa that we confirmed for Campania (Table 4), the observations made during this study also allowed Scoppola et al. (2016) to confirm the presence of *Trifolium multistriatum* W.D.J.Koch for the same region.

Some of the specimens collected in the study area require additional investigations aimed to clarify their taxonomic status. For example, the complex of *Centaurea deusta* shows a considerable variability in Italy (Stinca et al. 2019a). The samples found are probably attributable to a new taxon under study.

In recent years, especially in Campania, some researchers have focused their attention on the territories that are not well known from a floristic point of view, such as the lowlands and urbanized areas (e.g., Stinca et al. 2016, 2017a, Motti et al. 2018, Croce et al. 2019, Stinca 2019, Stinca and Mei in press). Some studies were carried out also in well-known areas from a floristic point of view, that have allowed to update their flora (e.g., Rosati et al. 2012, Stinca and Motti 2013, Stinca et al. 2014, 2017b, 2019b, Salerno and Stinca 2017, Stinca 2017). The floristic exploration of eastern Irpinia and Vulture-Melfese area, although carried out in a few days and in a limited number of sampling localities, allowed recording a considerable amount of taxa. The high number of species of floristic interest found, as well as the numerous floristic novelties suggest a high biodiversity level of the eastern Irpinia and Vulture-Melfese area, which are areas poorly studied by botanists in the past but that deserve further research.

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Supplementary material 1

Supplementary figures and tables 1–8

Authors: Stinca Adriano, Chianese Giuseppina, D'Auria Giuseppe, Fascetti Simonetta, Ravo Maria, Romano Vito Antonio, Salerno Giovanni, Astuti Giovanni, Bartolucci Fabrizio, Bernardo Liliana, Bonari Gianmaria, Bouvet Daniela, Cancellieri Laura, Carli Emanuela, Caruso Giuseppe, Catalano Immacolata, Cennamo Gennaro Domenico, Ciaschetti Giampiero, Conti Fabio, Di Pietro Romeo, Fortini Paola, Gangale Carmen, Lapenna Maria Rita, Lattanzi Edda, Marcucci Rossella, Peccenini Simonetta, Pennesi Riccardo, Perrino Enrico Vito, Peruzzi Lorenzo, Roma-Marzio Francesco, Scoppola Anna, Tilia Agnese, Villani Mariacristina, Rosati Leonardo

Data type: species data

Explanation note: **Figure S1.** Thermo-pluviometric diagram of the representative station of Monticchio Bagni. **Table S2.** List of the sampling sites and relative details. **Figure S3(1–8).** Topographic maps of sampling. **Figure S4.** Botanists participating at the field survey in eastern Irpinia and Vulture-Melfese area. **Figure S5.** Playbills of the two workshops held in 2016 in Portici (Library of Agriculture and Department of Agricultural Sciences of the University of Naples Federico II) and Barisciano (Apennine Floristic Research Center) to revise the critical samples collected during the field survey in eastern Irpinia and Vulture-Melfese area. **Table S6_1.** Public herbaria in which the collected exsiccata are kept. **Table S6_2.** Private herbaria in which the collected exsiccata are kept. **Table S7.** Floristic list of taxa surveyed in the eastern Irpinia and Vulture-Melfese area with the number of sampling sites in bold. **Figure S8.** Orchids recorded in the eastern Irpinia and Vulture-Melfese area only by digital photographs.

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RESEARCH ARTICLE

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Global and Regional IUCN Red List Assessments: 8

Giuseppe Fenu[1], Liliana Bernardo[2], Roberta Calvo[3], Pierluigi Cortis[4], Antonio De Agostini[4], Carmen Gangale[5], Domenico Gargano[2], Maria Letizia Gargano[3], Michele Lussu[4], Pietro Medagli[6], Enrico Vito Perrino[7], Saverio Sciandrello[8], Robert P. Wagensommer[9], Simone Orsenigo[10]

1 *Centre for the Conservation of Biodiversity (CCB), Department of Life and Environmental Sciences, University of Cagliari, Viale S. Ignazio da Laconi 13, 09123, Cagliari, Italy* **2** *Department of Biology, Ecology, and Earth Sciences, University of Calabria, Via P. Bucci, 87036, Rende, Italy* **3** *Department of Agricultural, Food and Forest Sciences (SAAF), University of Palermo, Viale delle Scienze, Bldg. 5, I-90128, Palermo, Italy* **4** *Department of Life and Environmental Sciences, University of Cagliari, Botany Section, Viale S. Ignazio da Laconi 13, 09123, Cagliari, Italy* **5** *Museo di Storia Naturale della Calabria ed Orto Botanico dell'Università della Calabria, Via N. Savinio, 87036, Rende, Italy* **6** *Department of Biological and Environmental Science and Technologies, University of Salento, Via Monteroni 165, 73100, Lecce, Italy* **7** *CIHEAM – Mediterranean Agronomic Institute of Bari, Via Ceglie 9, 70010, Valenzano (BA), Italy* **8** *Department of Biological, Geological and Environmental Sciences, University of Catania, Piazza Università, 2, 95131 Catania, Italy* **9** *Department of Chemistry, Biology and Biotechnology, University of Perugia, Via del Giochetto 6, 06123, Perugia, Italy* **10** *Department of Earth and Environmental Sciences, University of Pavia, Via S. Epifanio14, 27100, Pavia, Italy*

Corresponding author: *Giuseppe Fenu* (gfenu@unica.it)

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Abstract

In this contribution, the conservation status assessment of four vascular plants according to IUCN categories and criteria are presented. It includes the assessment of *Ophrys normanii* J.J.Wood at global level, and the regional assessment of *Genista anglica* L., *Helianthemum lippii* (L.) Dum.Cours., and *Scrophularia lucida* L. (Italy).

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

Ophrys normanii J.J.Wood

Global Assessment
Taxonomy and nomenclature
Order: Asparagales *Family*: Orchidaceae

O. ×*maremmae* O.Danesch & E.Danesch nothosubsp. *woodii* H.Baumann *&* S.Kunkele. Corrias, Inform. Bot. Ital. 15(2/3):178. (1983) 1985

Common name: Ophrys of Norman (En), Ofride di Norman (It).

Geographic distribution range: *Ophrys normanii* (Fig. 1) is endemic to Sardegna and its distribution consists of only three populations located in the south-western portion of the island (Fig. 2).

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

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

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

Reproduction: Entomophilous pollination based on the sexual deception of males of *Bombus vestalis* Geoffroy, 1785 (Hymenoptera, Apidae). Seed dispersion is anemochorous.

Habitat and Ecology: *Ophrys normanii* shows a narrow altitudinal range from 200 to 400 m a.s.l. This species prefers deep and mature soils originating from carbonate rocks. Usually, it grows in underbrush and clearings of forests dominated by *Quercus ilex* L., rarely at the edge of maquis.

Population information: the main population is located in the Municipality of Buggerru, consisting in approximately 100 individuals organised into seven groups. The population of Fluminimaggiore consists of a single group counting approximately 15 individuals, while another 15 scattered individuals grow in the area of "Arenas-Baueddu". In the municipality of Domusnovas, approximately 100 individuals occur in three groups. A few scattered individuals are also present between Iglesias and Cagliari.

Threats: 2.3.1 *Nomadic grazing:* the high number of wild boars (*Sus scrofa* L.) and sheep (*Ovis aries* L.) grazing during the reproductive period of this plant limit its fitness.

Figure 1. Flowers of *Ophrys normanii*. Photograph by V. Rodi.

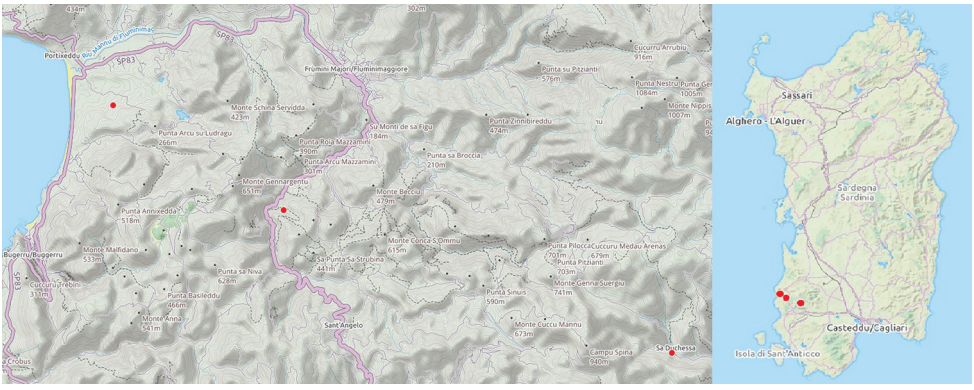

Figure 2. Geographic range and distribution map of *Ophrys normanii*.

2.2 *Wood plantations:* silvicultural activities cause damage to the population (this threat exists especially in the main population located in the municipality of Buggerru).

5.2 *Gathering terrestrial plants:* populations are subjected to the attention of photographers, orchid lovers and collectors that harm the plants and collect individuals.

CRITERIA APPLIED:
Criterion C: total population assessed in less than 2,500 mature individuals;
C2) a continuous decline in the number of mature individuals (mainly related to voluntary collection) was observed;
ai) Population structure with no population outnumbering the 250 mature individuals.
Criterion D: Total population assessed in less than 1000 mature individuals.

EN	Endangered	C2a(i)

Rationale for the assessment: *Ophrys normanii* is endemic to SW-Sardegna, and threatened by multiple factors directly or indirectly linked to human activity. The current global population counts approximately 400 mature individuals, distributed in three main populations: one larger and two smaller ones with few mature individuals. Considering that all populations are subjected to a continuous decline, mainly due to the collection of individuals, and that no population shows more than 250 mature individuals, this species can be considered as endangered (EN).

Previous assessment: this species was recently assessed as near threatened (NT) in Italy (Orsenigo et al. 2018), but new field data allowed us to reconsider its assessment.

Conservation actions: *Ophrys normanii* is not protected by any international, national or regional specific law. Nevertheless, the populations located in the municipalities of Buggerru and Domusnovas are included in the SCI areas "Is Compinxius – Campo Dunale di Buggerru – Portixeddu" (ITB042247) and "Monte Linas – Marganai" (ITB041111) respectively.

Conservation actions needed: research activities and especially monitoring programs are encouraged in order to better understand the autecology of this species; *ex situ* conservation could prevent the risk of extinction.

Note: This species was initially considered as hybridogenous (Corrias 1985). Nevertheless, recent studies (Goegler et al. 2009, 2015) demonstrated how this hypothesis is not correct.

P. Cortis, A. De Agostini, M. Lussu

Genista anglica L.

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

Genista anglica L., Sp. Pl.: 710 (1753)

Common name: Petty whin (En), Ginestra d'Inghilterra (It).

Geographic distribution range: *Genista anglica* (Fig. 3) is a western European species, reaching northwards Great Britain, eastwards southern Sweden and northern Germany. The southern portion of the range is found in the southern Italian peninsula (Gibbs 1968). In this context, the Italian populations represent a striking disjunction, as they are separated by thousands of kilometres from the closest ones occurring in southern France. In Italy, *G. anglica* is confined to the southern extreme of the peninsula. Here, this plant inhabits a reduced number of sites, which are split into three distinct groups, namely in Sila, Serre Calabre, and Aspromonte mountains (Fig. 4). Brullo et al. (2001a, 2001b) described the isolated Italian populations as two endemic taxa (*G. silana* Brullo, Gangale & Spamp. and *G. brutia* Brullo, Scelsi & Spamp.). However, this taxonomic treatment was rejected by Prieto et al. (2016), who evidenced a high relatedness among Italian and Iberian populations.

Distribution: Countries of occurrence: Belgium, Denmark, France, Germany, Great Britain, Italy, Netherlands, Portugal, Spain, and Sweden.

Biology: *Plant growth form:* perennial (suffruticose chamaephyte/nanophanerophyte).

Flowering time: From April to June.

Reproduction: This species is mainly pollinated by honeybees and bumblebees (Tsaliki and Diekmann 2011), and seed dispersal mainly relies on explosive dehiscence.

Habitat and Ecology: *Genista anglica* is typical of Atlantic heathland communities. In southern Italy, this plant usually occurs in mountain plains, at the border of wetlands (Gentile 1979, Gargano et al. 2007) or within scrublands dominated by *Cytisus scoparius* (L.) Link (Brullo et al. 2001b).

Population information: There is no detailed information available on population dynamics; however, many populations are declining due to various kinds of habitat modification.

Threats: *2.1. Annual & perennial non-timber crops*: in some sites, the expansion of cultivations causes a reduction on natural habitats.

2.3. Livestock and farming and ranching: trampling and grazing due to nomadic domestic animals affects the quality of many areas colonized by the species.

7.2. Dams & water management/use: in many sites, the species suffers for variations in the hydrological regimes, due to the presence of small and large dams, and the removal of surface water for agricultural use.

7.3. Other ecosystems modifications: locally, vegetation dynamics can originate habitat variations, which are unfavourable for the plant.

9.3.1. Nutrient loads: The proximity to cultivated lands and the long-lasting presence of livestock promote soil eutrophication in numerous occurrence sites.

CRITERIA APPLIED:

Criterion B: **EOO:** 3,920 km^2 calculated with minimum convex hull polygon in QGIS.
AOO: 200 km^2 calculated with a 2×2 km fixed cell grid (Gargano 2011).

a) Number of locations: overall, we identified nine locations based on the main threat affecting the species in a given area. According to this criterion, the populations occurring in Aspromonte can represent a unique location subjected to the expansion of

Figure 3. *Genista anglica* at Silvana Mansio (Serra Pedace, Cosenza; Calabria), a locality included in the Sila National Park. Photograph by L. Bernardo.

Cytisus scrublands. Instead, the two isolated populations found in Serre Calabre can be considered as two distinct locations threatened by site modifications, which are inducing variations of the local water regime. In the Sila mountain range, the major threat affecting *G. anglica* populations at higher elevation is the eutrophication related to grazing. Based on this threat, we identified five locations. Instead, at lower altitudes, the sites found in this mountain area are affected by soil consumption for agriculture and by eutrophication caused by the extensive use of fertilizers. In this case, the aggregation of contiguous sites allows the identification of a single location. b) Habitat extent and quality (iii) are declining in many sites, as well as the number of mature individuals (v). A reduction of AOO (ii) is likely to have affected the species in Italy, especially in the southern part of its regional range, but it is difficult to quantify due to the precision gaps in historical records. No documented decline of the regional EOO.

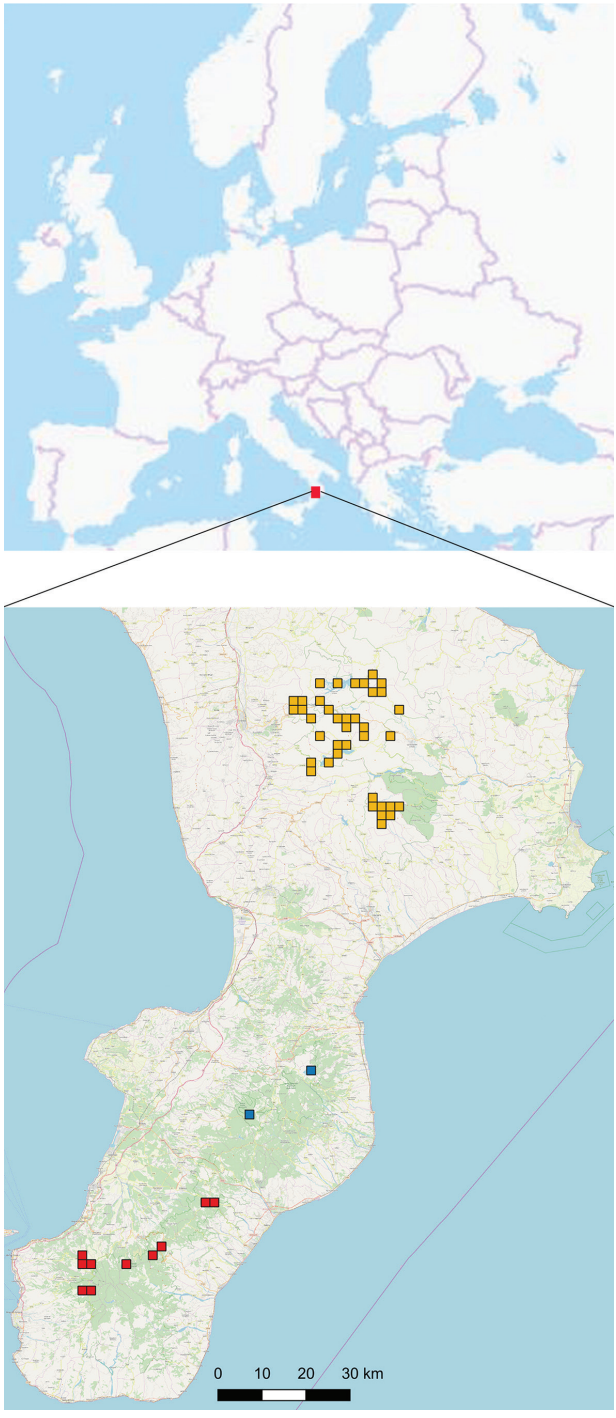

Figure 4. Position of the study area in the European context (upper side), and location of the Italian populations of *Genista anglica* (lower side). Brown squares, localities in Sila; blue squares, localities in Serre Calabre; red squares, localities in Aspromonte.

Red List category and Criteria (Regional Assessment)

VU	**Vulnerable**	**B1ab(ii,iii,v)+2ab(ii,iii,v)**

Rationale for the assessment: In Italy, *Genista anglica* is restricted to a reduced number of sites on three mountain areas located in the extreme southern part of the Italian peninsula. The regional distribution range consists in an EOO of 3,920 km^2 and an AOO of 200 km^2. This species is threatened by various kinds of habitat modifications, including expansion of cultivated lands, grazing, adverse vegetation dynamics, soil eutrophication, hydrological variations. Based on the prevalent threats acting across its regional range, *G. anglica* occurs in less than 10 locations. Because of the rarity and the overall decline of area of occupancy, habitat extent and quality, and population size promoted by the above-listed threats, this taxon qualifies as Vulnerable (VU) at the regional level. The geographical isolation makes unlikely any contribution of the European *G. anglica* populations to the conservation status of the Italian ones. Therefore, there is no reason for up- or down-grading the level of conservation concern established during the assessment procedure.

Previous assessment: The taxon is not evaluated (NE) at the global level (IUCN 2019).

Conservation actions: All the known Italian populations of *Genista anglica* occur within national and regional protected areas, namely: Sila National Park, Regional Park of Serre Calabre, and Aspromonte National Park.

Conservation actions needed: improved site management, in order to preserve habitat extent and quality, with a major attention to the control of scrub encroachment and the preservation of hydrological, and nutritional soil properties.

D. Gargano, C. Gangale, L. Bernardo

Helianthemum lippii (L.) Dum.Cours.

Regional Assessment (Italy)

Taxonomy and nomenclature

Order: Malvales *Family*: Cistaceae

Helianthemum lippii (L.) Dum.Cours., Bot. Cult. 3: 130 (1802) ≡ *Cistus lippii* L., Mant. Pl.: 245 (1771) = *Helianthemum sessiliflorum* (Desf.) Pers., Syn. Pl. 2: 78 (1806).

Common name: Sun rose (En), Eliantemo di Lippi (It), Raqrouq (Ar).

Geographic distribution range: *Helianthemum lippii* (Fig. 5) grows in the Middle East, Arabian Peninsula, and North Africa (Escudero et al. 2007), where it is well suited to severe climatic conditions (Greuter et al. 1984, Dobignard and Chatelain 2011), and in the Mediterranean Basin (GBIF Secretariat 2017). In Italy, the presence of *Helianthemum lippii* is reported for southern regions (Francini

Figure 5. *Helianthemum lippii* in Sicily. Photograph by G. Domina.

1953, Brullo et al. 1987; Fig. 6), for the northwestern coast of Sicily, and on the southwestern coast of Puglia (observations by P. Medagli and G.N. Silletti). According to Venturella et al. (2015), the populations of *Helianthemum lippii* previously reported from Calabria are currently doubtful and should be excluded from the vascular flora of this Region.

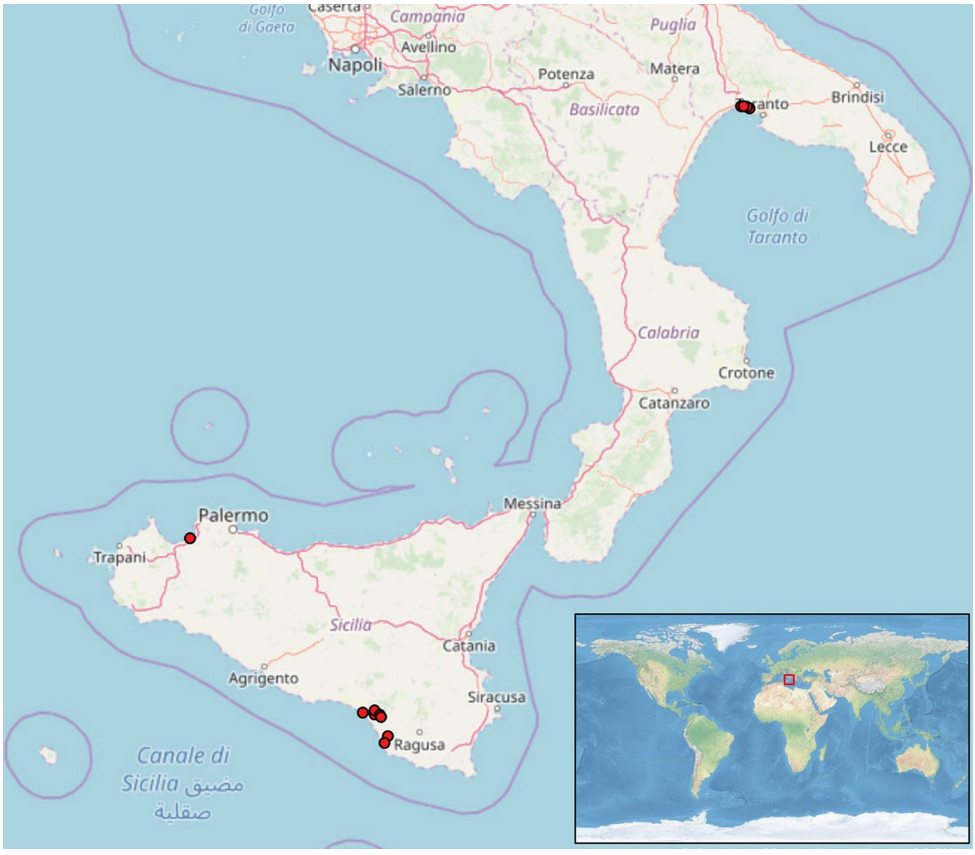

Figure 6. Geographic range and distribution map of *Helianthemum lippii* in Sicily and Puglia.

Distribution: *Countries of occurrence*: Algeria, Egypt, Greece, Iran, Iraq, Israel, Italy (mainland and Sicily), Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Pakistan, Qatar, Syria, Spain, and Tunisia.

Biology: *Plant growth form:* Perennial (nanophanerophyte). *Chromosome number: 2n = 20* (Díaz Lifante et al. 1992).

Flowering and fruiting time: Flowering and fruiting periods in the Mediterranean area range from April to May.

Reproduction: No detailed information on pollination, dispersal strategy, and seed germination is available.

Habitat and Ecology: *Helianthemun lippii* is a perennial shrub typical of arid grasslands and marine sands, growing in Sicily and in Puglia from 0 to 300 m a.s.l. (Pignatti 1982).

Population information: Direct observations indicate that in several localities, such as Balestrate (Palermo), Macconi Cava Cammarata (Gela), Biviere and Macconi di Gela (Gela), Contrada Dirillo (Acate, province of Ragusa), Pineta Vittoria (Vittoria, province of Ragusa), and Vallata del Fiume Ippari (Pineta di Vittoria)

(Vittoria, province of Ragusa) the populations are declining. Conversely, the populations in Piano Stella (Gela), Piano del Duca (Gela), Cava Randello and Passo Marinaro (province of Ragusa) are stable, while in Contrada Pirrera (Acate, province of Ragusa) the population is increasing. In Lido Azzurro, Bosco Tagliacozzo, Dune di Patemisco, Foce del fiume Tara, and Pineta di Chiatona (province of Taranto) populations are stable.

Threats: *1.1. Housing and urban areas:* In the northwestern part of Sicily (Balestrate, province of Palermo), the population grows in an expanding residential area, that has a negative impact of the population of *H. lippii*.

4.1. Roads and railroads: The population of Balestrate (province of Palermo) is threatened by the construction of an access road to a residential area.

2.1 Annual and perennial non-timber crops: In southern areas of Sicily, such as Macconi Cava Cammarata (Gela), Piano Stella (Gela), and Passo Marinaro (province of Ragusa) the populations are located in intensive agricultural areas, among greenhouses.

2.3.1 Nomadic Grazing: In southern Sicily, such as in Piano Stella (Gela), Piano del Duca (Gela), Acate Pirrera (Ragusa), Acate Dirillo (Ragusa), and Pineta Vittoria (Ragusa), the populations are subjected to sheep and goat overgrazing.

3.2 Mining and Quarrying: In southern Sicily, such as in Macconi Cava Cammarata (Gela), and Passo Marinaro (Ragusa), the populations grow in areas used as sand quarries.

6.1 Recreational Activities: In Puglia, the populations are located in a seaside area affected by heavy tourism, in particular in the proximity of equipped beaches set up during the summer season.

7.1 Fire & Fire suppression: The populations in Piano Stella (Gela), Piano del Duca (Gela), Acate Pirrera (Ragusa), Acate Dirillo (Ragusa), and Pineta Vittoria (Ragusa) are frequently burnt by fires.

CRITERIA APPLIED:

Criterion B: **EOO**: 41,917 km^2 calculated with GeoCAT (Geospatial Conservation Assessment Tool) programme (Bachman et al. 2011).

AOO: 48 km^2 calculated with GeoCAT (Geospatial Conservation Assessment Tool) programme (Bachman et al. 2011).

No. of Locations > 10 (identification based on the main threat affecting the species in a given area).

Decline: direct observation of a decline in EOO, number of populations and number of mature individuals.

Criterion D: Total population assessed in more than 1000 mature individuals.

Red List category and Criteria (Regional Assessment)

NT	**Near Threatened**

Rationale for the assessment: *Helianthemum lippii* shows a wide distribution, ranging from the Mediterranean area to central Asia (Pakistan). In Italy, the distribution of

this species is limited to a restricted portion of Sicily and Puglia, where the population suffers multiple threats causing a decline in EOO, in number of populations/localities and in number of mature plants. The known Italian populations of *Helianthemum lippii* consist of more than 1000 mature individuals. Although the populations of *H. lippii* are threatened by several natural and human-related factors and a decline was observed in several populations, the populations are not severely fragmented, the number of locations was higher than 10 and the total number of mature individuals was higher than 1000. For all these reasons, this species is classed as Near Threatened (NT) at regional level (Italy).

Previous assessment: *Helianthemum lippii* was not previously evaluated (NE) at a global level (IUCN 2019). A preliminary assessment of *H. lippii* in Sicily as an endangered taxon was provided by Raimondo et al. (2011), without any further explanation.

Conservation actions: *Helianthemum lippii* is not protected at either regional, national or international levels. No seed collection from the Italian population exists in germplasm banks.

Conservation actions needed: Monitoring activities of the habitats and populations of *Helianthemum lippii* should be activated. *In situ* and *ex situ* conservation strategies should be planned to protect this rare and threatened plant in Italy from further decline.

R. Calvo, M.L. Gargano, S. Sciandrello

Scrophularia lucida L.

Regional Assessment (Italy)
Taxonomy and nomenclature
Order: Lamiales *Family*: Scrophulariaceae

Scrophularia lucida L., Syst. Nat. 10 (2): 1114 (1759) = *Scrophularia provincialis* Rouy, Bull. Soc. Bot. France 38: 264 (1891) = *Scrophularia rutifolia* Boiss., Fl. Or. 4 (2): 404 (1879)

Common name: Apulian figwort (En), Scrofularia pugliese (It).

Geographic distribution range: *Scrophularia lucida* (Fig. 7) is distributed in the eastern Mediterranean Basin (Marhold 2011+; Fig. 8). Populations in the Maritime Alps, France, represent the westernmost limit of its range. In Italy, this species occurs only in the administrative regions of Puglia and Basilicata, while it is no longer recorded in Liguria and erroneously recorded in Piemonte (Bartolucci et al. 2018). The Italian populations are located along coasts and hinterland of central-southern Puglia, while it is rarer in Basilicata. In Puglia, it is reported for Monopoli (Perrino and Signorile 2009), Polignano a Mare (Perrino et al. 2013), Lama Belvedere (2005, F. Angiulli, BI n. 35404.) (Province of Bari); Cisternino (observation by E.V. Perrino), Fasano (Perrino et al. 2014), Rosa Marina along the gravine, Gravina di San Biagio and Santa

Figure 7. *Scrophularia lucida* photographed at Fasano (Brindisi). Photograph by E.V. Perrino.

Figure 8. Geographic range and distribution map of *Scrophularia lucida* L.

Maria d'Agnano (Ostuni; observations by P. Medagli), Lamaforca and Torre Santa Sabina (Carovigno; Province of Brindisi; observation by E.V. Perrino); several more or less continuous localities in Salento from Otranto to S. Maria di Leuca, and other sites

at Rupi di S. Mauro (Gallipoli), Montagna Spaccata (Galatone), Torre Uluzzo and Torre dell'Alto at Porto Selvaggio (Nardò; province of Lecce; observations by P. Medagli), Gravina di Palagianello, Gravina di Castellaneta, Gravina di Laterza, Grottaglie at the Gravina di Fantiano, Gravina di Fullonese and Gravina di Riggio, Massafra at Gravina della Madonna della Scala, Statte at the Gravina di Leucaspide, Gravina di Ginosa (Province of Taranto). In Basilicata, this species is reported for Gravina di Matera (Medagli and Gambetta 2003, Terzi and D'Amico 2008) and Picciano (Matera; observation by P. Medagli).

Distribution: *Countries of occurrence*: France, Greece, Jordan, Israel, Italy, Lebanon, Syria, and Turkey.

Biology: *Plant growth form:* biennial/perennial (hemicryptophyte/chamaephyte). *Chromosome number:* 2*n* = 24, 26 (Kamari et al. 1995, Pignatti 2018).

Flowering time: From April to late July.

Reproduction: Each ripening capsule disperses several small seeds (balistochorous dissemination), that can be transported by ants (myrmecochorous dissemination). Therefore, this species displays a low ability to increase its range due to its dissemination strategies.

Habitat and Ecology: *Scrophularia lucida* grows in rocky limestone cliffs from sea level to 400 m a.s.l., colonizing natural rock crevices (Perrino et al. 2013). Its habitat is protected by the Habitats Directive 92/43/EEC, as "Calcareous rocky slopes with chasmophytic vegetation" (code 8210) (Biondi and Blasi 2009). In Italy, *S. lucida* is considered a characteristic species of the endemic alliance *Caro multiflori-Aurinion megalocarpae* Terzi *et* D'Amico 2008 (Terzi and D'Amico 2008).

Population information: There is no information available on population dynamics.

Threats: *6.1 Recreational activities:* the populations near the coast could be affected by the tourists in summer just when this species is flowering and fruiting.

7.1.1 Increase in fire frequency/intensity: an increase in fire frequency or intensity would negatively affect the populations.

10.3 Avalanches and landslides: some populations can be lost or reduced by landslides caused by the erosion of the slopes where the plant grows.

CRITERIA APPLIED:

Criterion B: **EOO:** 8,964 km^2 calculated with minimum convex hull (with Google Earth Pro)

AOO: 180 km^2 calculated with a 2×2 km cell fixed grid

a) Not severely fragmented; number of locations > 10
b) No continuing decline
c) No extreme fluctuations

Red List category and Criteria (Regional Assessment)

LC	**Least Concern**

Rationale for the assessment: *Scrophularia lucida* is an east-Mediterranean species currently occurring in Italy only in Puglia and Basilicata. The habitat of this species is

quite conservative and neither continuing decline nor extreme fluctuations have been observed or can be projected. The distribution is not severely fragmented and the identified threats are only potential in most of the occurrence sites. Therefore, this species is assigned to the Least Concern (LC) category.

Previous assessment: This species was not previously evaluated (NE), neither at national (Italy) nor at global level (IUCN 2019).

Conservation actions: *Scrophularia lucida* is unprotected by international, national or regional laws.

Conservation actions needed: Research activities and monitoring programs are recommended in order to better understand the reproductive biology of this species and its population trend. Moreover, *ex situ* germplasm resource banking is recommended, for possible plant translocation programmes aimed at increasing the low number of individuals of the subpopulations.

Notes: Recently, some authors reported the antitumoral (breast cancer) activity of some metabolites of *S. lucida* (Lewenhofer et al. 2018).

E.V. Perrino, R.P. Wagensommer, P. Medagli

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RESEARCH ARTICLE

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Light intensity affects leaf morphology in a wild population of *Adenostyles alliariae* (Asteraceae)

Bailey Francis[1], Robert Tucker Gilman[2]

1 *Faculty of Biology, Medicine and Health, University of Manchester, Oxford Road, Manchester M13 9PL, UK*
2 *Department of Earth and Environmental Science, University of Manchester, Oxford Road, Manchester M13 9PL, UK*

Corresponding author: *Bailey Francis* (bailey.francis@student.manchester.ac.uk)

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Abstract

Low light conditions can impose environmental stress on plants, and plants often respond adaptively by increasing their leaf area. Light stress on plants can also result in developmental instability, which can manifest as increased fluctuating asymmetry in leaves or other organs. The relationship between light conditions and fluctuating asymmetry has been documented in experimental populations, but has been less frequently observed in the wild. Here, we studied how leaf surface area and fluctuating asymmetry correlate with light intensity in a wild population of *Adenostyles alliariae* (Asteraceae). We found strong evidence that leaf surface area increases and weak evidence that fluctuating asymmetry increases as light intensity decreases. Our results help to elucidate the relationship between light stress and developmental instability under naturally occurring conditions.

Keywords

fluctuating asymmetry, light intensity, developmental instability, phenotypic plasticity, *Adenostyles alliariae*

Introduction

Plant growth and survival are strongly influenced by abiotic factors such as light intensity, nutrient availability, and temperature (Agarwal et al. 2006). These abiotic factors can produce conditions that are unfavourable for normal plant development (Jan et al. 2012). Plants living in shaded or poor nutrient habitats or in areas outside their optimal temperature ranges can display increased levels of stress compared to plants

living in more favourable environments (Sridevi et al. 1999; Lynch and Brown 2001; Yang et al. 2019). To survive in these stressful environments, plants have evolved the ability to respond to abiotic stressors with physiological and morphological alterations (Alpert and Simms 2002), resulting in intraspecific phenotypic variation (Miner et al. 2005; Rozendaal et al. 2006).

Plants require light for their development and metabolism, but they sometimes occur in areas where light availability is below the optimum level (i.e., light stress, Niinemets 2010; Cramer et al. 2011; Zhu et al. 2017). In these conditions, plants often respond by increasing their leaf area to intercept more sunlight (Dwyer et al. 2014; Liu et al. 2016), although this response can vary even among closely related species (Sultan 2003). As a result, plants growing in different natural light conditions are expected to have different leaf sizes (Marques et al. 1999).

Another consequence of light stress for plants is a phenomenon known as developmental instability (DI). DI occurs when an organism is unable to achieve its developmentally programmed phenotype, and can result from unfavourable environmental conditions (Markow 1995). One common manifestation of DI is fluctuating asymmetry (FA), or small deviations from perfect symmetry in otherwise symmetrical structures (Moller and Shykoff 1999; Cornelissen and Stiling 2010). These deviations are caused when organisms are exposed to severe stress at certain critical development stages, resulting in abnormal phenotypes and increased phenotypic variability among individuals (Waddington 1956; Graham et al. 1993). FA can reflect disturbances in developmental homeostasis at the molecular, chromosomal or epigenetic levels (Parsons 1990). Because FA is easily measured in the field, it is often used as a surrogate for DI in ecological studies (Palmer and Strobeck 1986; Graham et al. 2010). In studies of DI resulting from light stress in plants, researchers have often focused on FA in the leaves (Midgley et al. 1998; Roy and Stanton 1999; Venâncio et al. 2016).

If leaf FA is greater at low light intensity, this might be because low light intensity causes developmental stress. Alternatively, the relationship might be mediated by leaf growth. If leaves in low light conditions are larger than leaves in high light conditions, then they must grow faster or for longer, and faster or longer growth might result in DI (Moller and Eriksson 1994; Cuevas-Reyes et al. 2011). These potential drivers of FA have not been fully disentangled.

In the Carnic Alps, the herbaceous perennial *Adenostyles alliariae* (Asteraceae) is a useful model for investigating DI in response to light conditions. The species is common and grows in both coniferous forests and alpine meadows, and therefore occupies habitats with a wide variety of light conditions. Phenotypic variation and DI have not yet been examined in this species. Additionally, light stress is one of the most uncharacterized and least studied abiotic stresses that plants encounter (Yang et al. 2019). In this study we investigated both phenotypic variation and DI of *A. alliariae* leaves in areas of differing sunlight exposure. We measured phenotypic variation using leaf area, and used leaf FA as a surrogate for DI (Santos et al. 2013). We hypothesised that leaves growing in low light conditions would have increased area and increased FA, which may indicate phenotypic compensation for low light conditions and increased levels of stress in *A. alliariae*, respectively.

Methods

Site selection

Fieldwork was conducted at the Baita Torino field station in the Passo del Pura, Ampezzo, Friuli-Venezia Giulia, Italy (46°25.5433'N, 12°44.5167'E (DDM), 1400 m asl) between 11:00 and 13:00 on 9, 11 and 12 July 2019. The area is part of the Carnic Alps, which are characterised by high plant biodiversity and endemism (Pignatti and Pignatti 2014). We selected four study sites in the vicinity of the Baita Torino. Two sites (i.e., the shaded sites) were covered by coniferous forest (primarily *Abies alba* and *Picea abies*) and two sites (i.e., the open sites) were unforested. Sites were selected for their coverage properties and for the presence of *A. alliariae*. Thus, site selection was not random.

Data collection

At each site we randomly selected 25 individual *A. alliariae* plants with no signs of herbivory for study (i.e., 100 plants in total). We identified the most basal leaf on each plant and we measured the light intensity at its apex and base, and on the right and left side of the leaf at its widest points using the Google Science Journal application (version 3.2) on an iPhone 7. We averaged these measurements to estimate the light intensity reaching the leaf. We then collected the leaf and photographed it on a white background with a 25 mm scale bar. We used ImageJ (version 1.51) to measure the adaxial surface area of each leaf. We also measured the distance from the midrib to the widest points on the left and on the right sides of the leaf. We called these distances *Ls* and *Rs*, respectively (Figure 1). We estimated the directed asymmetry, d, of each leaf using $d = \log(Ls) - \log(Rs)$ (Waddington 1960; Venâncio et al. 2016). Thus, $d > 0$ if $Ls > Rs$ and $d < 0$ if $Ls < Rs$. This measure is unitless and depends on the shape but not on the size of the leaf. We estimated the undirected asymmetry of each leaf as $|d|$ (Waddington 1960; Venâncio et al. 2016). The undirected asymmetry captures the magnitude but not the direction of asymmetry in each leaf.

Analyses

Asymmetry in a population can be fluctuating or directional. Directional asymmetry occurs if one side of an organ or organism is consistently different from the other in all members of a population, and need not indicate DI (Graham et al. 1993). For example, in Tengmalm's owl (*Aegolius funereus*), the right ear aperture is positioned higher on the head than the left, and this is believed to enhance directional hearing (Norberg 1978). In our study, asymmetry would be directional if the left side of the leaf were consistently larger than the right side, or vice versa. To test for directional asymmetry, we applied a one-sample t-test to ask whether d was significantly different from zero.

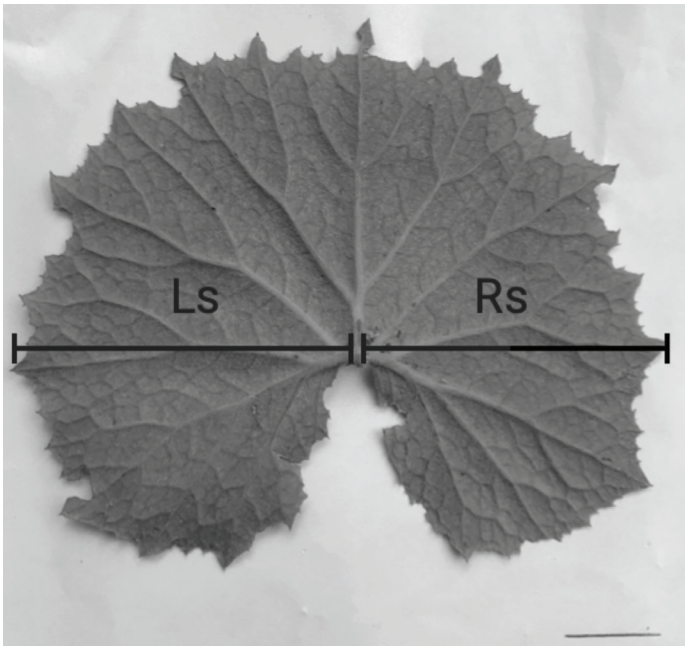

Figure 1. The most basal leaf from an *A. Alliariae* plant sampled in this study. *Ls* and *Rs* represent the measures for the midrib to the widest points on left and right of the leaf, respectively.

In the absence of directional asymmetry, we can interpret the undirected asymmetry of leaves in our study as FA. We regressed the logged leaf area and FA on the logged light intensity reaching each leaf using mixed effects models implemented in the R package lme4 (Bates et al. 2015). The models included random effects of site (to account for potential differences in site qualities such as soil chemistry) and day (to account for systematic differences in light measurements due to weather on different days). The residuals of the fitted models were not normally distributed, so we Box-Cox transformed logged leaf area and FA (Box and Cox 1964; Venâncio et al. 2016) using the powerTransform function in the R package car (Fox and Weisberg 2019). Box-Cox transformation requires that data to be transformed be strictly positive, and our FA measurements included two zeros. Therefore, we Winsorised the zero values to the smallest non-zero value in the data set (i.e., the smallest FA we know we could detect, Tukey 1962) prior to Box-Cox transformation. Then, we refit the mixed effects models to the transformed data. We calculated p-values for the effects of logged light intensity on logged leaf area and FA using the Satterthwaite approximation (Satterthwaite 1941; Luke 2017) implemented in the R package lmerTest (Kuznetsova et al. 2017).

If the relationship between FA and light intensity is mediated by leaf growth, then under the same light conditions we would expect leaves that grow faster or for longer (i.e., larger leaves) to show more FA. Thus, we would expect to see a relationship between leaf area and FA after controlling for light intensity. To test this, we regressed Box-Cox transformed FA on logged light intensity and logged leaf area in a mixed

model with random effects of site and day, and estimated p-values using the Satterthwaite approximation.

Data are available in Suppl. material 1: File S1: aa_data.csv, and the R code used to analyze the data is available in Suppl. material 1: File S2: Francis_and_Gilman_analysis.R. Both files are also archived in the TRY Plant Trait Database (Kattge et al. 2011) at https://doi.org/10.17871/TRY.49.

Results

The light intensity measured at individual leaves varied within sites (Figure 2), but was higher overall at open sites (8.26 ± 0.22 log(lx)) than at shaded sites (6.75 ± 0.25 log(lx)) (Monte Carlo randomisation, $p < 0.0001$). The mean logged leaf area was 9.53 ± 0.07 log(mm^2) in open sites and 9.79 ± 0.07 log(mm^2) in shaded sites. The mean undirected asymmetry was 0.069 ± 0.005 in open sites and 0.080 ± 0.008 in shaded sites.

Adaxial surface area increased with decreasing light intensity ($p < 0.0001$, $\beta = -0.27$ log(mm^2) $log(lx)^{-1}$ calculated at the mean-centered logged light intensity of 7.50 log(lx); Figure 3A). We found no evidence that asymmetry in the study population was directional rather than fluctuating ($p = 0.2032$) and thus we treated undirected asymmetry as FA. We found weak evidence that FA increased with decreasing light intensity ($p = 0.0730$, $\beta = -4.8 \times 10^{-3}$ $log(lx)^{-1}$ calculated at the mean-centered logged light intensity; Figure 3B). If we forced site type (i.e., open or shaded) into the model, we found no relationship between site type and either logged leaf area ($p = 0.70$) or FA ($p = 0.99$). Thus, leaf morphology is better explained by light intensity at the individual leaf than by light intensity at the study site. We found no relationship between FA and logged leaf area after controlling for the effect of light intensity ($p = 0.532$). Therefore, we have no evidence that the effect of light intensity on FA was mediated by leaf growth.

Discussion

Plants can respond to environmental stresses by modifying their physiology and morphology, and this is reflected in their phenotypic variation (Miner et al. 2005; Rozendaal et al. 2006). Such modifications are common in plants growing in conditions of poor light availability (Markesteijn et al. 2007). In this study, we found that *A. alliariae* growing at lower light intensity produce larger leaves. A plastic response of leaf size to light intensity is likely to be adaptive for plants that experience variable light conditions between generations or across small spatial scales (Markesteijn et al. 2007).

We found weak evidence that leaf FA increases with decreasing light intensity in *A. alliariae*. The relationship between light intensity and FA has found mixed support in the literature. Several studies have reported increased leaf FA in plants growing at low light intensity under manipulated (*Sinapis arvensis* Roy & Stanton, 1999; *Quercus pyrenaica* Puerta-Pinero et al., 2008; *Silene vulgaris* Sandner & Matthies, 2017) or natural

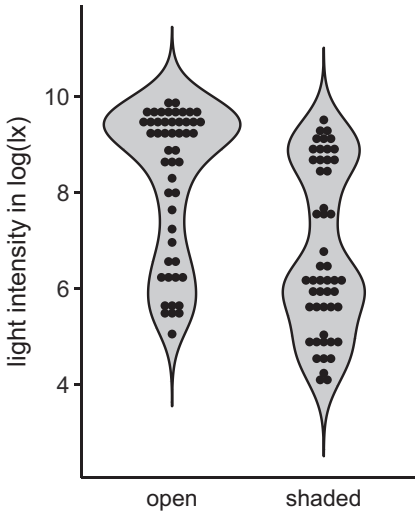

Figure 2. Light intensity measured at individual leaves in open and shaded sites.

conditions (*Quercus alba* Kusi, 2013; *Miconia fallax* Alves-Silva, 2012). In contrast, Wuytack and colleagues (2011) found no effect of light intensity on leaf FA in *Salix alba* and Venâncio and colleagues (2016) found no effect of light intensity on leaf FA in *Bauhinia brevipes*, albeit in a study of only 26 plants versus the 100 plants in our study. Other studies have found that FA increases with increasing light intensity. For example, Midgley and colleagues (1998) found that leaf FA in *Dimorphotheca sinuate* increased with UV-B exposure, although their UV-B exposure treatments simulated depleted ozone conditions and were therefore greater than plants regularly encounter. Tucic and Miljkovic (2010) found increased FA in *Iris pumila* growing higher light conditions in nature, but in flowers rather than leaves. To our knowledge, our study provides the first evidence of increasing FA with decreasing light intensity in a naturally occurring population of an herbaceous plant. Given the variability of reported results, systematic work to identify the ecological traits or genotypes that mediate the relationship between leaf FA and light intensity might reward effort.

Some authors have suggested that the relationship between low light intensity and increased leaf FA might be mediated by leaf growth (Moller and Eriksson 1994; Cuevas-Reyes et al. 2011). That is, leaves grow to greater size under low light conditions, and the demands of longer or faster growth might result in stress and thus developmental instability. However, if that were the case, we would expect larger leaves to show more FA under similar light conditions, and we did not see this pattern in our study. Many environmental conditions other than light can also affect leaf FA, and some of these conditions may have varied among sites in our study. However, we controlled for site-specific environmental variation by including site as a random effect in our analyses. Therefore, we believe that differences in light intensity are likely to explain the differences we observed in leaf FA among *A. alliariae* plants.

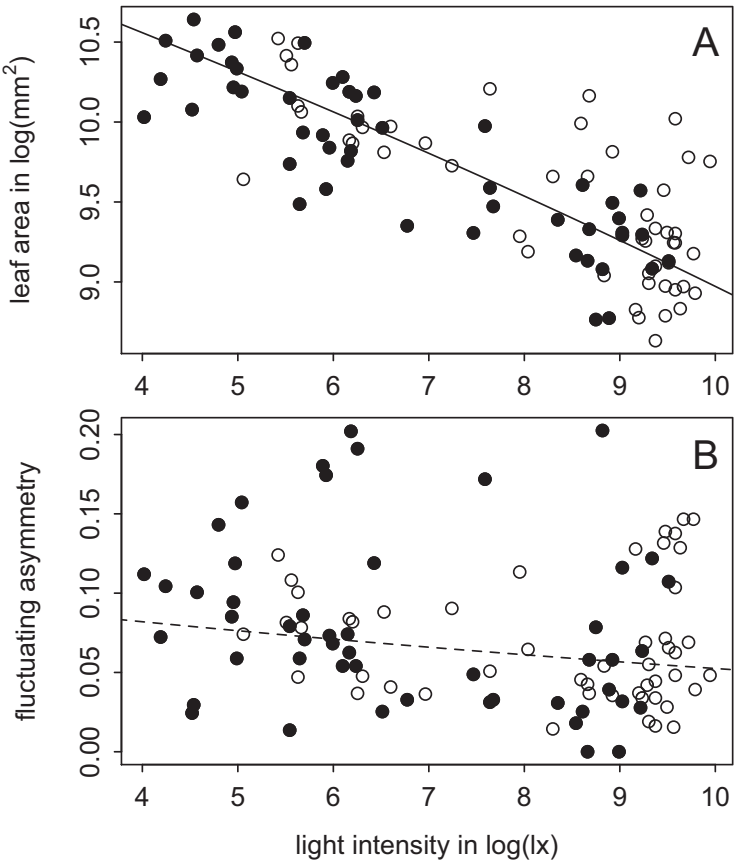

Figure 3. Effects of light intensity on adaxial surface area **A** and FA **B** in *A. Alliariae* leaves. Each point represents the most basal leaf of a plant growing in a shaded (filled circles) or open (open circles) site. The solid line indicates a significant relationship ($p < 0.0001$) and the dashed line indicates a marginally significant relationship ($p = 0.0732$). Lines of best fit are back-transformed from models fitted to Box-Cox transformed data.

Our study examined only one leaf per plant. Therefore, we cannot determine whether light intensity at each leaf affects the morphology of that leaf, or whether the light intensity experienced by each plant affects the morphology of all leaves on the plant and the light intensity at the most basal leaf is correlated with the light intensity experienced by the plant as a whole. These two possibilities are not mutually exclusive, and the answer need not be the same for leaf area and FA. Studies that assess the light intensity at and morphology of multiple leaves per plant could answer this question. To our knowledge, this analysis has rarely been attempted for FA (but see Kusi 2013).

A broad understanding of how light intensity affects developmental instability in plants remains to be achieved. By linking light intensity to fluctuating asymmetry in a naturally occurring population, albeit weakly, we believe our study offers a step toward that goal.

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Supplementary material 1

Supplementary files

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RESEARCH ARTICLE

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Notulae to the Italian flora of algae, bryophytes, fungi and lichens: 8

Sonia Ravera[1], Marta Puglisi[2], Alfredo Vizzini[3], Cecilia Totti[4], Gabriella Arosio[5], Renato Benesperi[6], Elisabetta Bianchi[6], Fabrizio Boccardo[7], Ian Briozzo[8], Davide Dagnino[8], Antonio B. De Giuseppe[9], Francesco Dovana[10], Luca Di Nuzzo[6], Simonetta Fascetti[11], Gabriele Gheza[12], Paolo Giordani[13], Jiří Malíček[14], Mauro Giorgio Mariotti[8], Helmut Mayrhofer[15], Luigi Minuto[8], Juri Nascimbene[16], Pier Luigi Nimis[17], Stefano Martellos[17], Nicodemo G. Passalacqua[9], Elena Pittao[17], Giovanna Potenza[11], Domenico Puntillo[9], Leonardo Rosati[11], Giovanni Sicoli[18], Daniel Spitale[19], Valeria Tomaselli[20], Raffaella Trabucco[21], Claudia Turcato[8], Chiara Vallese[16], Maria Zardini[21]

1 *Via del Labaro 54, 00188 Roma, Italy* **2** *Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Sezione di Biologia vegetale, Università di Catania, via A. Longo 19, 95125, Catania, Italy* **3** *Institute for Sustainable Plant Protection (IPSP) – CNR, viale P.A. Mattioli 25, 10125, Torino, Italy* **4** *Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, via Brecce Bianche, 60131 Ancona, Italy* **5** *Ecosfera s.n.c., Corso Italia 78, 20832 Desio (Monza e Brianza), Italy* **6** *Dipartimento di Biologia, Università di Firenze, via La Pira 4, 50121 Firenze, Italy* **7** *Via Filippo Bettini 14/11, I-16162 Genova, Italy* **8** *Dipartimento di Scienze della Terra, Ambiente e Vita, Università di Genova, Corso Europa 26, 16132 Genova, Italy* **9** *Museo di Storia Naturale della Calabria ed Orto Botanico, Università della Calabria, 87036 Arcavàcata di Rende (Cosenza), Italy* **10** *Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino, viale P.A. Mattioli 25, 10125 Torino, Italy* **11** *Scuola di Scienze Agrarie, Forestali, Alimentari ed Ambientali, Dipartimento di Biologia, Difesa e Biotecnologie Agro-Forestali, Università della Basilicata, viale dell'Ateneo Lucano 10, 85100 Potenza, Italy* **12** *Sezione di Ecologia del Territorio, Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, via S. Epifanio 14, 27100 Pavia, Italy* **13** *Dipartimento di Farmacia (DIFAR), Università di Genova, viale Cembrano 4, 16148 Genova, Italy* **14** *Institute of Botany, The Czech Academy of Sciences, Zámek 1, CZ-252 43 Průhonice, Czech Republic* **15** *Institut für Biologie, Bereich Pflanzenwissenschaften, Karl-Franzens-Universität Graz, Holteigasse 6, 8010 Graz, Austria* **16** *Dipartimento di Scienze Biologiche, Geologiche e Ambientali (BiGeA), Università di Bologna, via Irnerio 42, 40126 Bologna, Italy* **17** *Dipartimento di Scienze della Vita, Università degli Studi di Trieste, via L. Giorgieri 10, 34127 Trieste, Italy* **18** *Dipartimento di Biologia, Ecologia e Scienze della Terra, Università della Calabria, 87036 Arcavàcata di Rende (Cosenza), Italy* **19** *Museo di Scienze Naturali dell'Alto Adige, via dei Bottai 1, 39100 Bolzano, Italy* **20** *Consiglio Nazionale delle Ricerche, Istituto di Bioscienze e Biorisorse (CNR-IBBR), via G. Amendola 165/A, 70126 Bari, Italy* **21** *Museo di Storia Naturale di Venezia, Salizada del Fontego dei Turchi 1730, 30135 Venezia, Italy*

Corresponding author: *Sonia Ravera* (sonia.ravera@unimol.it)

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Abstract

In this contribution, new data concerning algae, bryophytes, fungi, and lichens of the Italian flora are presented. It includes new records and confirmations for the algae genus *Chara*, the bryophyte genera *Homalia*, *Mannia*, and *Tortella*, the fungal genera *Cortinarius*, *Russula*, and *Stereum*, and the lichen genera *Cetrelia*, *Cladonia*, *Enterographa*, *Graphis*, *Lecanora*, *Lepraria*, *Multiclavula*, *Mycomicrothelia*, *Parmelia*, *Peltigera*, *Pleopsidium*, *Psora*, *Scytinium*, *Umbilicaria*, and *Rhizocarpon*.

Keywords

Ascomycota, Basidiomycota, Bryidae, Charophyceae, Marchantiidae

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@unimol.it) for lichens.

Floristic records

Algae

Chara gymnophylla A.Braun (Characeae)

+ **LIG**: Hills near Case Serro, Framura (La Spezia), ditch along a dirt road (UTM WGS84: 32T 542779.4895693), 273 m, 15 March 2019, *D. Dagnino*, *C. Turcato* (GE 639); Magra Valley, Bozi di Saudino lakes, Sarzana (La Spezia), artificial lake (UTM WGS84: 32T 577083.4883397), 5 m, 29 May 2019, *D. Dagnino*, *C. Turcato*, *I. Briozzo* (GE 640); Vara Valley, Sesta Godano (La Spezia), river bank and puddles (UTM WGS84: 32T 551412.4904355), 210 m, 12 July 2019, *D. Dagnino*, *C. Turcato*, *I. Briozzo* (GE 716 and GE 717). – Species new for the flora of Liguria.

This species was found in three Ligurian Special Areas of Conservation (SACs): "IT1343419 Monte Serro" (GE 639), "IT1345101 Piana della Magra" (GE 640) and "IT1343502 Parco della Magra-Vara" (GE 716 and GE 717). These sites show strong

ecological differences: the Monte Serro site is a small puddle in a ditch, few centimeters deep, colonized by a herbaceous hygrophilous plant community within a Mediterranean maquis habitat. The Magra Valley site is an artificial lake, where *C. gymnophylla* is widespread in the shallow waters near the banks, growing strictly associated to *Myriophyllum spicatum* L. The Vara Valley site is a constantly flowing Mediterranean river, where *C. gymnophylla* grows in both running and stagnant water. *Chara gymnophylla* was considered by some authors (e.g., Mouronval et al. 2015) as a variety of *Chara vulgaris* L., because its main diagnostic feature (i.e. rays without cortex) is strongly influenced by growth conditions (Bazzichelli and Abdelahad 2009 and references therein). Moreover, recent genetic analysis suggested that *C. gymnophylla* should be divided into tylacanthous forms (which are closely related to *Chara contraria* A.Braun ex Kützing) and aulacanthous forms (which are related to *C. vulgaris*) (Schneider et al. 2016). Nevertheless, *C. gymnophylla* is currently accepted as valid species (Guiry and Guiry 2019). In Italy, this species has been recorded from Veneto, Umbria, Lazio, and Sicilia (Bazzichelli and Abdelahad 2009).

D. Dagnino, C. Turcato, I. Briozzo, L. Minuto

***Chara virgata* Kützing (Characeae)**

+ **TOS**: Valsora quarry, NW slopes of Monte Pelato, near Passo del Vestito (Massa), standing water in a marble quarry (UTM WGS84: 32T 597874.4880003), 878 m, 27 March 2019, leg. *F. Oneto*, *D. Ottonello*, det. *D. Dagnino D.*, *C. Turcato* (GE 638). – Species new for the flora of Tuscany.

The site of discovery belongs to the protected area "Parco Regionale delle Alpi Apuane", and it is characterized by an old (temporarily inactive) marble quarry, occurring in the north-western slope of Monte Pelato. This species was found in standing waters at the base of the quarry front. *Chara virgata* (formerly *Chara delicatula* C.Agardh) is very similar to *Chara globularis* Thuiller, from which it is distinguished by the features of the stipulodes (well developed and rudimentary in the upper and lower row, respectively), of the spines (papillar), of the bractlets (longer than the oogonia) and for the isostic or tylacanthous cortex (Bazzichelli and Abdelahad 2009). Nevertheless, such morphological features (particularly the stipulodes) are often mixed in the two species, despite they recently resulted clearly genetically differentiated (Schneider et al. 2016). The two species are also quite different in their ecology: *C. virgata* is considered as an indicator of oligotrophic waters, while *C. globularis* is considered as an indicator of eutrophic environments (Blindow 1992; Toivoneh and Huttunen 1995; Krause 1997), although mixed populations of the two species in the same water bodies are known from central Italy (Bazzichelli and Abdelahad 2009) and Poland (Pelechaty et al. 2004). *Chara virgata* is widespread in Europe, Asia and North America (Guiry and Guiry 2019). In Italy, it was reported in Trentino-Alto Adige, Lombardia, Veneto, Friuli Venezia Giulia, Umbria and Lazio (Bazzichelli and Abdelahad 2009).

D. Dagnino, C. Turcato, M.G. Mariotti

Bryophytes

Homalia lusitanica Schimp. (Neckeraceae)

+ **BAS**: Vallone Zifero, Viggianello (Potenza) on soil (UTM WGS84: 33S 591332.4424048), 438 m, 17 August 2001, *D. Puntillo* (CLU No. 3412, 3414). – Species new for the flora of Basilicata.

Homalia lusitanica was described by Schimper (1856) as *Omalia lusitanica* for the Sierra de Sintra in Portugal. It is a species with a Mediterranean-oceanic distribution, restricted to western and southern European countries and North Africa (Ros et al. 2013). It forms green mats on wet, shaded rocks and slopes along streams and on walls of caves from lowland to montane belt. It is easily distinguished from the other species of the genus *Homalia* by the vein extending ¾ to 4/5 of the way up the leaf, the strongly dentate leaf apex and the presence of pseudoparaphyllia along the stem. In Italy, this species is quite common from the north to the south, where it can be found either on wet vertical rocks or at the entrance of caves (Aleffi et al. 2008). In the new site of the Basilicata Region it was collected sterile on a vertical wall with periodic water percolation in a very humid and shaded situation.

D. Puntillo

Mannia pilosa (Hornem.) Frye & L.Clark (Aytoniaceae)

+ **TAA**: Vallunga valley, Selva di Val Gardena, Val Gardena, Puez-Odle Nature Park/ Naturpark Puez-Geisler (Bolzano) 1869 m (UTM WGS 84 32T 713568.5160726), 19 July 2019, *D. Spitale* (Herb. BOZ: BRYO 5055). – Species new for the flora of Trentino-Alto Adige.

Mannia pilosa was found in a small concavity on a vertical dolomite rocks with N-NO aspect. The specimens were characterized by a small thallus, about 5×5 cm wide, showing a single but well developed archegoniophorus; the stalk had many long narrow scales, the epidermis was lacunose and the ventral scales were reddish, characteristics which separate *M. pilosa* from the other species of the genus *Mannia* (Frey et al 2006, Damsholt 2009). Our finding represents the first certain record for Trentino-Alto Adige (Aleffi et al 2008); in fact, the report by Düll (1991) for this Region is reported as doubtful in Aleffi et al. (2008), since it derives from a probable misinterpretation of the data reported in Zodda (1934). *Mannia pilosa* is very rare in Italy, where it was previously reported only for Veneto, Friuli Venezia Giulia (with old reports published before 1950) and Valle d'Aosta. *Mannia pilosa* is an Arctic-Alpine species, scattered in the eastern and central Alps up to 3.200 m a.s.l. and very rare in the western Alps (Frey et al 2006); in Europe, it is rare and restricted to a few northern and central countries where it is considered a threatened species (Hodgetts 2015).

D. Spitale

***Tortella flavovirens* (Bruch) Broth. var. *papillosissima* Sergio & Casas (Pottiaceae)**

+ **PUG**: Torre Guaceto (Brindisi), on loose soil on coastal dunes (UTM WGS84: 33T 734834.4511178), 2 m, 21 April 2016, leg. *V. Tomaselli*, det. *M. Puglisi* (CAT); Lesina (Foggia), on loose soil (UTM WGS84: 33T 529757.4638416), 2 m, 17 April 2018, leg. *V. Tomaselli*, det. *M. Puglisi* (CAT); Torre dell'Orte, Otranto (Lecce), on loose soil in coastal dunes (UTM WGS84: 34T 287684.4446078) 20 m, 23 May 2018, leg. *V. Tomaselli*, det. *M. Puglisi* (CAT). – Variety new for the flora of Puglia.

Tortella flavovirens var. *papillosissima* was described by Sérgio and Casas de Puig (1981) for Estepona (Malaga) and is distinguished from *T. flavovirens* var. *flavovirens* for the upper and mid-leaf cells with papillae 6–8 μm long, not rounded at the tip, more evident in the pericostal cells. This moss is known at present from Spain, Malta, Sicily, and in the Italian peninsula from the Campania Region (Ros et al. 2013, Puglisi et al. 2012), showing a typical Mediterranean distribution area. During a widespread investigation on the bryophyte vegetation of the garrigues of southern Italy, *T. flavovirens* var. *papillosissima* was found in Puglia, representing the second record for the Italian peninsula. The moss was collected from loose soil in dry and more or less exposed places near the sea in the ambit of garrigues with dominance of *Thymbra capitata* (L.) Cav. at Torre Guaceto and Torre dell'Orte, and garrigues with *Halimium halimifolium* (L.) Willk. and *Erica multiflora* L. at Lesina. In these sites it was associated to *Trichostomum brachydontium* Bruch, *T. flavovirens* var. *flavovirens*, *Bryum dichotomum* Hedw., *Didymodon fallax* (Hedw.) R.H.Zander. *Tortella flavovirens* var. *papillosissima* has a phytosociological role, being the characteristic species of the association *Tortelletum papillosissimae* Puglisi 2010 belonging to the alliance *Tortellion flavovirentis* Guerra ex Guerra & Puche, 1984 (Puglisi and Privitera 2012).

M. Puglisi, V. Tomaselli

Fungi

***Cortinarius catharinae* Consiglio (Cortinariaceae)**

+ **CAL**: Orto Botanico Università della Calabria, Rende (Cosenza), on the ground, close to *Quercus pubescens* Willd. and *Quercus cerris* L. trees in a patch of a mixed deciduous coppice stand (UTM WGS84: 33S 605816.4357342), 220 m, 28 November 2018, *G. Sicoli*, *A.B. De Giuseppe*, *N.G. Passalacqua* (CLU No. F305). – Species new for the flora of Calabria.

Cortinarius catharinae is an agaricaceous, terricolous, mycorrhizal fungus, in the subgenus *Phlegmacium* (Fr.) Trog, section *Calochroi* M.M.Moser & Horak ("the *Cortinarius parvus* complex"), clearly distinct from the closest species, *C. albertii* Dima, Frøslev & T.S.Jeppesen and *C. parasuaveolens* (Bon & Trescol) Bidaud, Moënne-Locc.

& Reumaux, due to a strong blood red KOH- reaction on the pileus margin, and to a faint lilac tinge, which was observed only on the upper part of the stipe (not on the pileus and bulb margin), respectively (Vizzini et al. 2012; Brandrud et al. 2018). This species has still locally been reported in Italy, where it should be quite common especially in deciduous oak and mixed-hardwood stands on calcareous soils.

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

***Russula innocua* (Singer) Singer (Russulaceae)**

+ **LIG**: Passo delle Salse (Imperia) under *Fagus sylvatica* L., (UTM WGS84: 32T 398071.4884909), 1000 m, 3 August 2019, *F. Boccardo* (Herb. GDOR 4690). – Species new for the flora of Liguria.

Russula innocua, a rare species typical of deciduous woods, is associated mainly with *Fagus sylvatica* L., *Carpinus* and *Tilia*, on rich clayey soil. *Russula innocua* has, as major morphological features, small basidiome, pileus with greenish-green surface, lamellae rather distant, whitish, flesh greying, smell like leaves of *Pelargonium* and spores with isolate spines (Sarnari 1988). In Italy, it has been recorded for Trentino-Alto Adige (Südtirol) and Umbria, in according with Sarnari (1988).

F. Boccardo, F. Dovana

***Stereum subtomentosum* Pouzar (Stereaceae)**

+ **CAL**: Orto Botanico Università della Calabria, Rende (Cosenza), on a dead log of *Quercus pubescens* Willd. in a mixed deciduous coppice stand (UTM WGS84: 33S 605943.4357286), 220 m, 19 November 2018, *G. Sicoli*, *A.B. De Giuseppe*, *N.G. Passalacqua* (CLU No. F306). – Species new for the flora of Calabria.

Stereum subtomentosum is distinguishable from the closest species due to a longer projection (up to 5–6 cm) of the reflexed part of basidiomes, which is also sessile (Jülich 1989, Strid 1997).

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

Lichens

***Cetrelia monachorum* (Zahlbr.) W.L.Culb. & C.F.Culb. (Parmeliaceae)**

+ **LIG**: loc. Valletti, Val di Vara, Varese Ligure (La Spezia), on *Castanea sativa* Mill., (UTM WGS84: 32T 543460.4913486), 757 m, 3 January 2018, leg. *P. Giordani*, *D. Locati*, det. *P. Giordani* (GE 2708). – Species new for the flora of Liguria.

Cetrelia monachorum is a large foliose lichen with rounded marginal lobes and an upper surface with whitish pseudocyphellae (Obermayer and Mayrhofer 2007). It is distinguished from the other taxa of the *Cetrelia olivetorum* group by some morphological characters (e.g., the shape of the pseudocyphellae) and by its chemical charac-

teristics, such as the presence of the imbricaric acid syndrome (major) and perlatolic acid (minor). According to Nimis (2016), it is probably the most common species of *Cetrelia* in Italy, but knowledge on its distribution is still scarce. On this basis, Nascimbene et al. (2013) included it in the Italian Red List of epiphytic lichens as "Data Deficient". In Italy it was previously known for some places in the eastern Alps (Obermayer and Mayrhofer 2007, Nascimbene 2014, Nascimbene and Marini 2015). In the Ligurian locality, which is so far the southernmost in Italy, the species was found on epiphytic bryophytes at the base of chestnut trunks in an abandoned chestnut grove.

P. Giordani

***Cladonia botrytes* (K.G.Hagen) Willd. (Cladoniaceae)**

– LOM: *Sulla terra dei Colli di Niardo* (on the soil of the mounts of Niardo), Niardo (Brescia), ante 1893, *E. Rodegher* (PAV). – Species to be excluded from the flora of Lombardia.

Baroni (1893), describing a lichen collection made by Emilio Rodegher, reported *Cladonia botrytes* for Niardo in Val Camonica. The only known lichen herbarium by Emilio Rodegher is currently preserved in PAV, and it fully corresponds with the species list reported by Baroni (1893). Two specimens in the herbarium by Rodegher, collected in two localities of Val Camonica (one in the mountains of Niardo and the other in Mount Concarena), are labelled under «*Cladonia botrytes*», but they are both instead fertile specimens of *Cladonia squamosa* Hoffm. It can be inferred that Rodegher had an erroneus concept of «*Cladonia botrytes*». The other citations of this species for Lombardia are those by Giacomini (1936) and Dalle Vedove et al. (2004), but these authors did not report new records of the species only citing the previous record by Baroni (1893). The same is for Nimis (1993, 2016). Therefore, even if habitat conditions suitable for this species (cf. Bogomazova 2012; Yahr et al. 2013) can be found in the region, *Cladonia botrytes* should be excluded from Lombardia.

G. Gheza

***Cladonia pseudopityrea* Vain. (Cladoniaceae)**

+ TOS: Pian degli Ontani (Pistoia), on bark at the base of a chestnut tree (UTM WGS84: 32T 637474.4884316), 1033 m, 29 September 2018, *G. Gheza* (Herb. Gheza, GZU). – Species new for the flora of Toscana.

Cladonia pseudopityrea is a rare species in Europe, where it has a scattered distribution in the Mediterranean area (Ahti and Puntillo 1995). Its taxonomic position against the strictly related *Cladonia ramulosa* (With.) J.R.Laundon is unclear (T. Ahti, pers. comm.). It has been reported in Italy so far only from Sardegna and Calabria (Nimis 2016), and this is the first record from central Italy. It is also the first record of this species on *Castanea sativa* Mill. *Cladonia pseudopityrea* is mainly lignicolous, but it can also be epiphytic, and occurs usually in rather moist woodlands. It is included in the Red List of Italian epiphytic lichens as endangered (Nascimbene et al. 2013).

G. Gheza, J. Nascimbene, H. Mayrhofer

***Enterographa zonata* (Körb.) Källsten ex Torrente & Egea (Roccellaceae)**

+ **BAS**: Cerro Falcone, Calvello (Potenza) on acid rock (UTM WGS84: 33T 567880.4479043), 1066 m, 16 November 2003, *D. Puntillo*, *G. Potenza* (CLU No. 13214). – Species new for the flora of Basilicata.

Enterographa zonata has a thallus thin to moderately thick, violet-tinged chocolate-brown with a conspicuous, black marginal prothallus, rare apothecia, speckled with dot-like dark brown soredia that become abraded and pale. It is a rather rare to extremely rare species in Italy (Nimis 2016), usually found on vertical to underhanging surfaces of hard siliceous rocks and in woodlands, forming mosaics generally in humid habitats under overhangs. All the specimens collected in Southern Italy (Calabria and Basilicata) currently stored in CLU are devoid of apothecia.

D. Puntillo, G. Potenza

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

+ **VEN**: *Ad Cerasorum corticem in collibus ditionis Bassanensis* (on the cortex of cherry trees on the hills dominating Bassano del Grappa), Bassano del Grappa (Vicenza) (UTM WGS 84: 32T 707293.5071093), 1869, *V. Trevisan*, det. *S. Martellos*, *M. Zardini* (Museo di Storia Naturale di Venezia No. MSNVE-25000 under the name *Opegrapha scripta* Ach. var. *recta* Schaer.). – Species new for the flora of Veneto.

Neuwirth and Aptroot (2011) have proposed a new taxonomy for *Graphis scripta* s.lat., recognizing four distinct taxa: *G. betulina* (Pers.) Ach., *G. macrocarpa* (Pers.) Röhl., *G. pulverulenta* (Pers.) Ach., and *G. scripta* (L.) Ach. s.str. A more recent study based on both molecular and morphological characters (Kraichak et al. 2015) showed that, although between six and seven putative species are nested within the complex, these do not fully correspond to the taxa that were recently distinguished based on apothecium morphology. Pending a revision of the Italian material, Nimis (2016) treats *G. scripta* in a broad sense, while the few recent records of the species delimited by Neuwirth and Aptroot (2011) are provisionally treated as separate units. *Graphis pulverulenta* is a crustose lichen of the *G. scripta* group, characterised by apothecia with mostly acute ends and widely exposed white- to grey-pruinose discs, found on the bark of broad-leaved trees in various forest types. In Italy it is known to occur in Friuli Venezia Giulia, Trentino-Alto Adige, Lombardia, Piemonte, and Puglia (Nimis 2016). The specimen is the number 210 of Lichenotheca Veneta, a collection of exsiccata produced in 1869 by Vittore Benedetto Antonio Trevisan (1818–1897), and published in a limited number of copies. The specimen is preserved at the Natural History Museum of Venice, in one of the only two copies of the Lichenotheca Veneta known to still exist in a complete form. The apothecia have a widely open, bluish grey pruinose disc and no thalline margin, which are typical features of *Graphis pulverulenta*.

S. Martellos, P.L. Nimis, R. Trabucco, J. Nascimbene, M. Zardini

***Lecanora thysanophora* R.C.Harris (Lecanoraceae)**

+ **FVG**: Trieste Karst, Dolina di Percedol, Monrupino/Repen (Trieste), on *Carpinus betulus* L. in Asaro-Carpinetum betuli (UTM WGS84: 33T 406900.5062000), ca. 275 m, 27 March 2019, *P.L. Nimis*, *E. Pittao* (TSB No. 41071); Carnic Alps, Lake of Sauris, Bosco della Stua (Udine), on *Abies alba* Mill. in very humid forest (UTM WGS84: 33T 325300.5145650), c. 1020 m, 30 July 2002, leg. *M. Tretiach*, rev. *P.L. Nimis*, 30 August 2019 (TSB No. 36066). – Species new for the flora of Italy.

Lecanora thysanophora is a sorediate, mostly sterile epiphytic species described from North America and firstly reported from Europe (Tønsberg 1999, Harris et al 2000), which has been often confused with sterile specimens of the mainly epilithic *Haematomma ochroleucum* var. *ochroleucum*. Both species, when sterile, are extremely similar, and also have a similar chemistry, as they produce atranorin, usnic acid, and zeorin, but *L. thysanophora* also contains a characteristic set of terpenoids ("thysanophora-unknowns") and (at least in European specimens) lacks porphyrilic acid, which is present in *H. ochroleucum* (Kukwa and Motiejūnaitė 2005). Furthermore, the soredia of *L. thysanophora* are ca. 25 µm wide, while those of *Haematomma* are 30–120 µm wide, and the prothallus of *L. thysanophora* is often zoned, its hyphae being 4–5(-5.5) µm thick, while the prothallus of *Haematomma* is not zoned, and the hyphae are 3–3.5(-4) µm thick (Wirth et al. 2013). Although *H. ochroleucum* may occur also on bark, it is primarily an epilithic species of siliceous rocks, while all previous records from Friuli Venezia Giulia were on bark, based on samples from the two localities cited above; thus, this species should be excluded from the lichen biota of the Region. We suspect that several earlier records of *H. ochroleucum* from the Alps could be referred to *L. thysanophora*.

P.L. Nimis, E. Pittao

***Lepraria borealis* Loht. & Tønsberg (Stereocaulaceae)**

+ **TAA**: Val di Roia (Bolzano), on siliceous soil (UTM WGS84: 32T 613293.5182546), 2504 m, 19 July 2018, leg. *D. Spitale*, det. *H. Mayrhofer*, *J. Nascimbene*, *G. Gheza* (Herb. Nascimbene, JN6429); Val di Mazia (Bolzano), on siliceous soil (UTM WGS84: 32T 624485.5183334), 2608 m, 18 July 2018, leg. *D. Spitale*, det. *H. Mayrhofer*, *J. Nascimbene*, *G. Gheza* (Herb. Nascimbene, JN5792); Val di Roia (Bolzano), on siliceous soil (UTM WGS84: 32T 613080.5182281), 2704 m, 19 July 2018, leg. *D. Spitale*, det. *H. Mayrhofer*, *J. Nascimbene*, *G. Gheza* (Herb. Nascimbene, JN6433); Val Martello (Bolzano), on siliceous soil (UTM WGS84: 32T 630870.5158008) 2908 m, 25 July 2019, leg. *D. Spitale*, det. *H. Mayrhofer*, *J. Nascimbene*, *G. Gheza* (Herb. Nascimbene, JN6481). – Species new for the flora of Trentino-Alto Adige.

Lepraria borealis is a circumboreal species dwelling on siliceous rock and soil in the mountain belt (Nimis 2016). It is reported with only few scattered records from the Alps (Nimis et al. 2018) and elsewhere in Italy (Nimis 2016), where it was found only

recently (Baruffo et al. 2006). It has a granular whitish thallus, which can resemble that of *Dibaeis baeomyces* (L.f.) Rambold & Hertel, but it has a different chemistry. The specimens analyzed by means of TLC contained rangiformic acid and atranorin.

C. Vallese, H. Mayrhofer, J. Nascimbene, D. Spitale, G. Gheza

***Lepraria crassissima* (Hue) Lettau (Stereocaulaceae)**

+ **LOM**: trail between Pianezza and Diga del Gleno, Vilminore di Scalve (Bergamo), on a steep siliceous rock cliff at the edge of the trail (UTM WGS84: 32T 583583.5095828), 1529 m, 30 April 2018, leg. *G. Gheza*, det. *H. Mayrhofer*, *J. Malíček* (Herb. Gheza, GZU). – Species new for the flora of Lombardia.

Lepraria crassissima is a misunderstood and overlooked species which was reported so far in Italy only from Friuli Venezia Giulia, Emilia-Romagna, and Toscana (Baruffo et al. 2006). It grows mainly on siliceous rock, as the specimen reported here, but can occur also on calcareous rock (Baruffo et al. 2006). The analyzed specimen contained divaricatic and nordivaricatic acids as major compounds, and zeorin and atranorin in traces. It was collected in proximity of other *Lepraria* species, i.e. *Lepraria finkii* (B. de Lesd.) R.C.Harris and *Lepraria vouauxii* (Hue) R.C.Harris, which grew on the same rock cliff at the edge of the trail.

G. Gheza, H. Mayrhofer

***Multiclavula mucida* (Pers.) R.H.Petersen (Clavulinaceae)**

+ **FVG**: Carnic Alps, Foresta di Ampezzo (Udine), below Passo Pura along the road to the Lake of Sauris, on a rotting stump in humid beech forest (UTM WGS84: 33T 326100.5144200), ca. 1340 m, 26 July 2019, *P.L. Nimis*, *E. Pittao* (TSB No. 41073). – Species new for the flora of Friuli Venezia Giulia.

Multiclavula mucida is one of the few lichenized basidiomycetes occurring in Italy, mostly growing on rotting stumps. It has been largely neglected by lichenologists, especially due to its ephemeral fruiting bodies, being hitherto known only from Veneto and the Apennines in the Emilia-Romagna region (Nimis 2016), but it is likely to be more widespread, being known, for example, from almost all of the Austrian Alps (Nimis et al. 2018).

P.L. Nimis, E. Pittao

***Mycomicrothelia confusa* D.Hawksw.**

+ **PUG**: Strada provinciale San Vito (Brindisi), on *Tilia* sp. (UTM WGS84: 33T 747163.4503018), 25 m, leg. *G. Arosio*, det. *S. Ravera* (Herb. Ravera). – Species new for the flora of Puglia.

This epiphytic species (non- or doubtfully lichenised) colonizes smooth bark of deciduous trees in shaded-humid habitats, mostly in the Thyrrenian side of Italy (Nimis 2016). It is characterized by a prominent white thallus and by numerous, black, ± glo-

bose perithecia surrounded by a minute fringe. It is easy recognizable compared to other Pyrenocarpales by the ascospores, which are brown when mature, 1-septate, constricted at the septum to produce two unequally-sized cells. Although it is considered very rare in Italy (Nimis 2016), it is certainly more widespread than generally believed, but penalized during field observations due to its scarce visibility, as it consists of tiny black spots.

S. Ravera, G. Arosio

***Parmelia omphalodes* (L.) Ach. (Parmeliaceae)**

+ **BAS**: Monte Volturino, Marsicovetere (Potenza), on siliceous rocks (UTM WGS84: 33T 569330.4472730), 1533 m, 11 July 2019, *G. Potenza*, *L. Rosati*, *S. Fascetti* (HLUC No. 804); Il Ciglio, Monte Serranetta, Pignola (Potenza), on siliceous rocks (UTM WGS84: 33T 33T 568937.4490258), 1427 m, 20 June 2019, *G. Potenza*, *L. Rosati* (HLUC No. 801). – Species new for the flora of Basilicata.

This species is mostly distributed in alpine and mountainous areas of Europe, North America, and Asia (GBIF.org 2018). In Italy, it is common in the Alps, where it can reach the nival belt, less common in the mountains of southern Italy; in particular, it is rarer in the highest peaks of the Apennines for the paucity of suitable substrata (Nimis 1993, 2016).

Giovanna Potenza, Simonetta Fascetti, Leonardo Rosati, Domenico Puntillo

***Peltigera degenii* Gyeln. (Peltigeraceae)**

+ **VDA**: Gran Paradiso National Park, Valsavarenche (Aosta), on siliceous rock cover by mosses (UTM WGS84: 32T 360250.5045832), 1932 m, 18 July 2018, leg. *C. Vallese*, det. *R. Benesperi*, *C. Vallese* (Herb. Benesperi). – Species new for the flora of Valle d'Aosta.

Peltigera degenii is a foliose terricolous species growing on mossy rocks in forest and on soil rich in humus (Nimis 2016). It is mainly distributed in the Holarctic Kingdom (Martínez et al. 2003), with an optimum in the mountain belt (Nimis et al. 2018). *Peltigera degenii* is characterized by the absence of lichen substances. It may be distinguished by a glossy, glabrous upper surface with membranous lobe and by a pale brown to whitish lower surface with narrow veins and simple rhizines (Goffinet et al. 1994; Vitikainen 1994). In general, this species is not hard to distinguish from other species of the genus *Peltigera*. Nevertheless, according to Goward et al. (1995), some confusion may emerge with rare glabrous specimens of *Peltigera membranacea* (Ach.) Nyl., but in this species veins and rhizines are always erect-tomentose.

C. Vallese, J. Nascimbene, R. Benesperi

***Pleopsidium chlorophanum* (Wahlenb.) Zopf (Acarosporaceae)**

+ **BAS**: Monte Volturino, Marsicovetere (Potenza), on siliceous rocks (UTM WGS84: 33T 569330.4472730), 1533 m, 11 July 2019, *G. Potenza*, *L. Rosati*, *S. Fascetti* (HLUC No. 807). – Species new for the flora of Basilicata.

Pleopsidium chlorophanum is an arctic-alpine, bipolar species reported from the Holarctic region, as well as from many sites in the Antarctic (Nimis et al. 2018). This lichen grows on sunny dry places exposed to wind, usually on vertical and overhanging surfaces of metal-rich siliceous rock (Nimis et al. 2018). In Italy it has been reported above treeline, reaching the nival belt in the Alps, where it is widespread and locally abundant, extending southwards to the mountains of Sicilia (Nimis 1993, 2016, Wirth et al. 2013).

G. Potenza, S. Fascetti, L. Rosati, D. Puntillo

***Psora vallesiaca* (Schaer.) Timdal (Psoraceae)**

+ **TOS**: Anticlinale di Monsummano (Pistoia), on limestone outcrops along the path to Monsummano Alto (UTM WGS84: 32T 647153.4858836), 127 m, 30 march 2019, leg. *L. Di Nuzzo*, *E. Bianchi*, *R. Benesperi*, det. *L. Di Nuzzo* (Herb. Benesperi). – Species confirmed for the flora of Toscana.

Psora vallesiaca is a squamulose lichen, with brown squamules, white up-turned margins and K+ yellow turning red medulla. It grows both on calcareous soils and rocks. This unit has been attributed to various names, and its nomenclatural position has been clarified only recently (Timdal 1984, 1991). The only report of this specie for Toscana was by Baglietto (1871, under the name *Psora albilabra* (Dufour) Körb.), basing on material collected by Beccari in 1862 in Asciano (FI). We checked this herbarium specimen and confirmed its correspondence with *P. vallesiaca*.

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

***Rhizocarpon alpicola* (Wahlenb.) Rabenh. (Rhizocarpaceae)**

+ **TAA**: Valle Aurina, 3 km NE of Casere fraz. di Predoi (Bolzano), on siliceous boulder (UTM WGS84: 33T 283639.5216407), 2000 m, 19 July 2009, *J. Malíček* (Herb. Malíček no. 2321). – Species confirmed for the flora of Trentino-Alto Adige.

Rhizocarpon alpicola is a crustose species with a more or less yellow areolate thallus. It grows mainly on hard siliceous rocks with a preference for cold situations in late-snow areas. Its distribution in Italy is currently limited to the alpine and subalpine belts of the Alps (Nimis 2016), with a single record from the northern Apennines dating back to the early 1900s (Zanfrognini 1902), and a few recent Italian records (Nimis 2016). Reports from Trentino-Alto Adige date back to the 19th century and the to the first half of the 20th century (Arnold 1879, Torre and Sarnthein 1902, Cengia-Sambo 1935). The specimen reported here shows 1-septate ascospores without transverse septa, which may, however, occasionally be present in this species.

J. Malíček, S. Ravera

***Scytinium palmatum* (Huds.) Gray (Collemataceae)**

+ **BAS**: Il Ciglio, Monte Serranetta, Pignola (Potenza), on siliceous rocks (UTM WGS84: 33T 568937.4490258), 1427 m, 20 June 2019, *G. Potenza*, *L. Rosati* (HLUC No.803). – Species new for the flora of Basilicata.

This species is bipolar and reported from Europe, eastern Asia, Australasia, and west coast of North America (GBIF.org 2018). In Italy it is considered mainly as a Tyrrhenian mild-temperate lichen, found amongst terricolous or epilithic mosses in areas with siliceous substrata, sometimes on soil (Nimis 1993, 2016), seemingly most frequent in the western and southern Alps (Nimis et al. 2018).

G. Potenza, S. Fascetti, L. Rosati, D. Puntillo

***Umbilicaria decussata* (Vill.) Zahlbr. (Umbilicariaceae)**

+ **BAS**: Monte Volturino, Marsicovetere (Potenza), on siliceous rocks (UTM WGS84: 33T 569330.4472730), 1533 m, 11 July 2019, *G. Potenza*, *L. Rosati*, *S. Fascetti* (HLUC No. 808). – Species new for the flora of Basilicata.

Umbilicaria decussata is a cosmopolitan species reported from Europe, Asia, Africa, North and South America, Australasia, and Antarctica (GBIF.org 2018). It is found on steeply inclined to slightly underhanging surfaces of wind-exposed siliceous rocks; it can reach the nival belt in the Alps and it is also reported from the mountains of Calabria (Nimis 1993, 2016).

G. Potenza, S. Fascetti, L. Rosati, D. Puntillo

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RESEARCH ARTICLE

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Notulae to the Italian alien vascular flora: 8

Gabriele Galasso[1], Gianniantonio Domina[2], Sebastiano Andreatta[3], Claudia Angiolini[4], Nicola M.G. Ardenghi[5], Claudio Aristarchi[6], Matteo Arnoul[7], Mattia M. Azzella[8], Gianluigi Bacchetta[9], Fabrizio Bartolucci[10], Silvia Bodino[5], Giacomo Bommartini[11], Gianmaria Bonari[12], Sergio Buono[13], Vito Buono[14], Orazio Caldarella[15], Giacomo Calvia[9], Emilio Corti[16], Marco D'Antraccoli[17], Rocco De Luca[18], Fabrizio De Mattia[19], Stefano Di Natale[16], Alessandra Di Turi[6], Assunta Esposito[20], Giulio Ferretti[16], Tiberio Fiaschi[4], Maria C. Fogu[9], Luigi Forte[21], Jessica Frigerio[19], Leonardo Gubellini[22], Lorenzo Guzzetti[23], Nicole Hofmann[24], Valentina L.A. Laface[25], Gaetano Laghetti[26], Andrea Lallai[9], Alfonso La Rosa[27], Lorenzo Lazzaro[16], Silvano Lodetti[5], Michele Lonati[28], Fabio Luchino[29], Sara Magrini[30], Andrea Mainetti[28], Michela Marignani[9], Gina Maruca[26], Pietro Medagli[31], Giacomo Mei[24], Flavio Menini[32], Valerio Mezzasalma[19], Alice Misuri[16], Sara Mossini[33], Michele Mugnai[16], Carmelo M. Musarella[25], Ginevra Nota[28], Nicola Olivieri[34], Alessia Padula[16], Marziano Pascale[35], Federico Pasquini[16], Lorenzo Peruzzi[17], Gianni Picella[36], Lorenzo Pinzani[17], Silvia Pirani[28], Marco Pittarello[28], Lina Podda[9], Simone Ravetto Enri[28], Carmelo D. Rifici[37], Francesco Roma-Marzio[38], Rosario Romano[39], Leonardo Rosati[40], Filippo Scafidi[2], Enrico Scarici[41], Marco Scarici[42], Giovanni Spampinato[25], Adriano Stinca[20], Robert P. Wagensommer[43], Giovanni Zanoni[44], Chiara Nepi[45]

1 *Sezione di Botanica, Museo di Storia Naturale di Milano, Corso Venezia 55, 20121 Milano, Italy* **2** *Dipartimento di Scienze Agrarie, Alimentari e Forestali (SAAF), Università di Palermo, Viale delle Scienze, edificio 4, 90128 Palermo, Italy* **3** *Museo Civico di Storia Naturale di Verona, Piazza Arsenale 8, 37126 Verona, Italy* **4** *Dipartimento di Scienze della Vita, Università di Siena, Via P.A. Mattioli 4, 53100 Siena, Italy* **5** *Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, Via Sant'Epifanio 14, 27100 Pavia, Italy* **6** *Via Crocetta di Apparizione 32, 16133 Genova, Italy* **7** *Loc. Serre 6, 10060 Angrogna (Torino), Italy* **8** *Centro Ricerche Frascati, Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile (ENEA), Via E. Fermi 45, 00044 Frascati (Roma), Italy* **9** *Dipartimento di Scienze della Vita e dell'Ambiente, Università di Cagliari, Viale Sant'Ignazio da Laconi 13, 09123 Cagliari, Italy* **10** *Centro Ricerche Floristiche dell'Appennino (Università di Camerino – Parco Nazionale del Gran Sasso e Monti della Laga), San Colombo, 67021 Barisciano (L'Aquila), Italy* **11** *Via Buggia 17, 37050 Belfiore (Verona), Italy* **12** *Department of Botany and Zoology, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic*

13 *Via XXV Aprile 6, 01010 Oriolo Romano (Viterbo), Italy* **14** *Vico Traversa 2, 70127 Bari, Italy* **15** *Viale Maria Santissima Mediatrice 38, 90129 Palermo, Italy* **16** *Dipartimento di Biologia, Università di Firenze, Via G. La Pira 4, 50121 Firenze, Italy* **17** *Dipartimento di Biologia, Università di Pisa, Via Derna 1, 56126 Pisa, Italy* **18** *Via M. Reitano Spadafora, isolato 43, 98124 Messina, Italy* **19** *FEM2 Ambiente s.r.l., Piazza della Scienza 2, 20126 Milano, Italy* **20** *Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche, Università della Campania Luigi Vanvitelli, Via A. Vivaldi 43, 81100 Caserta, Italy* **21** *Dipartimento di Biologia e Museo Orto Botanico, Università di Bari Aldo Moro, Via E. Orabona 4, 70125 Bari, Italy* **22** *Centro Ricerche Floristiche Marche, Provincia di Pesaro e Urbino, Via E. Barsanti 18, 61122 Pesaro (Pesaro e Urbino), Italy* **23** *Dipartimento di Biotecnologie e Bioscienze, Università di Milano-Bicocca, Piazza della Scienza 2, 20126 Milano, Italy* **24** *Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università Politecnica delle Marche, Via Brecce Bianche 10, 60131 Ancona, Italy* **25** *Dipartimento di Agraria, Università Mediterranea di Reggio Calabria, Feo di Vito snc, 89122 Reggio Calabria, Italy* **26** *Istituto di Bioscienze e Biorisorse, Consiglio Nazionale delle Ricerche (CNR-IBBR), Via G. Amendola 165/a, 70126 Bari, Italy* **27** *Cooperativa Silene, Via V. D'Ondes Reggio Vito 8/a, 90127 Palermo, Italy* **28** *Dipartimento di Scienze Agrarie, Forestali e Alimentari (DISAFA), Università di Torino, Largo P. Braccini 1, 10095 Grugliasco (Torino), Italy* **29** *Via Torrente Allume 6/a, 98027 Roccalumera (Messina), Italy* **30** *Banca del Germoplasma della Tuscia, Università della Tuscia, Largo dell'Università snc, blocco c, 01100 Viterbo, Italy* **31** *Dipartimento di Scienze e Tecnologie Biologiche e Ambientali (DiSTeBA), Università del Salento, Strada Provinciale Lecce-Monteroni 165, 73100 Lecce, Italy* **32** *Via D. Ricci 4, 37042 Caldiero (Verona), Italy* **33** *Via E. Raovati 6, 27049 Stradella (Pavia), Italy* **34** *Via Maestri del Lavoro 40, 64100 Teramo, Italy* **35** *Via della Repubblica 14, 12018 Roccavione (Cuneo), Italy* **36** *Via Quarnaro 16, 70121 Bari, Italy* **37** *Via G. Mazzini 5, 98064 Librizzi (Messina), Italy* **38** *Sistema Museale di Ateneo, Università di Pisa, Via L. Ghini 13, 56126 Pisa, Italy* **39** *Via A. Gramsci Vicolo 1 6, 96011 Augusta (Siracusa), Italy* **40** *Scuola di Scienze Agrarie, Forestali e Ambientali, Università della Basilicata, Via Ateneo Lucano 10, 85100 Potenza, Italy* **41** *Loc. Paglianello 1/a, 01012 Capranica (Viterbo), Italy* **42** *Via degli Anguillara 90, 01012 Capranica (Viterbo), Italy* **43** *Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Via del Giochetto 6, 06122 Perugia, Italy* **44** *Via Ambrosi 9, 37038 Soave (Verona), Italy* **45** *Sistema Museale di Ateneo, Università di Firenze, Via G. La Pira 4, 50121 Firenze, Italy*

Corresponding author: *Gabriele Galasso* (gabriele.galasso@comune.milano.it)

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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, exclusions, and status changes for Italy or for Italian administrative regions of taxa in the genera *Bunias*, *Calocedrus*, *Calycanthus*, *Celosia*, *Clerodendrum*, *Convolvulus*, *Crassula*, *Cyclamen*, *Datura*, *Dicliptera*, *Eragrostis*, *Erigeron*, *Gamochaeta*, *Gazania*, *Impatiens*, *Kolkwitzia*,

Leucaena, *Ludwigia*, *Medicago*, *Muscari*, *Nigella*, *Oenothera*, *Opuntia*, *Paulownia*, *Petroselinum*, *Phyllostachys*, *Physalis*, *Pseudosasa*, *Quercus*, *Reynoutria*, *Roldana*, *Saccharum*, *Sedum*, *Semiarundinaria*, *Senecio*, *Sisyrinchium*, *Solanum*, *Sporobolus*, *Tulipa*, *Vachellia*, *Verbena*, and *Youngia*. Nomenclatural and distribution updates published elsewhere are provided as Suppl. material 1.

Keywords
Alien species, floristic data, Italy

How to contribute

The text for the new records should be submitted electronically to Chiara Nepi (chiara.nepi@unifi.it). The corresponding specimen along with its scan or photograph has to be sent to FI Herbarium: 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), status changes, exclusions, and confirmations should be submitted electronically to: Gabriele Galasso (gabriele.galasso@comune.milano.it). Each text should be within 2,000 characters (spaces included).

Floristic records

Bunias orientalis L. (Brassicaceae)

+ (NAT) **EMR**. – Status change from casual to naturalized alien for the flora of Emilia-Romagna.

In Italy, this species was already cultivated in botanical gardens in the late 18th century (e.g., in Pavia, see Anonymous 1785) and was first recorded as a casual alien in 1897 (Penzig 1897; Béguinot and Mazza 1916). *Bunias orientalis* now occurs as a casual alien in most of the northern regions, with the exceptions of Piemonte and Friuli Venezia Giulia, where it is considered naturalized (Galasso et al. 2018a). In Emilia-Romagna, it is known as casual in the province of Ferrara (Piccoli et al. 2014). On July 2nd, 2019, a large population was discovered in the locality Casino of the former municipality of Nibbiano (now Alta Val Tidone), province of Piacenza (WGS84: 44.945631N, 9.332003E). Here, fruiting individuals form a thick stand of 3,350 m^2, with a 75% cover, on waste land colonized by *Artemisia vulgaris* L., *Cirsium arvense* (L.) Scop., *Elymus repens* (L.) Gould subsp. *repens*, and *Sambucus ebulus* L. More than 1,200 rosettes were counted across a mowed wheat field of 31,000 m^2 in locality Casa Castellina (WGS84: 44.946498N, 9.330900E) and further individuals were observed along the nearby roadsides. This species, similarly to other European countries (see e.g., Clement and Foster 1994), was likely introduced as a grain impurity. The pronounced tendency to invasiveness in these localities needs to be monitored.

N.M.G. Ardenghi, S. Bodino, S. Lodetti

***Calocedrus decurrens* (Torr.) Florin (Cupressaceae)**

+ (CAS) **TOS**: Firenze (Firenze), Parco delle Cascine, alla confluenza tra il Torrente Mugnone e il Fiume Arno (WGS84: 43.790598N, 11.197569E), 50 m, 3 February 2019, *L. Pinzani* (FI). – Casual alien species new for the flora of Toscana.

Calocedrus decurrens has been already recorded as casual in Lombardia, Umbria, and Sardegna (Galasso et al. 2018a). Some young individuals originated by seeds from nearby cultivated plants were found in Firenze, at the Cascine Park.

L. Pinzani

***Calycanthus floridus* L. (Calycanthaceae)**

+ (CAS) **MAR**: San Benedetto del Tronto (Ascoli Piceno), aiuola presso Viale delle Palme (WGS84: 42.949722N, 13.884780E), epifita su stipite di *Phoenix canariensis*, ca. 8 m, 9 July 2019, *N. Olivieri* (FI). – Casual alien species new for the flora of Marche.

Calycanthus floridus is an ornamental species native to southeastern North America and introduced in Italy in 1788 (Maniero 2015). In Italy, it is known as casual alien only in Toscana (Galasso et al. 2018a). Some young individuals of the species have developed as epiphytes on the trunk of a young *Phoenix canariensis* H.Wildpret, settling among the remains of fibrous tissue present among the stumps of the leaf rachids. The plants developed from seeds produced by a shrub cultivated in a flowerbed at a short distance. The area is located in a rather sheltered position due to the presence of groups of *Pinus halepensis* Mill. subsp. *halepensis* and alignments of buildings that limit insolation and reduce the influence of the eastern sea winds, creating a cooler microclimate.

N. Olivieri

***Celosia argentea* L. (Amaranthaceae)**

+ (CAS) **SIC**: Polizzi Generosa (Palermo), strada SS643 (WGS84: 37.839167N, 13.960000E), bordo stradale, ca. 550 m, 12 September 2005, *G. Domina*, *S.L. Jury* (PAL); Ciminna (Palermo), strada SP33 (WGS84: 37.895676N, 13.544894E), bordi stradali, ca. 600 m, 7 October 2018, leg. *F. Scafidi*, det. *F. Scafidi*, *G. Domina* (FI). – Casual alien species confirmed for the flora of Sicilia.

This species was likely introduced in Italy for ornamental purposes, and the individuals found along the roadside may have originated from cultivated plants growing nearby. This species was identified according to Iamonico (2013). In Galasso et al. (2018a), it is reported as casual alien for many Italian administrative regions, but not recently recorded from Sicilia.

F. Scafidi, G. Domina

***Clerodendrum trichotomum* Thunb. (Lamiaceae)**

+ (CAS) **TOS**: Borgo San Lorenzo (Firenze), fraz. Panicaglia, ex stazione ferroviaria lungo la ferrovia Faentina (WGS84: 43.978605N, 11.407556E), alcune piante spontaneizzate ai

margini di un giardino in vicinanza di piante adulte coltivate, 281 m, 8 November 2018, *M. Mugnai*, *A. Misuri*, *G. Ferretti* (FI). – Casual alien species new for the flora of Toscana.

This species was already recorded in Italy as naturalized, mostly in northern Italy. Some young individuals were found at the railway station of Panicaglia, probably originating from adult fruiting plants of a neighboring garden. Given the ephemeral condition of the occurrence site, we consider this species as casual for Toscana.

M. Mugnai, A. Misuri, L. Lazzaro

***Convolvulus sabatius* Viv. subsp. *mauritanicus* (Boiss.) Murb. (Convolvulaceae)**

+ (NAT) **PUG**: Giovinazzo (Bari), tra Giovinazzo e Santo Spirito (comune di Bari) (WGS84: 41.179111N, 16.689172E), margine stradale, 3 m, 29 May 2019, leg. *V. Buono*, det. *R.P. Wagensommer* (FI, BI Nos. 42141, 42142); Lecce (Lecce), presso il cimitero (WGS84: 40.359449N, 18.165857E), aiuola incolta, 40 m, 15 June 2019, *P. Medagli* (LEC). – Naturalized alien subspecies new for the flora of Puglia.

Convolvulus sabatius was first recorded from Puglia near Giovinazzo (Bianco 1969) and then collected in Salento (Marchiori et al. 1993), Bari and Monopoli (Perrino et al. 2013). These collections were all attributed to *C. sabatius* subsp. *sabatius*. Our gatherings, from Giovinazzo and Lecce, show long spreading hairs on stems, leaves and calyx and are, therefore, attributed to *C. sabatius* subsp. *mauritanicus*, according to Carine and Robba (2010) and Wood et al. (2015). Consequently, we consider *C. sabatius* subsp. *sabatius* as recorded from Puglia by mistake (Bartolucci et al. 2019).

R.P. Wagensommer, V. Buono, P. Medagli

***Crassula muscosa* L. (Crassulaceae)**

+ (CAS) **MAR**: San Benedetto del Tronto (Ascoli Piceno), Via C. Colombo (WGS84: 42.956186N, 13.882666E), epifita su stipite di *Phoenix canariensis*, ca. 6 m, 9 July 2019, *N. Olivieri* (FI). – Casual alien species new for the flora of Marche.

Crassula muscosa is native to southern Africa and is widely cultivated as ornamental. In Italy, it is known as casual alien in Toscana, Campania, and Sicilia, while it is considered naturalized in Liguria, Calabria, and Sardegna (Galasso et al. 2018a). Some individuals of this species grow as epiphytes on the trunk of a *Phoenix canariensis* H.Wildpret inside the city. The plants have developed among the residues of fibrous tissue between the remains of the cut leaf rachids, in a partially shaded position. Individuals may have arisen *via* vegetative propagation from fragments of plants grown for ornamental purposes in nearby buildings.

N. Olivieri

***Cyclamen persicum* Mill. (Primulaceae)**

+ (CAS) **LIG**: Genova (Genova), lungo Via Tortona (WGS84: 44.42558N, 8.95276E), a bordo strada, nelle crepe dell'asfalto, 81 m, 18 April 2019, *A. Di Turi*, *C. Aristarchi* (FI, GE). – Casual alien species new for the flora of Liguria.

Cyclamen persicum is a widely cultivated plant, whose native range extends from Algeria to the eastern Mediterranean. It is reported in Italy as a casual alien for Lombardia (Banfi and Galasso 2010), Sardegna (Lazzeri et al. 2015), and Lazio (Nicolella 2018). Well-developed specimens were first recorded in 2000 in Viale G. Odino in the centre of Genova. Recently other specimens have been found at three different sites, both in the city centre (Via Fieschi, WGS84: 44.403397N, 8.935548E, 36 m) and in more peripheral sites (Via V. Bocciardo, WGS84: 44.404441N, 8.993866E, 168 m; and Via Tortona). All grow in the cracks of sidewalks, without any other species nearby. One of them was in bloom when recorded (April 2019).

A. Di Turi, C. Aristarchi

***Datura wrightii* Regel (Solanaceae)**

+ (CAS) **MAR**: Urbino (Pesaro e Urbino), fraz. Canavaccio, lungo il Fiume Metauro (WGS84: 43.688780N, 12.700244E), greto fluviale, ca. 175 m, 13 September 2018, *L. Gubellini*, *N. Hofmann* (FI, PESA). – Casual alien species new for the flora of Marche.

Datura wrightii is an annual plant native to the southwestern United States and Mexico (Verloove 2008). It is reported as casual alien in almost all regions of northern and central Italy (Lombardia, Veneto, Trentino-Alto Adige, Friuli Venezia Giulia, Liguria, Emilia-Romagna, Umbria, Lazio, Abruzzo, Campania, Puglia, and Calabria), as naturalized alien for Toscana and Sicilia, and as invasive alien for Sardegna (Galasso et al. 2018a). In Marche, a single individual was observed with abundant flowers and fruits in a stony bank along the Metauro River, far from gardens and urban centre. This species has been long confused with the related *D. inoxia* Mill., less common in Italy, which differs from *D. wrightii* for the type of indument (Verloove 2008).

L. Gubellini, N. Hofmann

***Dicliptera squarrosa* Nees (Acanthaceae)**

+ (CAS) **ITALIA** (**TOS**): Seravezza (Lucca), fraz. Querceta, vicino all'ingresso della stazione ferroviaria "Forte dei Marmi-Seravezza-Querceta", Via Ragazzi del '99 (WGS84: 43.978158N, 10.198074E), margine stradale, 18 m, 23 October 2018, *M. Mugnai*, *L. Lazzaro*, *G. Ferretti* (FI). – Casual alien species new for the flora of Italy (Toscana).

Dicliptera squarrosa is an ornamental plant native to South America, which presents several forms, separated mostly geographically and hardly forming discrete units (Wasshausen and Wood 2004). This species is currently widely available for sale worldwide and is largely used also in Italy. We found one flowering individual clearly escaped from cultivation close to the Querceta railway station. According to some authors (J. Wood, pers. commun.), the forms cultivated in Europe should be referred to *Dicliptera suberecta* (André) Bremek., currently considered as a synonym of *D. squarrosa* (Zuloaga et al. 2008). Nevertheless, further studies are needed to solve this issue and we prefer to provisionally maintain this record under *D. squarrosa*.

M. Mugnai, L. Lazzaro, F. Pasquini, G. Ferretti

***Eragrostis mexicana* (Hornem.) Link subsp. *virescens* (J.Presl) S.D.Koch & Sánchez Vega (Poaceae)**

+ (CAS) **MAR**: Gradara (Pesaro e Urbino), presso il cimitero comunale (WGS84: 43.942494N, 12.769445E), incolto erboso (oliveto abbandonato), ca. 330 m, 16 November 2018, *L. Gubellini*, *N. Hofmann* (FI, PESA). – Casual alien subspecies new for the flora of Marche.

Eragrostis mexicana subsp. *virescens* is an alien annual grass from South America recorded in Europe since 1927, and in Italy since 1975 (Martini and Scholz 1998). Until now, it was reported in Italy as naturalized alien in northern regions (Piemonte, Liguria, Lombardia, Veneto, Trentino-Alto Adige, Friuli Venezia Giulia, Emilia-Romagna) and Calabria, and as casual alien for Valle d'Aosta, Lazio, Campania, and Puglia (Galasso et al. 2018a). A large number of individuals were detected by S. Montanari (pers. commun.) in an uncultivated grassy field, and the abundance of specimens suggests a naturalization of the species, which can be confirmed by monitoring the site.

L. Gubellini, N. Hofmann

***Erigeron karvinskianus* DC. (Asteraceae)**

+ (NAT) **MAR**: Ancona (Ancona), porto antico (WGS84: 43.623791N, 13.509335E), mura in pietra del porto antico e degli scavi adiacenti, 10 m, 28 August 2018, *G. Mei* (*Herb. G. Mei*); Sirolo (Ancona), piazzetta del belvedere e centro storico (Piazzale Marino) (WGS84: 43.522444N, 13.621030E), mura in pietra e bordure degli spazi verdi, 110 m, 12 November 2018, *G. Mei* (FI, ANC, *Herb. G. Mei*); Piobbico (Pesaro e Urbino), vicino al ponte sul Torrente Biscubio (WGS84: 43.352610N, 12.303703E), mura in pietra, ca. 330 m, 21 November 2018, *L. Gubellini*, *N. Hofmann* (FI, PESA). – Naturalized alien species new for the flora of Marche.

Erigeron karvinskianus is an American perennial species native to Mexico and Guatemala which occurs all over western Europe, probably escaped from floriculture. To date, it is present in almost all the Italian territory, with the exception of Valle d'Aosta, Molise, Basilicata, and Sardegna (Galasso et al. 2018a). In all the recorded localities, this species was also observed near road edges and in unmanaged flowerbeds, mainly colonizing the gaps in walls, where it seems to be more competitive than other species, such as *Cymbalaria muralis* G.Gaertn., B.Mey. & Scherb. subsp. *muralis*, *Linaria vulgaris* Mill. subsp. *vulgaris*, and *Parietaria judaica* L. In all the sites, this species is in expansion, in particular in Piobbico, a site monitored since 2016.

L. Gubellini, N. Hofmann, G. Mei

+ (INV) **CAM**: Castellammare di Stabia (Napoli), tra il Castello Angioino e Quisisana (WGS84: 40.687474N, 14.481252E), muro in pietra calcarea, 135 m, 24 April 2013, *A. Stinca* (PORUN-Herb. Stinca); *ibidem* (WGS84: 40.687493N, 14.481536E), muro in pietra calcarea, 130 m, 29 September 2018, *A. Stinca* (PORUN-Herb. Stinca); Ravello (Salerno), Villa Rufolo (WGS84: 40.648479N, 14.613078E), muro in pietra cal-

carea, 353 m, 10 March 2014, leg. *A. Stinca*, *M. Ravo*, det. *A. Stinca* (PORUN-Herb. Stinca). – Status change from naturalized to invasive alien for the flora of Campania.

Erigeron karvinskianus was reported as naturalized for Campania by Galasso et al. (2018a). However, we found this alien plant, in dense and extensive populations, mostly on walls of limestone and tuff blocks of several sites in the Sorrento peninsula. In these environments, it easily spreads by abundant seed production and competes strongly with endemic species, such as *Campanula fragilis* Cirillo subsp. *fragilis*. Therefore, this species should be considered invasive in Campania.

A. Stinca, A. Esposito

***Gamochaeta pensylvanica* (Willd.) Cabrera (Asteraceae)**

+ (NAT) **CAL**: Reggio Calabria (Reggio Calabria), Catona (WGS84: 38.185074N, 15.637955E), marciapiedi, 2 m, 12 June 2019, leg. *V.L.A. Laface*, det. *V.L.A. Laface*, *C.M. Musarella*, *G. Spampinato* (FI, REGGIO); Villa San Giovanni (Reggio Calabria), Viale U. Zanotti Bianco (WGS84: 38.214703N, 15.637015E), marciapiedi, 8 m, 26 June 2019, *V.L.A. Laface* (REGGIO); Reggio Calabria (Reggio Calabria), Cittadella Universitaria (WGS84: 38.121004N, 15.662473E), aiuola, 80 m, 26 June 2019, *V.L.A. Laface*, *C.M. Musarella*, *G. Spampinato* (REGGIO); Campo Calabro (Reggio Calabria), Musalà (WGS84: 38.214607N, 15.672014E), bordo strada, 154 m, 30 June 2019, *V.L.A. Laface* (REGGIO); Reggio Calabria (Reggio Calabria), Gallico Marina (WGS84: 38.169410N, 15.651119E), marciapiedi, 16 m, 10 July 2019, *V.L.A. Laface* (REGGIO). – Naturalized alien species new for the flora of Calabria.

Gamochaeta pensylvanica is native to North America. In Italy, its first record by Moraldo and La Valva (1989) for Campania, was erroneously attributed by these authors to *G. purpurea* (L.) Cabrera (Soldano 2000) and then recorded in the same region by Stinca et al. (2016, 2018). The origin of the introduction of this species in Italy is uncertain. Probably, *G. pensylvanica* arrived in Italy through the importation of potting soil used in plant nurseries. Currently, according to Galasso et al. (2018a), *G. pensylvanica* is a naturalized alien species in Campania, Piemonte, Lombardia, Emilia-Romagna, and Sicilia, whereas it is casual in Toscana, Lazio, and Puglia. In Calabria, this species was observed for the first time in 2008 in locality Catona (Reggio Calabria).

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

***Gazania linearis* (Thunb.) Druce (Asteraceae)**

+ (CAS) **CAL**: San Calogero (Vibo Valentia), Via L. Pirandello (WGS84: 38.576041N, 16.023808E), bordo strada, 256 m, 9 June 2019, *C.M. Musarella* (FI, REGGIO). – Casual alien species new for the flora of Calabria.

Gazania linearis has its native range in South Africa and Lesotho. Since it has been cultivated as an ornamental plant since the 19th century, it has become an invasive plant in several regions of the world (Hassler 2019). In Italy, according to Galasso et

al. (2018a), this species is a casual alien to Toscana, Molise, and Puglia, whereas it is doubtfully recorded for Sardegna.

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

***Impatiens parviflora* DC. (Balsaminaceae)**

+ (INV) **TOS**: Abetone Cutigliano (Pistoia), fra Pianosinatico e Cecchetto in loc. Serrabosco, versante SE di Poggio del Romito (WGS84: 44.125410N, 10.717628E), bosco misto di conifere di impianto con residui di faggeta, 900 m, 21 July 2019, *F. Roma-Marzio*, *M. D'Antraccoli*, *L. Peruzzi* (PI No. 025544). – Status change from naturalized to invasive alien for the flora of Toscana.

Impatiens parviflora is native to central and eastern Asia and represents one of the most widespread aliens in central Europe, being the only alien plant widespread in European forests (Godefroid and Koedam 2010; Hejda 2012). In Italy, this species is reported as naturalized in Friuli Venezia Giulia, Emilia-Romagna, Liguria, Toscana, and Lazio, and as invasive in Valle d'Aosta, Piemonte, Lombardia, Trentino-Alto Adige, and Veneto (Galasso et al. 2018a). During a field survey conducted in the Tuscan Apennines, we noticed a large population of this species. The plants are particularly dense, totally covering the herbaceous layer in shady sites and showing a preference for dry, acidic and nutrient-poor soil conditions, as also highlighted by Godefroid and Koedam (2010). Accordingly, we retain the status of invasive species as more appropriate for *I. parviflora* in Toscana.

F. Roma-Marzio, M. D'Antraccoli, L. Peruzzi

***Kolkwitzia amabilis* Graebn. (Linnaeaceae)**

+ (CAS) **PIE**: Avigliana (Torino), piazzola di sosta lungo la via che porta alla Sacra di San Michele (WGS84: 45.065342N, 7.375007E), margine stradale, ca. 400 m, 8 May 2019, *M. Arnoul*, *M. Lonati* (FI, TO). – Casual alien species new for the flora of Piemonte.

This ornamental species is native to China. It is reported in Italy as casual only for Lombardia (Galasso et al. 2018a).

M. Arnoul, M. Lonati

***Leucaena leucocephala* (Lam.) de Wit subsp. *glabrata* (Rose) Zárate (Fabaceae)**

+ (CAS) **SAR**: Sestu (Cagliari), loc. Su Moriscau, presso la strada provinciale (WGS84: 39.165891N; 9.044471E), aree incolte, 26 m, 11 July 2019, *A. Lallai* (FI, CAG); Monserrato (Cagliari) (WGS84: 39.150639N, 9.084440E), bordo strada, 15 m, 13 July 2019, *L. Podda* (CAG). – Casual alien subspecies new for the flora of Sardegna.

This subspecies is native to central America and southern Mexico, and it was introduced in many countries for several purposes, sometimes becoming invasive (Hughes 1998a, 1998b). In Italy, it has been reported as naturalized in Sicilia (Raimondo and Domina 2007; Pignatti et al. 2017; Galasso et al. 2018a). In Sardegna, it has been ob-

served since 2006 in the industrial area of Sestu, where some plants are growing not far from the cultivated parental plants. Some saplings and young trees have also been observed in the surroundings of Monserrato, in fallow land and roadsides close to Via C. Cabras.

A. Lallai, L. Podda, G. Bacchetta

***Ludwigia hexapetala* (Hook. & Arn.) Zardini, H.Y.Gu & P.H.Raven (Onagraceae)**

+ (NAT) **LAZ**: Bracciano (Roma), fraz. Vigna di Valle, Museo Storico dell'Aeronautica Militare, sul Lago di Bracciano (WGS84: 42.085342N, 12.218902E), sulla spiaggia e sulla riva del lago, 162 m, 12 June 2019, *S. Buono* (FI). – Naturalized alien species new for the flora of Lazio.

Ludwigia hexapetala is a herbaceous perennial plant native to central and South America; its habitat includes lakeshores, ponds, ditches, and streams. The large tolerance of this species to the variations of hydrological and climatic conditions, as well as the strong ability to colonize both beaches and swamps, make it a noxious invader of aquatic ecosystems in North America and in Europe, where it is reported (as included in *L. grandiflora* (Michx.) Greuter & Burdet) in the list of invasive alien species of Union concern (Regulation (EU) n. 1143/2014). It was recorded for Italy by Galasso (2007), based on specimens collected in Lombardia and Veneto and, later, as invasive for Emilia-Romagna (Alessandrini et al. 2017). This species is already established around the coasts of Bracciano Lake, where large populations with hundreds of plants regularly develop flowers and fruits. Nowadays, it occurs with dense populations on about 2 km of the coast near Vigna di Valle, together with other aliens, such as *Amorpha fruticosa* L., *Datura wrightii* Regel, *Eclipta prostrata* (L.) L., *Oenothera glazioviana* Micheli, *Physalis peruviana* L., *Salvia hispanica* L. (see also Galasso et al. 2018b, 2018c, 2019). Moreover, it is widespread near Trevignano Romano (Roma), loc. Pantane, where it was wrongly reported as *L. peploides* (Kunth) P.H.Raven subsp. *montevidensis* (Spreng.) P.H.Raven (Azzella and Iberite 2010). Some individuals can be observed on the east coast of the lake (Lungolago di Polline).

S. Buono, M.M. Azzella, S. Magrini

***Medicago* ×*varia* Martyn (Fabaceae)**

+ (CAS) **TOS**: Greve in Chianti (Firenze), Monte San Michele, Valico del Morellino (WGS84: 43.550176N, 11.398473E), lungo strada, ca. 10 individui, 748 m, 27 June 2018, *T. Fiaschi* (FI). – Casual alien nothospecies new for the flora of Toscana.

This nothospecies (*Medicago falcata* L. subsp. *falcata* × *M. sativa* L.) is likely much more widespread in Italy than currently recorded (Galasso et al. 2018a).

G. Bonari, T. Fiaschi, C. Angiolini

***Muscari armeniacum* Leichtlin ex Baker (Asparagaceae)**

+ (CAS) **PIE**: Verbania (Verbano Cusio Ossola), fraz. Pallanza, Via Prossano, a lato dell'ingresso dei Giardini Botanici di Villa Taranto (WGS84: 45.926149N,

8.565000E), muro di cinta, crepa nel cemento, 206 m, N, 22 April 2019, *N.M.G. Ardenghi*, *S. Mossini* (FI). – Casual alien species new for the flora of Piemonte.

Muscari armeniacum, usually grown for ornamental purposes, is known as a casual alien in different regions of northern and central Italy, except Piemonte (Galasso et al. 2018a). A single individual was found within the crack of a wall near the entrance of the Botanical Gardens of Villa Taranto, where this species is widely cultivated in flowerbeds.

N.M.G. Ardenghi, S. Mossini

***Nigella sativa* L. (Ranunculaceae)**

+ (CAS) **PUG**: Bari (Bari), Lungomare N. Sauro (WGS84: 41.122055N, 16.878997E), fessure di marciapiede, 1 m, 22 May 2019, leg. *G. Picella*, det. *L. Forte*, *R.P. Wagensommer* (BI No. 42139); *ibidem*, 17 June 2019, leg. *L. Forte*, det. *L. Forte*, *R.P. Wagensommer* (FI, BI No. 42140). – Casual alien species new for the flora of Puglia.

Nigella sativa grows in many countries of the temperate regions, where it is cultivated for its aromatic seeds (Zohary 1983). In Italy, it was already cultivated in Ancient Rome (Arrigoni and Viegi 2011), and it is currently reported as a casual alien in Sardegna, extinct in Piemonte, and not recently recorded for Friuli Venezia Giulia and Toscana (Galasso et al. 2018a). In the latter region, Arcangeli (1882) already indicated its occurrence in Casentino as doubtful. No recent information about cultivation of this species in Puglia is available.

L. Forte, R.P. Wagensommer, G. Picella

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

+ (NAT) **MAR**: Fano (Pesaro e Urbino), loc. Rosciano (WGS84: 43.822978N, 12.995544E), margini stradali e campi, ca. 28 m, 2 June 2017, *L. Gubellini* (FI, PESA). – Naturalized alien species confirmed for the flora of Marche.

Oenothera speciosa is a showy perennial alien introduced as ornamental, native to prairies in the United States of America (Missouri and Nebraska) and northern Mexico (Wager et al. 2007; Keener et al. 2019). In Italy, this species is reported as casual alien for Lombardia, Veneto, Toscana, and as naturalized for Emilia-Romagna (Galasso et al. 2018a). For Marche, the occurrence of a *Oenothera* with pink flowers near Senigallia was reported by G. Mazzufferi (pers. commun.). The same data was later verified and recorded by Montanari and Marconi (2010), but no precise locality information was provided. In Rosciano, several specimens have been observed for some years along roadsides and uncultivated areas, where they are slowly spreading.

L. Gubellini, N. Hofmann

+ (CAS) **SIC**: Augusta (Siracusa), centro urbano, villetta comunale tra Via A. Gramsci e Via Papa Giovanni XXIII (WGS84: 37.247270N, 15.221336E), 25 May 2019, leg. *R. Romano*, det. *N.M.G. Ardenghi* (FI). – Casual alien species new for the flora of Sicilia.

Many individuals grow in an abandoned urban garden, probably introduced a few years ago for ornamental purposes in a small flowerbed. Currently, *O. speciosa* displays an 80% cover of the flowerbed and is expanding in the surrounding areas.

R. Romano, O. Caldarella, A. La Rosa, F. Luchino, N.M.G. Ardenghi

***Opuntia scheeri* F.A.C.Weber (Cactaceae)**

+ (CAS) **UMB**: Castiglione del Lago (Perugia), loc. Badiaccia, vicino alla sponda del Lago Trasimeno, lungo la strada SR71, presso l'ingresso di un'abitazione privata (WGS84: 43.168985N, 12.014299E), coltivata e spontaneizzata lungo un fosso, 261 m, 9 October 2018, *M. Mugnai*, *S. Di Natale*, *G. Ferretti* (FI). – Casual alien species new for the flora of Umbria.
+ (CAS) **TOS**: Sesto Fiorentino (Firenze), fraz. Montorsoli, nei pressi della ex stazione ferroviaria lungo la ferrovia Faentina (WGS84: 43.836202N, 11.284043E), pianta spontaneizzata sulla scarpata al margine stradale, 265 m, 7 February 2019, *M. Mugnai* (FI). – Casual alien species new for the flora of Toscana.

Opuntia scheeri is a species native to Mexico, often cultivated as an ornamental plant. It was recorded for the first time in Italy in 1994 (Guiggi 2008), and currently occurs in several regions of northern Italy (Piemonte, Lombardia, Trentino-Alto Adige, Veneto, Emilia-Romagna: Galasso et al. 2018a). Both the records reported here refer to individuals growing close to inhabited areas and derived most likely from cultivated plants. The record from Umbria refers to several well-established plants, probably originated by vegetative means from individuals cultivated nearby. The Tuscan occurrence, instead, consists of a single established individual.

M. Mugnai, E. Corti, S. Di Natale

***Paulownia tomentosa* (Thunb.) Steud. (Paulowniaceae)**

+ (CAS) **TOS**: Vaglia (Firenze), fraz. Fontebuona, ex stazione ferroviaria lungo la ferrovia Faentina (WGS84: 43.880886N, 11.289335E), numerose piante spontaneizzate nei pressi dei marciapiedi e degli edifici della stazione, 332 m, 8 November 2018, *M. Mugnai*, *A. Misuri*, *G. Ferretti* (FI). – Casual alien species new for the flora of Toscana.

Paulownia tomentosa is an ornamental plant native to China and introduced to Europe. It is usually cultivated in parks and gardens, but it is also used for timber production thanks to its fast growth and high-quality wood. The size of plantations in Italy has been increasing rapidly since 1989 (Mezzalira and Colonna 2002). This species occasionally escapes cultivation and becomes invasive, growing rapidly in disturbed areas. It is considered as invasive in the USA, and a potentially invasive species in Europe and South America, where it has been introduced (CABI 2019). We observed an abundant population at the Fontebuona railway station, close to a large cultivated plant. The population consists of numerous individuals of various ages, deriving from both seeds and root suckers. Recently (May 8th, 2019) this species was detected in another site, on the right bank of the Arno River in loc. Riscaggio (Reggello, Firenze, WGS84: 43.7249776N, 11.4662411E).

A. Misuri, L. Pinzani, G. Ferretti

***Petroselinum crispum* (Mill.) Fuss (Apiaceae)**

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

In Italy, *Petroselinum crispum* is reported for most of the regions (Galasso et al. 2018a). Although an agronomic study on populations naturalized in Trentino-Alto Adige was published recently (Fusani et al. 2016), it is considered as casual alien at national level. We detected numerous plants inhabiting steep and shady calcarenitic cliffs at Capo Sant'Elia (Cagliari, Sardegna). This population displays a well-structured partition in age classes, with seedlings, juveniles, and fruiting individuals that suggest the establishment of a naturalized population. Interestingly, the presence in this area of the phyto-toponym "su perdusemini", clearly referring to parsley, and used at least from the 18th century to name a tower probably built during the 16th century, suggests that naturalized populations may be present in this area since a long time. However, *P. crispum* was not previously recorded in the accurate flora of Capo Sant'Elia compiled by Martinoli (1950). In this context, it must be pointed out that the origin of this widely cultivated plant has not yet been identified with certainty, though it possibly originates in the eastern or central Mediterranean region (Agyare et al. 2017; Pignatti et al. 2018). It is noteworthy that Linnaeus (1753) stated its wild habitat to be Sardegna, close to springs.

M.C. Fogu, M. Marignani, L. Rosati

***Phyllostachys viridiglaucescens* (Carrière) Rivière & C.Rivière (Poaceae)**

– **VDA**. – Alien species to be excluded from the flora of Valle d'Aosta.

Phyllostachys viridiglaucescens in Valle d'Aosta was recorded for two localities (Mainetti and Banfi 2018). Surveys in 2018 [Champdepraz (Aosta), terrazzamenti abbandonati a ca. 300 m dalla fraz. Chef-Lieu (WGS84: 45.68873546N, 7.65795915E), terrazzamenti abbandonati, ca. 540 m, 7 October 2018, *A. Mainetti*, *S. Ravetto Enri*, *V. Mezzasalma* (FI); Arnad (Aosta), boscaglia a lato della strada SS26 sul confine con il comune di Hône (WGS84: 45.624517N, 7.736778E), boscaglia ripariale, ca. 350 m, 7 October 2018, *A. Mainetti*, *S. Ravetto Enri*, *V. Mezzasalma* (FI)] revealed short oblique internodes at the base of the culms for both the localities. This is a distinctive feature of *P. aurea* Carrière ex Rivière & C.Rivière (Tison and de Foucault 2014), a species already reported from Valle d'Aosta (Galasso et al. 2018a). Furthermore, the identity of this plant was confirmed by a DNA fingerprinting (RAPD) analysis performed by FEM2-Environment Company (spin-off of the University of Milano-Bicocca) within the BambApp Project (BambApp 2019) (Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università di Torino), using samples from a private botanical collection (T. Froese: Cravanzana, Cuneo, Italy) verified by us as reference base. Consequently, *P. viridiglaucescens* should be excluded from the flora of Valle d'Aosta.

A. Mainetti, S. Ravetto Enri, V. Mezzasalma

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

+ (NAT) **PIE**: Arona (Novara), fraz. Montrigiasco, zona Cascina Motto (WGS84: 45.77122N, 8.51728E), bosco a *Robinia pseudoacacia* dominante, ca. 425 m, 15 January 2018, *M. Pittarello*, *A. Mainetti*, *F. De Mattia* (FI). – Status change from casual to naturalized alien for the flora of Italy; naturalized alien species new for the flora of Piemonte.
+ (NAT) **VDA**: Antey-Saint-André (Aosta), loc. Filey, nei pressi della riva orografica sinistra del Torrente Marmore (WGS84: 45.81154804N, 7.58866366E), prato da sfalcio, ca. 1030 m, 21 July 2018, *M. Lonati*, *S. Pirani*, *J. Frigerio* (FI). – Naturalized alien species new for the flora of Valle d'Aosta.

According to Galasso et al. (2018a), *Phyllostachys viridis* was previously reported in Italy only for Lombardia. Its identity was confirmed by a DNA fingerprinting (RAPD) analysis performed by FEM2-Environment Company (spin-off of the University of Milano-Bicocca) within the BambApp Project (BambApp 2019), using samples from a private botanical collection (T. Froese: Cravanzana, Cuneo, Italy) verified by us as reference base. These populations originated from agamic propagation of nearby cultivated plants.

M. Pittarello, A. Mainetti, F. De Mattia, M. Lonati, S. Pirani, J. Frigerio

***Physalis angulata* L. (Solanaceae)**

+ (CAS) **UMB**: Otricoli (Terni), area archeologica Utriculum, riva idrografica sinistra del Fiume Tevere (WSG84: 42.408889N, 12.458889E), coltivo, 42 m, 30 July 2015, *E. Scarici*, *M. Scarici* (FI). – Casual alien species new for the flora of Umbria.

Physalis angulata is a tropical American species that it is occasionaly cultivated for its edible fruits (Hawkes 1972). It is reported in Italy only in Lombardia, Veneto, and Lazio (Galasso et al. 2018a). Many individuals grow in cultivated areas along the river.

E. Scarici, M. Scarici

***Pseudosasa japonica* (Siebold & Zucc. ex Steud.) Makino ex Nakai (Poaceae)**

+ (NAT) **VDA**: Châtillon (Aosta), traversa di Strada Chemin de Barat che porta alla stazione di servizio autostradale (direzione Aosta) (WGS84: 45.747689N, 7.618339E), prato da sfalcio, ca. 490 m, 13 October 2018, *S. Ravetto Enri*, *M. Lonati*, *L. Guzzetti* (FI). – Naturalized alien species new for the flora of Valle d'Aosta.

In Italy, *Pseudosasa japonica* was reported for all northern regions with the exception of Liguria and Valle d'Aosta (Galasso et al. 2018a). Single branches per node and palmfont-like leaves clearly permitted to identify the species (Li et al. 2006; Tison and de Foucault 2014). In addition, the identity was confirmed by a DNA fingerprinting (RAPD) analysis conducted by FEM2-Environment Company (spin-off of the University of Milano-Bicocca) within the BambApp Project (BambApp 2019), using samples from a private botanical collection (T. Froese: Cravanzana, Cuneo, Italy) verified by us as reference base. The recorded population originated from agamic propagation of nearby cultivated plants.

S. Ravetto Enri, M. Lonati, L. Guzzetti

***Quercus rubra* L. (Fagaceae)**

+ (CAS) **SAR**: Villagrande Strisaili (Nuoro), Monte Idolo (WGS84: 39.940833N, 9.488056E), graniti, 881 m, 2 June 2019, *G. Bacchetta* (FI, CAG). – Casual alien species new for the flora of Sardegna.

The red oak is an American taxon, which was imported in Europe starting from the 17th century (Magni Diaz 2004), and in Italy from 1803 (Maniero 2015). In Sardegna, it was introduced in reforestations and for ornamental purposes (Veri and Bruno 1974; Arrigoni 2006). In recent years, numerous trees and saplings were found on the eastern side of the Gennargentu Massif (Monte Idolo), all growing close to reforestations with red oak and other alien trees.

G. Bacchetta, G. Calvia, L. Podda

***Reynoutria bohemica* Chrtek & Chrtková (Polygonaceae)**

+ (NAT) **MAR**: Urbino (Pesaro e Urbino), lungo la strada SS73bis (WGS84: 43.730503N, 12.635836E), scarpata stradale, ca. 410 m, 16 November 2018, *N. Hofmann* (FI, PESA). – Naturalized alien species new for the flora of Marche.

Reynoutria bohemica is of hybrid origin between the alien species *R. japonica* Houtt. and *R. sachalinensis* (F.Schmidt) Nakai, and it has been recognized and described only at the end of the last century in the Czech Republic (Chrtek and Chrtková 1983). Like other congener species, *R. bohemica* colonizes ruderal environments, roadsides and waterways, and forms dense stands that shade and crowd out all other plants, thereby reducing the biodiversity of invaded plant communities and damaging habitats beyond repair (Padula et al. 2008). In Italy, it has been reported, so far, for Valle d'Aosta, Piemonte, Lombardia, Veneto, and Toscana as invasive alien, for Friuli Venezia Giulia and Emilia-Romagna as naturalized alien, and for Trentino-Alto Adige, Liguria as casual alien (Galasso et al. 2018a). In the Urbino site, which represents the first record for Marche, a large number of individuals has been monitored for several years, and a considerable increase of the population was observed. For this reason, containment measures should be taken.

L. Gubellini, N. Hofmann

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

+ (CAS) **SIC**: Librizzi (Messina), Via A. Cullurafi (WGS84: 38.096521N, 14.957978E), su scarpata stradale alberata con suolo profondo, 8 April 2019, *C.D. Rifici* (FI). – Casual alien species confirmed for the flora of Sicilia.

Roldana petasitis is native to central America (Jeffrey 1986). According to Galasso et al. (2018a), this species is naturalized in Liguria, while in Lazio, Puglia, and Basilicata it is considered as a casual alien. Although Fiori (1927) reported this taxon as growing wild in Sicilia, Giardina et al. (2007) excluded it from this region. A few individuals of different age were found in Librizzi, growing along the roadside with other

nitrophilous species typical of urban areas. The population, monitored since 2013, is particularly resilient, despite the continuous cuts made during ordinary maintenance of public flowerbeds. In Sicilia, this species occurs also in Siracusa, at Latomia dei Cappuccini, in a limestone quarry (R. Genovese, pers. commun.).

C.D. Rifici, A. La Rosa, O. Caldarella, F. Luchino

***Saccharum biflorum* Forssk. (Poaceae)**

+ (NAT) **PUG**: Melendugno (Lecce) lungo la Circonvallazione di Melendugno (WGS84: 40.270194N, 18.343408E), bordo strada, 35 m, 22 August 2019, *G. Laghetti*, *G. Maruca*, *C.M. Musarella* (REGGIO). – Naturalized alien species confirmed for the flora of Puglia.

For Italy, *Saccharum biflorum* was known, until now, only in Sicilia and Sardegna, whereas it was not, until recently, recorded in Puglia (Galasso et al. 2018a). A population was found also in Puglia, between a road and an abandoned field, covering a surface of about 20 m^2. Due to its extension and to the number of the flowering stems, we can consider this species as naturalized in this locality.

C.M. Musarella, G. Maruca, G. Laghetti

***Sedum palmeri* S.Watson (Crassulaceae)**

+ (CAS) **PIE**: Verbania (Verbano Cusio Ossola), fraz. Pallanza, Viale G. Azari (WGS84: 45.928311N, 8.552684E), marciapiede, 214 m, 22 April 2019, *N.M.G. Ardenghi*, *S. Mossini* (FI). – Casual alien species new for the flora of Piemonte.

Sedum palmeri, commonly cultivated as an ornamental pot plant, has been recorded from many northern Italian regions, except Piemonte (Galasso et al. 2018a). Some individuals were discovered growing within the cracks of a sidewalk. This species may be more widespread across the region, especially in urban areas.

N.M.G. Ardenghi, S. Mossini

+ (CAS) **TOS**: Figline e Incisa Valdarno (Firenze), loc. C. Torrione (WGS84: 43.6586857N, 11.4246546E), interno cipresseta, 310 m, 24 February 2019, *L. Pinzani* (FI). – Casual alien species new for the flora of Toscana.

In Italy, *Sedum palmeri* is recorded from Lombardia, Veneto, Friuli Venezia Giulia, Emilia-Romagna, Liguria, Lazio, Campania, and Sardegna (Galasso et al. 2018a). Various groups of individuals grow within a cypress wood. The main one is represented by more than 100 individuals.

L. Pinzani

***Semiarundinaria fastuosa* (Lat.-Marl. ex Mitford) Makino (Poaceae)**

+ (NAT) **ITALIA** (**PIE**): Borgo San Dalmazzo (Cuneo), Via Mangiacane (WGS84: 44.34109541N, 7.50195817E), canale di irrigazione e margine di seminativo, ca.

620 m, 1 February 2018, *M. Pascale*, *G. Nota*, *V. Mezzasalma* (FI). – Naturalized alien species new for the flora of Italy (Piemonte).

Semiarundinaria fastuosa is a bamboo native to Japan (south-western Honshu). The recorded population originated from agamic propagation from a private garden and colonized a nearby canal bank. Several branches per node, partially deciduous culm sheaths and minute auricles allowed us to identify this species (Li et al. 2006; Tison and de Foucault 2014). The identification was confirmed by DNA fingerprinting (RAPD) analysis performed by FEM2-Environment Company (spin-off of the University of Milano-Bicocca) within the BambApp Project (BambApp 2019), using samples from a private botanical collection (T. Froese: Cravanzana, Cuneo, Italy) verified by us as reference base.

M. Pascale, G. Nota, V. Mezzasalma

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

+ (CAS) **ABR**: San Vito Chietino (Chieti), loc. Marina, muro di contenimento coperto da vegetazione presso la strada SS16 Adriatica (WGS84: 42.305208N, 14.450116E), ca. 15 m, SW, 18 May 2019, *N. Olivieri* (FI). – Casual alien species new for the flora of Abruzzo.

Senecio angulatus is a succulent climbing plant native to South Africa, introduced for ornamental purposes in southern Europe, Macaronesia, northern Africa, California, Chile, Australia, and New Zealand. Currently, it is naturalized in Albania (Barina et al. 2011), Croatia (Milović et al. 2010), Iberian peninsula (Romero Buján 2007; Pyke 2008), and Chile (Ugarte et al. 2011) and is considered one of the most invasive species in the western Mediterranean area (Brundu et al. 1999), Mediterranean France (Brunel and Tison 2005), Australia (Ross and Walsh 2003; Randall 2007), and New Zealand (Bergin 2006). This species was introduced in Italy in 1875 (Maniero 2015). It is known as a casual alien in Lazio and Calabria, while it is naturalized in Puglia, Campania, Basilicata, Sicilia, and invasive in Liguria, Toscana, and Sardegna (Galasso et al. 2018a). In San Vito Chietino, this species grows on a brick retaining wall, located below the site of the Adriatic State Road, in a sunny and sheltered position, close to the Adriatic Sea. Here the plant is established along with *Arundo plinii* Turra, *Ficus carica* L., and *Rubus ulmifolius* Schott.

N. Olivieri

***Senecio inaequidens* DC. (Asteraceae)**

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

Senecio inaequidens is native to South Africa. It was recorded in Europe for the first time in the mid-twentieth century and observed in Italy in 1947 (Carrara Pantano and Tosco 1959; Anzalone 1976). It was reported as present throughout central and northern Italy and has been rapidly expanding since the beginning of the 1980s (Pignatti 1982). Now it is widespread in all Italian regions and often considered invasive (Galasso et al.

2018a). Our recent field investigations revealed the presence of this species in all Tuscan provinces, confirming many previous observations and adding several new occurrences (Peruzzi et al. 2019). Consequently, this species is abundant and well distributed in anthropized sites of Toscana, where it is spreading notwithstanding the control actions often undertaken. Moreover, this species has been observed in some natural sites. Accordingly, we regard the status of invasive alien as the most appropriate.

A. Misuri, G. Ferretti, M. Mugnai

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

+ (CAS) **SAR**: Olbia (Sassari), Parco F. Noce, presso il canale di Via L. Galvani (WGS84: 40.554511N, 9.295523E), prati e aiuole, 1–2 m, 25 June 2017, *G. Calvia* (FI); *ibidem*, Parco F. Noce, lato Via G. D'Annunzio, ai lati della pista (WGS84: 40.554352N, 9.300366E), aiuole e prati inglesi, 2 m, 25 June 2017, *G. Calvia* (*Herb. G. Calvia*). – Casual alien species new for the flora of Sardegna.

Sisyrinchium rosulatum is a species native to North America, introduced in Europe and other continents, and now naturalized in several countries (Nicolella and Ardenghi 2013). In Italy, this species has been reported as casual alien in Lazio (Nicolella and Ardenghi 2013; Galasso et al. 2018a). In Sardegna, it has been observed starting to 2015 in the town of Olbia, where it grows in the Fausto Noce community park and neighboring areas, above all in lawns but also in flowerbeds and along paths. It probably arrived there thanks to seed dispersed in lawns.

G. Calvia

***Solanum bonariense* L. (Solanaceae)**

+ (CAS) **LIG**: Genova (Genova), lungo Via Apparizione, nel tratto pedonale (WGS84: 44.40443N, 8.98889E), bordo strada, 42 m, 20 April 2019, *A. Di Turi*, *C. Aristarchi* (FI, GE, GDOR). – Casual alien species new for the flora of Liguria.

Solanum bonariense is a perennial shrub native to Uruguay, northern Argentina, and southern Brazil where it is widespread in pastures. Introduced in Europe as an ornamental, it is nowadays recorded in Italy as a casual species for Lombardia, Lazio, Campania, and as naturalized for Toscana and Sicilia (Galasso et al. 2018a). A well-developed specimen, growing together with *Parietaria judaica* L., has been recorded in a pedestrian street of Genova among houses surrounded by orchards and gardens.

A. Di Turi, C. Aristarchi

***Solanum laciniatum* Aiton (Solanaceae)**

+ (NAT) **ITALIA** (**TOS**): Monte Argentario (Grosseto), lungo la strada sterrata Via Panoramica, sopra Cala dell'Acqua Dolce (WGS84: 42.374541N, 11.185636E), macchia, 70 m, 22 June 2019, *F. Roma-Marzio*, *P. Liguori* (FI, *Herb. F. Roma-Marzio*). – Naturalized alien species confirmed for the flora of Italy and new for the flora of Toscana.

Solanum laciniatum is a species native to New Zealand and Australia from south-eastern Australia, Victoria, and Tasmania (Simon 1981). This species belongs to *Solanum* subg. *Archaesolanum* Bitter ex Marzell, composed of eight species occurring only in the SW-Pacific region (Poczai et al. 2011). In the Euro+Med area, *S. laciniatum* is recorded in Morocco, France, Spain, Israel, and Tunisia (Valdés 2012), whereas in Italy it is doubtfully occurring based on a record for Puglia (Beccarisi et al. 2015; Galasso et al. 2018a). This species is similar to *S. aviculare* G.Forst, that mainly differs from *S. laciniatum* in the shape of petals (notched in *S. laciniatum* and acute in *S. aviculare*), and in the colour of mature fruits (orange-yellow in *S. laciniatum* and orange-red to scarlet in *S. aviculare*). About six big tufts, probably originated from cultivated plants at a nearby hotel, were counted mixed with native species typical of the Mediterranean scrub. Furthermore, in the same area plants are present since 2006, as highlighted by some photos published on the Portal to the Flora of Italy (http://dryades.units.it/floritaly/index.php?procedure=taxon_page&tipo=all&id=11471).

F. Roma-Marzio

***Sporobolus indicus* (L.) R.Br. (Poaceae)**

+ (CAS) **MAR**: Piobbico (Pesaro e Urbino), alla confluenza tra il Torrente Biscubio e il Fiume Candigliano (WGS84: 43.589956N, 12.510999E), greto fluviale, ca. 335 m, 10 December 2018, *N. Hofmann* (FI, PESA). – Casual alien species new for the flora of Marche.

This perennial grass is naturalized throughout peninsular and insular Italy, except for Valle d'Aosta, Marche, Umbria, and Puglia (Galasso et al. 2018a). In Marche, a few individuals grow in the grassy edge of a riverbed on alluvial sandy soil. The occurrence of *Sporobolus indicus* could be due to the abundant presence in the site of migratory birds (especially ducks), that inhabit riverbanks and contribute to the conveyance of seeds.

L. Gubellini, N. Hofmann

***Sporobolus vaginiflorus* (Torr. ex A.Gray) Alph.Wood (Poaceae)**

+ (NAT) **TOS**: Fiesole (Firenze), fraz. Caldine, stazione ferroviaria di Caldine-Fiesole (WGS84: 43.830543N, 11.308060E), marciapiedi lungo il binario, 169 m, 8 November 2018, *M. Mugnai*, *A. Misuri*, *G. Ferretti* (FI). – Naturalized alien species new for the flora of Toscana.

Sporobolus vaginiflorus is a North American species already present in most of northern regions of Italy (Galasso et al. 2018a). The population reported here displayed several mature fruiting individuals spanning alongside the sidewalks of the Caldine-Fiesole railway station and in the surrounding areas.

M. Mugnai, S. Di Natale, A. Padula

***Tulipa clusiana* Redouté (Liliaceae)**

+ (NAT) **VEN**: Soave (Verona), alla 'Colombara' (WGS84: 45.44168063N, 11.24953327E), boschetto termofilo, 168 m, 2 March 2019, *G. Bommartini*, *G. Zanoni*, *F. Menini* (VER No. FDC7708). – Status change from casual to naturalized alien for the flora of Veneto.

Tulipa clusiana is native to Syria and Persia, in the Middle East (Banfi and Galasso 2010), and is recorded as a casual alien in several central-northern Italian regions, and as naturalized in Piemonte, Lombardia, and Marche (Galasso et al. 2018a). In Veneto, there was only one confirmed report by Busnardo (2000) in Bassano del Grappa (Vicenza). For the Verona province, there is only a historical sample collected by Goiran (1897, 1900, VER) and a recent indication of occasional presence in Custoza (F. Prosser, pers. commun.). In the locality reported here, the population consists of thousands of seedlings, which grow both within a thermophilic grove formed by different species, such as *Dioscorea communis* (L.) Caddick & Wilkin, *Fraxinus ornus* L. subsp. *ornus*, *Ligustrum vulgare* L., *Quercus pubescens* Willd. subsp. *pubescens*, *Robinia pseudoacacia* L., *Rubus ulmifolius* Schott, and *Sambucus nigra* L., and inside olive groves. This species was found in two small woods about 250 meters apart, and more on two other adjacent banks. Other localities have been found on the slopes of Monte Tenda, just above the medieval castle of Soave (WGS84: 45.44145545N, 11.24924856E, 95 m), more than 2 km away from the above-mentioned sites. The total area occupied, albeit discontinuously, by *T. clusiana* is over 10,000 m^2 and hosts thousands of individuals.

G. Bommartini, G. Zanoni, F. Menini, S. Andreatta

***Vachellia farnesiana* (L.) Wight & Arn. (Fabaceae)**

+ (CAS) **CAL**: Bova Marina (Reggio Calabria), loc. Vena (WGS84: 37.937774N, 15.911936E), scarpata bordo strada, 44 m, 27 April 2019, leg. *V.L.A. Laface*, det. *V.L.A. Laface*, *C.M. Musarella*, *G. Spampinato* (FI, REGGIO); Reggio Calabria (Reggio Calabria), Gallico, loc. Pietre della Zita (WGS84: 38.161215N, 15.663414E), scarpata bordo strada, 47 m, 9 October 2019, *V.L.A. Laface* (REGGIO); Brancaleone (Reggio Calabria), loc. Fiumarella (WGS84: 37.982290N, 16.089573E), bordo strada, 35 m, 28 October 2019, *V.L.A. Laface* (REGGIO). – Casual alien species new for the flora of Calabria.

The native range of *Vachellia farnesiana* is considered to be the New World (New 1984), and in particular North America (Gilman and Watson 1993). However, its exact origin is nowadays debated (Luken and Thieret 1996; Roskov 2006). In Europe, it occurs in France, Italy, and Spain (Roskov 2006). Currently, according to Galasso et al. (2018a), it is a casual alien in Sicilia and Sardegna. In this new Calabrian locality, we observed several seedlings near the mature plants. This is the first record for peninsular Italy.

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

***Verbena bonariensis* L. (Verbenaceae)**

+ (CAS) **FVG**: Gorizia (Gorizia), Borgo Castello, sulle mura del castello subito dopo Porta Leopoldina (WGS84: 45.942638N, 13.628783E), su mura di arenaria, 100 m, 25 April 2019, *F. Roma-Marzio*, *P. Liguori* (FI, *Herb. F. Roma-Marzio*). – Casual alien species new for the flora of Friuli Venezia Giulia.

Verbena bonariensis is native to South America (southern Brazil, Uruguay, Paraguay, northern Argentina) and has been introduced in many countries of Africa, Asia,

Australia, and Europe and in the USA (Munir 2002; Nesom 2010). In Italy, it is reported as naturalized alien in Liguria and as casual in Lombardia, Trentino-Alto Adige, Emilia-Romagna, Toscana, Umbria, and Lazio (Galasso et al. 2018a). About five plants were found on the ancient walls, probably as a result of escaped cultivated plants. Specimens were identified using the key reported by Nesom (2010).

F. Roma-Marzio

***Youngia japonica* (L.) DC. subsp. *japonica* (Asteraceae)**

+ (CAS) **SIC**: Messina (Messina), Rodia, loc. Contrada Marmora, presso il complesso residenziale Baia Verde (WGS84: 38.267442N, 15.478063E), fessure nella pavimentazione del marciapiede e interstizi tra marciapiede e muro, 14 February 2019, *F. Luchino* (FI). – Casual alien species new for the flora of Sicilia.

According to Shi and Kilian (2011), the Sicilian populations of *Youngia japonica* belong to the autonymic subspecies, native probably to China and naturalized in warm areas of all continents (Galasso et al. 2016). The single Italian record of this species in Genova (Liguria) is very recent (Galasso et al. 2016). We found approximately 30 individuals growing inside sidewalk cracks and in shady micro-soil located at the base of the walls. In the same area, the herbaceous vegetation consists mainly of several ruderal species linked to anthropic environments. *Y. japonica* has been observed as alien also in north-eastern Sicilia (A. Crisafulli and R.M. Picone, pers. commun.), namely in Messina along urban roads (Via F. Bisazza), in the flowerbeds and lawns of the Comando Arma dei Carabinieri (near Villa Mazzini) and in Milazzo (Messina) at C.da Scaccia in an uncultivated wet habitat.

F. Luchino, O. Caldarella, A. La Rosa, R. De Luca

Nomenclatural and distribution updates from other literature sources

Nomenclatural, status, and distribution updates according to Saccardo (1909), Viegi et al. (1974), Ricciardi and Anzalone (1988), Greuter et al. (1989), Prosser et al. (2009), Castellano and Spadaro (2011), Licitra and Napoli (2011), Schaefer and Renner (2011), Himmelreich et al. (2012), Pasta (2012), Sebastian et al. (2012), Coulot and Rabaute (2013), Gestri and Peruzzi (2016), Pasta et al. (2016), Thiede (2017), Ardenghi (2018), Carta et al. (2018), Gallo et al. (2018), Rich et al. (2018), Trejo-Torres et al. (2018), Antonietti and Dellavedova (2019), Ardenghi (2019), Badalamenti (2019), Benetti (2019), Berselli et al. (2019), Buccheri et al. (2019), Compton et al. (2019), Del Guacchio et al. (2019), Galasso (2019), Gallo (2019), Gariboldi and Frezzini (2019), Groom (2019), Marchetti (2019), Musarella (2019), Musarella et al. (2019), Pascale and Pellegrino (2019), Paton et al. (2019), Picco et al. (2019), Prosser et al. (2019), Sarmati et al. (2019), Stinca and Mei (2019), Stinca et al. (2019), Verloove et al. (2019), and corrections to Galasso et al. (2018a) are provided in Suppl material 1.

G. Galasso, F. Bartolucci

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Supplementary material 1

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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RESEARCH ARTICLE

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Notulae to the Italian native vascular flora: 8

Fabrizio Bartolucci[1], Gianniantonio Domina[2], Nicola M.G. Ardenghi[3], Giovanni Bacaro[4], Gianluigi Bacchetta[5], Franco Ballarin[6], Enrico Banfi[7], Giuseppina Barberis[8], Leonardo Beccarisi[9], Liliana Bernardo[10], Gianmaria Bonari[11], Federica Bonini[12], Salvatore Brullo[13], Sergio Buono[14], Vito Buono[15], Mario Calbi[16], Franco Caldararo[17], Giacomo Calvia[5], Laura Cancellieri[18], Serafino Cannavò[19], Davide Dagnino[8], Assunta Esposito[20], Simonetta Fascetti[21], Goffredo Filibeck[18], Graziana Fiorini[22], Luigi Forte[23], Gabriele Galasso[7], Giovanni Gestri[24], Daniela Gigante[12], Günter Gottschlich[25], Leonardo Gubellini[26], Nicole Hofmann[27], Lorenzo Lastrucci[28], Michele Lonati[29], Richard Lorenz[30], Livia Lunardi[22], Sara Magrini[31], Andrea Mainetti[29], Giovanni Maiorca[32], Giuliano Mereu[33], Rita T. Messa Ballarin[6], Luigi Minuto[8], Sara Mossini[34], Carmelo M. Musarella[19], Pier Luigi Nimis[4], Nicodemo G. Passalacqua[35], Simonetta Peccenini[8], Bruno Petriglia[36], Lina Podda[5], Giovanna Potenza[21], Simone Ravetto Enri[29], Francesco Roma-Marzio[37], Leonardo Rosati[21], Alessandro Ruggero[38], Giovanni Spampinato[19], Adriano Stinca[20], Manuel Tiburtini[39], Corrado Tietto[40], Valeria Tomaselli[41], Claudia Turcato[8], Daniele Viciani[22], Robert P. Wagensommer[42], Chiara Nepi[28]

1 *Centro Ricerche Floristiche dell'Appennino (Università di Camerino – Parco Nazionale del Gran Sasso e Monti della Laga), San Colombo, 67021 Barisciano (L'Aquila), Italy* **2** *Dipartimento di Scienze Agrarie, Alimentari e Forestali, Università di Palermo, Viale delle Scienze, ed. 4, 90128 Palermo, Italy* **3** *Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, Via Sant'Epifanio, 14, 27100 Pavia, Italy* **4** *Dipartimento di Scienze della Vita, Università di Trieste, Via L. Giorgieri 10, 34127, Trieste, Italy* **5** *Dipartimento di Scienze della Vita e dell'Ambiente, Università di Cagliari, Viale Sant'Ignazio da Laconi 13, 09123 Cagliari, Italy* **6** *Rione Sant' Andrea 431, 30015 Chioggia (Venezia), Italy* **7** *Sezione di Botanica, Museo di Storia Naturale di Milano, Corso Venezia 55, 20121 Milano, Italy* **8** *Dipartimento di Scienze della Terra, dell'Ambiente e della Vita, Università di Genova, Corso Europa 26, 16132 Genova, Italy* **9** *Riserva Naturale dello Stato di Torre Guaceto, Via Sant'Anna 6, 72012 Carovigno (Brindisi), Italy* **10** *Dipartimento di Biologia, Ecologia e Scienze della Terra (DIBEST), Università della Calabria, 87036 Arcavacata di Rende (Cosenza), Italy* **11** *Department of Botany and Zoology, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic* **12** *Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università di Perugia, Borgo XX Giugno 74, 06121 Perugia, Italy* **13** *Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Catania, Via A. Longo 19, 95125 Catania, Italy* **14** *GIROS Sezione "Etruria Meridionale", Via XXV Aprile 6, 01010 Oriolo Romano (Viterbo), Italy* **15** *Vico Traversa 2, 70127 Bari, Italy* **16** *Via Pisacane 16/8, 16129 Genova, Italy* **17** *Via Pagano 4/6, 85034 Fardella (Potenza), Italy* **18** *Dipartimento di Scienze Agrarie e Forestali, Università della Tuscia, Via San Camillo de Lellis snc, 01100 Viterbo, Italy* **19** *Dipartimento di Agraria,*

Università Mediterranea di Reggio Calabria, Feo di Vito snc, 89122 Reggio Calabria, Italy **20** *Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche, Università della Campania Luigi Vanvitelli, Via A. Vivaldi 43, 81100 Caserta, Italy* **21** *Scuola di Scienze Agrarie, Forestali e Ambientali, Università della Basilicata, Via Ateneo Lucano 10, 85100 Potenza, Italy* **22** *Dipartimento di Biologia, Università di Firenze, Via G. La Pira 4, 50121 Firenze, Italy* **23** *Dipartimento di Biologia e Museo Orto Botanico, Università di Bari Aldo Moro, Via Orabona 4, 70125 Bari, Italy* **24** *Via Bonfiglioli 30, 59100 Prato, Italy* **25** *Hermann-Kurz Strasse 35, D-72074 Tübingen, Germany* **26** *Centro Ricerche Floristiche Marche, Provincia di Pesaro e Urbino, Via Barsanti 18, 61121 Pesaro (Pesaro e Urbino), Italy* **27** *Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università Politecnica delle Marche, Via Brecce Bianche 10, 60131 Ancona, Italy* **28** *Museo di Storia Naturale, Università di Firenze, Via G. La Pira 4, 50121 Firenze, Italy* **29** *Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università di Torino, Largo P. Braccini 2, 10095 Grugliasco (Torino), Italy* **30** *Leibnizstrasse 1, 69469 Weinheim, Germany* **31** *Banca del Germoplasma della Tuscia, Università della Tuscia, Largo dell'Università, 01100 Viterbo, Italy* **32** *Agenzia Regionale per lo Sviluppo dell'Agricoltura Calabrese (ARSAC), Viale Trieste, 95 87100 Cosenza, Italy* **33** *Via Alghero 17, 08042 Bari Sardo (Ogliastra), Italy* **34** *Via E. Raovati 6, 27049 Stradella (Pavia), Italy* **35** *Museo di Storia Naturale della Calabria ed Orto Botanico, Università della Calabria, Via Savinio 87036 Arcavacata di Rende (Cosenza), Italy* **36** *Via Fontana Santo Stefano 24, 03011 Alatri (Frosinone), Italy* **37** *Sistema Museale di Ateneo, Orto e Museo Botanico, Università di Pisa, Via L. Ghini 13, 56126 Pisa, Italy* **38** *Loc. Parapinta, 07029 Tempio Pausania (Sassari), Italy* **39** *Via Madonna d'Ete 40, 63900 Fermo, Italy* **40** *Via Trinità 10, 35020 Pernumia (Padova), Italy* **41** *Istituto di Bioscienze e Biorisorse, Centro Nazionale delle Ricerche (IBBR/CNR), Via G. Amendola 165/A, Bari, Italy* **42** *Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Via del Giochetto 6, 06123 Perugia, Italy*

Corresponding author: *Fabrizio Bartolucci* (fabrizio.bartolucci@gmail.com)

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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, exclusions, and status changes to the Italian administrative regions for taxa in the genera *Ajuga*, *Chamaemelum*, *Clematis*, *Convolvulus*, *Cytisus*, *Deschampsia*, *Eleocharis*, *Epipactis*, *Euphorbia*, *Groenlandia*, *Hedera*, *Hieracium*, *Hydrocharis*, *Jacobaea*, *Juncus*, *Klasea*, *Lagurus*, *Leersia*, *Linum*, *Nerium*, *Onopordum*, *Persicaria*, *Phlomis*, *Polypogon*, *Potamogeton*, *Securigera*, *Sedum*, *Soleirolia*, *Stachys*, *Umbilicus*, *Valerianella*, and *Vinca*. Nomenclatural and distribution updates, published elsewhere, and corrigenda are provided as Suppl. material 1.

Keywords

Endemic, Floristic data, Italy, Nomenclature

How to contribute

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

Floristic records

Ajuga tenorei C.Presl (Lamiaceae)

+ **BAS**: Viggianello (Potenza), Piano Ruggio (WGS84: 39.917186N, 16.136930E), pascolo nitrofilo su suolo calcareo, 1550 m, 9 June 2016, *F. Caldararo* (FI). – Species confirmed for the flora of Basilicata.

This species is reported as doubtful for Basilicata (Bartolucci et al. 2018b), although several ancient and recent records are known for this region from the Pollino mountain range (Tenore 1831; Terracciano 1891; Cavara and Grande 1913; Gavioli 1947; Tomaselli et al. 2003). This report appeared in the web-forum Acta Plantarum (https://www.floraitaliae.actaplantarum.org/viewtopic.php?t=86853&p=555535).

L. Bernardo, F. Caldararo

Chamaemelum fuscatum (Brot.) Vasc. (Asteraceae)

+ **CAL**: Caloveto (Cosenza), lungo la SS 531 al km 6,5 (WGS84: 39.554431N, 16.763299E), accumuli di suolo argilloso alla base di un impluvio, 106 m, 6 March 2019, *G. Maiorca* (FI, CLU). – Species new for the flora of Calabria.

This species is reported for Emilia-Romagna (not confirmed), Toscana, Lazio, Abruzzo, Campania, Puglia (not confirmed), Sicilia, and Sardegna (Bartolucci et al. 2018b). We found a rich population on a limited surface, and supposedly it may be widespread on the clayey hills of the Ionian side of Calabria, but rarely observed because of its early flowering time.

L. Bernardo, G. Maiorca, N.G. Passalacqua

Clematis recta L. (Ranunculaceae)

+ **LIG**: Maissana (La Spezia), pendici E di M. Traversa (WGS84: 44.27129N, 9.57325E), ai piedi di una rupe, 800 m, 21 June 2019, *G. Barberis*, *M. Calbi* (GE). – Species confirmed for the flora of Liguria.

The species was cited by Bertoloni (1842–1844) "in Liguria orientali in montibus del Bracco", "ex Liguria occidua in valle Urìa" and by De Notaris (1844, under the

name *Clematis erecta* All.) "ad fossarum margines in pratis prope Sestri di Levante". When revising the photographic archive of Lucio Cortesogno, a petrographer and passionate naturalist, a slide was found taken in June 1994 in the "Bracco" area. Research in that area allowed the discovery of the species.

G. Barberis, M. Calbi

***Convolvulus sabatius* Viv. subsp. *sabatius* (Convolvulaceae)**

– (A) **PUG**. – Regional alien subspecies to be excluded from the flora of Puglia.

All the records of this subspecies for Puglia (Bianco 1969; Marchiori et al. 1993; Perrino et al. 2013; Bartolucci et al. 2018b) should be referred to *C. sabatius* subsp. *mauritanicus*, recently collected in the same localities in which *C. sabatius* subsp. *sabatius* was reported (Galasso et al. 2019).

V. Buono, R.P. Wagensommer, L. Forte

***Cytisus spinosus* (L.) Lam. (Fabaceae)**

– **BAS**. – Species to be excluded from the flora of Basilicata.

In Basilicata, *Cytisus spinosus* was reported by Gavioli (1947, under the name *Calycotome spinosa* Lk. var. *typica* Fiori) for two localities of the Ionian sector of the region (Policoro, Bosco di S. Giorgio). Subsequently, it was no longer reported (see e.g., Conti et al. 2006). Moreover, *C. spinosus* is considered absent or doubtfully occurring in the regions surrounding Basilicata, and in the work by Lattanzi (2008) only *C. infestus* (C.Presl) was reported for Basilicata. Based on the the revision of the specimens collected by Gavioli and stored in FI (barcodes FI056257, FI056258), which turned out to be *C. infestus*, we conclude that *C. spinosus* should be excluded from the flora of Basilicata.

L. Rosati, L. Lastrucci, S. Fascetti

***Deschampsia cespitosa* (L.) P.Beauv. subsp. *parviflora* (Thuill.) Dumort. (Poaceae)**

+ **TOS**: Pigelleto, Monte Amiata (Siena), cerreta tagliata (WGS84: 42.806373N, 11.667289E), 950 m s.l.m., 24 Jun 2010, *P. Castagnini* (FI). – Subspecies new for the flora of Toscana.

This subspecies is known for acidophilous broad-leaved forests from lowlands to highlands, but, until now, it was rarely observed in Italy (Bartolucci et al. 2018b).

E. Banfi, G. Bonari, G. Bacaro

***Eleocharis mamillata* (H.Lindb.) H.Lindb. subsp. *austriaca* (Hayek) Strandh. (Cyperaceae)**

0 **CAL**: La Sila (Calabria) Regione Ciricilla zona piana umida, m. 1370, 27 June 1950, *G. Sarfatti*, *R. Corradi* (FI barcode FI055691). – Species not recently confirmed for the flora of Calabria.

During an ongoing study of herbarium material belonging to *Eleocharis* subser. *Eleocharis* (Lastrucci et al. 2018), a specimen formerly identified by Sarfatti as "*Heleocharis palustris* R. et S. α *typica* Fiori" and stored in FI within the folder of *Eleocharis palustris* (L.) Roem. & Schult. aroused our interest for the absence of a clear neck-like constriction separating achene and stylopodium. This feature differentiates the *E. mamillata* group from the *E. palustris* group (Strandhede 1966). Moreover, the stomatal structure is typical of the *E. mamillata* complex, with guard cells longer than subsidiary cells and protruding at the ends of the stomata (Strandhede 1966). According to Bartolucci et al. (2018b), *E. mamillata* occurs in Italy with two subspecies: *E. mamillata* subsp. *mamillata* (recorded in Friuli-Venezia Giulia and doubtfully occurring in Valle d'Aosta and Piemonte) and *E. mamillata* subsp. *austriaca* (recorded in Valle d'Aosta, Lombardia, Trentino-Alto Adige, Veneto, and Friuli-Venezia Giulia). The conical structure of the stylopodium and the number of bristles varying between 4 and 5 allowed us to attribute the Calabrian specimen to *E. mamillata* subsp. *austriaca.* The historical presence of this taxon in Calabria could be related to the particular geological and tectonic history of central-southern Calabria, which is a territory of Alpine-European derivation, once close to the Sardinian-Corsican block and subsequently dislocated in its current position (see Haccard et al. 1972; Amodio-Morelli et al. 1976; Bernardo et al. 2011).

L. Lastrucci, L. Lunardi, G. Fiorini, D. Viciani

***Epipactis meridionalis* H.Baumann & R.Lorenz (Orchidaceae)**

– **LAZ**. – Species to be excluded from the flora of Lazio.

Baumann and Lorenz (1988) reported the only finding of *Epipactis meridionalis* for Lazio based on a collection by R. Lorenz from Filettino and Guarcino (Frosinone), still kept in his private herbarium. A recent revision of these specimens has led us to attribute them to *E. helleborine* (L.) Crantz, for the observed differences as compared to *E. meridionalis* (i.e. leaves not rounded and longer, epichile only slightly bent backwards, upper stem and ovarium not maroonish). Accordingly, *E. meridionalis* should be excluded from the flora of Lazio.

R. Lorenz, B. Petriglia, S. Buono, S. Magrini

***Euphorbia peplis* L. (Euphorbiaceae)**

+ **LIG**: Cogoleto (Genova), foce del T. Lerrone (WGS84 44.39066N, 8.66406E), spiaggia ghiaiosa, 0,5 m, 16 September 2011, *M. Calbi* (GE). – Species confirmed for the flora of Liguria.

Euphorbia peplis was indicated in the 19th century and in the first half of the 20th century for several sites throughout Liguria, before the intensive use of beaches for bathing purposes (see Barberis and Mariotti 1983). It was reported by Bartolucci et al. (2018b) as no longer recorded for the region.

G. Barberis, M. Calbi

***Groenlandia densa* (L.) Fourr. (Potamogetonaceae)**

+ **MAR**: Pioraco (Macerata), torrente Scarzito, presso la cava di ghiaia (WGS84: 43.170817N, 12.982622E), c. 453 m, 8 July 2015, *L. Gubellini* (FI, PESA). – Species new for the flora of Marche.

Groenlandia densa is a eurosibiric hydrophyte, that inhabits stagnant and current waters. In Italy, it has been reported in almost all administrative regions, except for Sardegna and Marche, and by mistake in Friuli Venezia Giulia (Bartolucci et al. 2018b). This species is quite rare and localized in the Marche, where it grows in flowing waters along with *Zannichellia pedunculata* Rchb., *Ranunculus trichophyllus* Chaix, and *Callitriche* sp.

L. Gubellini, N. Hofmann

***Hedera helix* L. subsp. *helix* (Araliaceae)**

+ **SAR**. – Status change from naturalized to native for the flora of Sardegna.

This sub-Atlantic taxon has been considered as native occurring in all the administrative regions of Italy, with the exception of Sardegna, where it is reported as naturalized (Bartolucci et al. 2018b). This status seems to be due to a misunderstanding, since the naturalization of the taxon referred to *H. helix* f. *poetarum* (Nicotra) McAll. & A.Rutherf., which sometimes spreads, by vegetative reproduction, in parks and gardens. On the other hand, the nominal subspecies is also native in Sardegna, as suggested by its distribution throughout the island, as well as the presence of many monumental plants on the Supramontes and in other mountain areas.

G. Bacchetta, G. Calvia, L. Podda

***Hieracium pseudogrovesianum* Gottschl. (Asteraceae)**

+ **TOS**: Abetone (Pistoia), versante N del M. Caligi sopra F. La Piastra (WGS84: 44.080896N, 10.739797E), faggeta, ca. 1500 m, 23 July 2016, leg. *G. Gestri*, det. *G. Gottschlich* (FI); Casone di Casamarconi (Pistoia), sopra l'abitato (WGS84: 44.019688N, 10.826457E), bosco misto di castagno e faggio, ca. 1000 m, 24 April 2015, leg. *G. Gestri*, det. *G. Gottschlich* (PI No. 021574); Garfagnana, Sella di Campaiana (Lucca), sul versante N della Pania di Corfino (WGS84: 44.206480N, 10.383362E) faggeta, ca. 1500, 30 June 2018, leg. *G. Gestri*, det. *G. Gottschlich* (PI No. 021594). – Species new for the flora of Toscana.

This species is endemic to Italy, and it was recorded so far only for Lazio and Abruzzo (Peruzzi et al. 2014, 2015). Based on the available material, it was not possible to attribute the Tuscan specimens to one of the five subspecies known for this species (Bartolucci et al. 2018b).

G. Gestri, G. Gottschlich

***Hydrocharis morsus-ranae* L. (Hydrocharitaceae)**

+ **CAL**: Laureana di Borrello (Reggio Calabria), Lago dell'Aquila (WGS84: 38.510242N, 16.028392E), 34 m, in un'ansa del lago, 12 September 2013, *S. Cannavò*, *C.M. Musarella*, *G. Spampinato* (FI, REGGIO); Laureana di Borrello (Reggio Calabria), Lago dell'Aquila (WGS84: 38.510242N; 16.028392E), 34 m, in un'ansa del lago, 11 September 2014, *S. Cannavò*, *C.M. Musarella*, *G. Spampinato* (REGGIO). – Species new for the flora of Calabria.

Hydrocharis morsus-ranae is a Eurasian hydrophyte, typically growing in oligo-mesotrophic and still waters. This species occurs in many northern and central Italian regions, whereas it is no longer recorded in Campania (Bartolucci et al. 2018b). The present record refers to several individuals growing in a bight on the eastern part of Lake Aquila, where a small tributary flows into the lake (Spampinato et al. 2019).

C.M. Musarella, S. Cannavò, G. Spampinato

***Jacobaea maritima* (L.) Pelser & Meijden subsp. *bicolor* (Willd.) B.Nord. & Greuter (Asteraceae)**

+ **BAS**: Maratea (Potenza), Monte S. Biagio (WGS84: 39.988893N, 15.725553E), garrigues with *Erica multiflora*, 588 m a.s.l., 22 May 2012, *L. Cancellieri* (FI). – Species new for the flora of Basilicata.

Jacobaea maritima subsp. *bicolor* is recorded as native only for Sicilia, Calabria, Campania, and as naturalized alien for Lazio (Bartolucci et al. 2018b). This Italian endemic subspecies is widespread mainly on coastal cliffs, rocks, and screes (Peruzzi et al. 2006; Passalacqua et al. 2008). The population of Monte S. Biagio fills a distribution gap along the southern Tyrrhenian coast.

L. Cancellieri, F. Filibeck

***Juncus atratus* Krock. (Juncaceae)**

+ **ITALIA (UMB)**: Castel Santa Maria, Cascia (Perugia), piano carsico soggetto a periodiche inondazioni (WGS84: 42.714089N, 13.106811E), 1065 m s.l.m., 11 July 2018, *D. Gigante*, *F. Bonini*, Confirm. *L. Lastrucci* (FI). – Species confirmed for the flora of Italy (Umbria).

Juncus atratus is a central European-southern Siberian wet-meadow species (Kirschner et al. 2002), with a central range extending in the steppe zone of sub-continental western Eurasia (Hultén and Fries 1986). In central Europe, this species is very rare and considered endangered (Schnittler and Gunther 1999). According to Pignatti et al. (2017), in Italy it was reported, probably by mistake, for Lombardia and for one locality in Veneto, in the plains in the surroundings of Verona. This species was considered as occurring in Veneto by Conti et al. (2005), but it was then treated as doubtful by Bartolucci et al. (2018b). We detected *J. atratus* in a karst plain regularly flooded in

winter and spring, in the transition area along the borders of a small temporary lake, in phytocoenoses dominated by *Alopecurus rendlei* Eig or *Eleocharis palustris* (L.) Roem. & Schult. subsp. *palustris*, subjected to summer mowing. The population is rather small and extremely localized. The most prominent distinctive features of this species are the blackish-brown tepals and capsula (*vs*. greenish or pale/castaneous-brown in *J. acutiflorus*, *J. articulatus*, *J. striatus*, and *J. thomasii*), the distinctly separated 5- to 10-flowered heads (*vs*. globose 8–30-flowered heads in *J. striatus*), the leaves with a polygonal (angled) transection (vs. circular in *J. articulatus* and *J. acutiflorus*), and the acute capsula (*vs*. obtuse in *J. thomasii*) (Kirschner et al. 2002). In addition, leaf septa are filled with a spider-like cortex (*vs*. hollow in *J. acutiflorus*) (Bernhardt and Britvec 2005). In *Juncus acutiflorus*, outer tepals are slightly curved at the apex (Kirschner et al. 2002; Pignatti et al. 2017), a trait never observed in our specimens. The identification has been confirmed by a comparison with several foreign specimens collected mostly in central Europe and stored in FI, formerly identified by the specialist Sven Snogerup.

D. Gigante, F. Bonini, L. Lastrucci

***Klasea nudicaulis* (L.) Fourr. (Asteraceae)**

+ **LIG**: Pigna (Imperia), Monte Grai, south-eastern slope (WGS84: 43.99501N, 7.67675E), mountain grassland on calcareous substrate, 1740 m, 10 July 2018, leg. *D. Dagnino*, det. *D. Dagnino*, *C. Turcato* (FI, GE No. 636). – Species new for the flora of Liguria.

Klasea nudicaulis occurs in Italy, France, Spain, and Marocco (Cantó 1984). In Italy, it is known in Piemonte, Trentino-Alto Adige, Emilia Romagna, Marche, Umbria, Lazio, and Abruzzo (Bartolucci et al. 2018b). Nevertheless, the distribution of this species is still scarcely known, as shown by some recent studies (Bertolli and Prosser 2006; Iocchi et al. 2010). Bartolucci et al. (2018b) consider this species as reported by mistake in Liguria, because the old records in the literature and the herbarium specimens stored in GE pertain to the French Maritime Alps, near the Italian border. Recent records confirmed the presence of this species in south-western Piemonte, close to the Ligurian border (Pascale 2009). We found *K. nudicaulis* in the Ligurian Maritime Alps, in the south-eastern slope of Monte Grai, within the Special Area of Conservation cod. IT1315421 "M. Toraggio – M. Pietravecchia" and the "Alpi Liguri Regional Natural Park". In the site of discovery, *K. nudicaulis* grows on calcareous substrate in a species-rich mountain grassland, dominated by *Helictotrichon sempervirens* (Vill.) Pilg. with small shrubs and rare trees (*Pinus sylvestris* L.). *Klasea nudicaulis* is, generally, considered as a valuable and rare species in Italy; it is protected by law in Piemonte (L.R. 32/1982) and Umbria (L.R. 49/1987).

D. Dagnino, C. Turcato, L. Minuto

***Lagurus ovatus* L. subsp. *ovatus* (Poaceae)**

+ (CAS) **PIE**: Torino, quartiere Mirafiori, Strada delle Cacce (WGS84: 45.019169N, 7.638775E), interstizio tra marciapiede e piano stradale, 244 m, 4 June 2019, *M. Lonati*, *A. Mainetti*, *S. Ravetto Enri* (FI). – Casual regional alien species new for the flora of Piemonte.

Lagurus ovatus L. subsp. *ovatus* is a widespread annual circum-Mediterranean taxon typical of dunes, fallows, and open areas. In Italy, this species has been reported in all regions, except Piemonte. It was probably accidentally introduced by humans from Mediterranean coastal regions. In Piemonte, as well as in Lombardia and Trentino-Alto Adige, it behaves as casual alien species (Bartolucci et al. 2018b).

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

***Leersia oryzoides* (L.) Sw. (Poaceae)**

+ **SAR**. – Status change from casual to native for the flora of Sardegna.

This species, which was first reported as native in Sardegna by Calvia and Urbani (2007), has been more recently considered as an alien casual species by Arrigoni (2015) and Bartolucci et al. (2018b). However, it occurs in rich populations along the rivers flowing to the eastern side of Lake Coghinas, both Riu Mannu di Berchidda and Riu Mannu di Oschiri, where it grows in well-preserved environments, together with several other species typical of riverbanks. It also occurs in a minor stream, in the countryside of Oschiri, flowing along the southern side of Mount Limbara.

G. Calvia, A. Ruggero

***Linum catharticum* L. subsp. *catharticum* (Linaceae)**

+ **SAR**: Seui (Ogliastra), propaggini settentrionali del Montarbu in località Fundu de Tonneri (WGS84: 39.890700N, 9.363300E ± 50 m), margini freschi di strada e mulattiera in arbusteto montano con esposizione a nord, substrato carbonatico, 980 m, 27 June 2019, *G. Mereu* (FI). – Species new for the flora of Sardegna.

This taxon is recorded for all regions of the Italian peninsula (Bartolucci et al. 2018b)as well as in neighbouring Corsica (Jeanmonod and Gamisans 2013). The identification of the subspecies is based on the description provided by Jeanmonod and Gamisans (2013).

G. Mereu

***Linum radiola* L. (Linaceae)**

+ **PUG**: Brindisi, Posticeddu (WGS84: 40.68999N, 17.84094E), waterlogged soils, 5 m, 6 April 2017, *S. Brullo*, *L. Beccarisi* (FI). – Species confirmed for the flora of Puglia.

Linum radiola is a paleotemperate species, recorded from the western side of the Italian peninsula (Pignatti et al. 2017). As regards Puglia, there are only old records from Gargano (Rabenhorst 1849; Béguinot 1909; Fenaroli 1970), but since then the species has no longer been confirmed (Bartolucci et al. 2018b). Recently, it was collected in a new locality of southern Puglia along the rocky coast near Posticeddu (Brindisi), outside the eastern boundary of Torre Guaceto State Nature Reserve. In this locality, it is limited to small rocky pools that are submerged until early spring, where it grows together with other hygrophilous microphytes. Based

on field investigations, *L. radiola* is currently represented by a small and discontinuous population, distributed over an area of about 2,000 m^2. Previously, the flora of this area was studied by Vaccari (1920), but this species is not mentioned in his floristic checklist.

L. Beccarisi, V. Tomaselli, S. Brullo

***Nerium oleander* L. subsp. *oleander* (Apocynaceae)**

+ (CAS) **PIE**: Pallanza (Verbano Cusio Ossola), Corso Europa (SS34), lato S (WGS84: 45.927688N, 8.560491E), 212 m, ciglio stradale, 22 April 2019, *N.M.G. Ardenghi & S. Mossini* (FI). – Casual regional alien species new for the flora of Piemonte.

A single robust individual was collected along a roadside in Pallanza, clearly grown from seeds dispersed by plants cultivated for ornamental purposes. This species has been recorded as a casual alien from most of the northern Italian regions, except Piemonte (Bartolucci et al. 2018b).

N.M.G. Ardenghi, S. Mossini

***Onopordum illyricum* L. subsp. *illyricum* (Asteraceae)**

+ (NAT) **VEN**: Battaglia Terme (Padova), Monte Ceva, Colli Euganei, lungo un sentiero sul versante meridionale arido, sassoso, aprico e solatio (WGS84: 45.308360N, 11.774450E), a c. 160 m s.l.m., 9 June 2019, *C. Tietto* (FI, PAD, *Herb. Tietto Pernumia*). – Naturalized regional alien species new for the flora of Veneto.

This steno-Mediterranean species, which mostly occurs in the central and southern Italian regions, is rare in the northern part of peninsular Italy, with punctiform stands near Firenze and Piombino in Toscana, close to Pesaro in Marche, and near Norcia in Umbria, being common in Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, and Sardegna (Pignatti et al. 2018; Bartolucci et al. 2018b). Concerning northern Italy, there are a few records close to Trieste in Friuli Venezia Giulia, as an alien species probably coming from Istria, where it is more widespread (Poldini 2009; Rottensteiner 2014; Pignatti et al. 2018). *Onopordum illyricum* grows in ruderal communities of warm and xeric habitats close to urban areas, along road margins, near stables, most often in sites with a Mediterranean climate. In the Euganen hills, there is a small, expanding population consisting of about 50 vigorous plants, growing on the stony, sunny and xeric southern slopes of Mt. Ceva. The arrival of this species is likely recent, since it was not mentioned by Masin and Tietto (2005, 2006), who had thoroughly explored the site in previous years. In the same place, the alien *Opuntia stricta* (Haw.) Haw. was reported for the first time in Italy (Tietto and Chiesura Lorenzoni 1999); its population presently extends to almost the entire upper southern slope of the hill, over 40 years after it was introduced.

P.L. Nimis, C. Tietto, R.T. Messa Ballarin, F. Ballarin

***Persicaria lapathifolia* (L.) Delarbre subsp. *lapathifolia* (Polygonaceae)**

+ **CAL**: Scalea (Cosenza), foce del Fiume Lao (WGS84: 39.777440N, 15.802962E), alveo fluviale sassoso e asciutto, 4 m, 20 August 2016, leg. *A. Stinca* et *M. Ravo*, det. *A. Stinca* (FI). – Species new for the flora of Calabria.

Persicaria lapathifolia subsp. *lapathifolia* was recorded for many northern, central, and southern Italian regions up to Campania (Bartolucci et al. 2018b).

A. Stinca, A. Esposito

***Phlomis fruticosa* L. (Lamiaceae)**

+ (CAS) **TOS**: Alberese (Grosseto), Versante NW di Poggio Bernarda (WGS 84: 42.665N, 11.103E), grassland dominated by *Asphodelus ramosus*, on limestone, 45 m a.s.l., 9 March 2019, *G. Filibeck* (FI). – Casual regional alien species new for the flora of Toscana.

This Mediterranean species, typical of cliffs and garrigues (Pirone 1995, Pignatti et al. 2018), is reported as native only for Sicilia, Calabria, Puglia, Abruzzo, and as casual alien for Veneto (Bartolucci et al. 2018b). The population found near Alberese has most probably been introduced, perhaps escaped from gardens. Currently, this species forms a small population in a wooded pasture on a hill near a farmhouse. The individuals were fruiting, but there was no evidence of seed germination. The presence of this species is considered, at the present time, as casual.

G. Filibeck, L. Cancellieri

***Polypogon subspathaceus* Req. (Poaceae)**

+ **LIG**: Genova Quinto in via Marasso (WGS84: 44.3856303N, 9.0225700E), interstizi della pavimentazione di terrazza, 30 m, 29 May 2019, *S. Peccenini* (FI, GE). – Species new for the flora of Liguria.

This report extends northwards the Tyrrhenian distribution of this species, so far reported only for Emilia-Romagna, Toscana, Lazio, Puglia, Sicilia, and Sardegna (Bartolucci et al. 2018b).

S. Peccenini

***Potamogeton coloratus* Hornem. (Potamogetonaceae)**

– **BAS**. – Species to be excluded from the flora of Basilicata.

In Basilicata, *P. coloratus* was only indicated for "Lago di Pignola" (Potenza Province) by Gavioli (1934, 1947, under the name *P. nodosus* L. var. *colorata* Vahl), and subsequently by Colacino et al. (1990) in a detailed vegetation study of this biotope. In recent years, during the monitoring of aquatic plant communities, *P. coloratus* was never observed, while *P. lucens* L. and *P. nodosus* Poir. were frequently detected. To ascertain the possibility of a regional extinction, we revised the specimens stored in

FI (barcode FI055688) and HLUC (Nos. 12007, 12008). All the specimens formerly attributed to *P. coloratus* showed characters belonging to *P. lucens*, such as the presence of submerged mucronate leaves, a petiole of relatively constant length along the stem and the absence of floating leaves (Wiegleb and Kaplan 1998). We conclude that all the specimens have to be referred to *P. lucens* (already known for this locality).Thus, *P. coloratus* must be excluded from the flora of Basilicata.

L. Rosati, L. Lastrucci, G. Potenza, S. Fascetti

***Securigera securidaca* (L.) Degen & Dörfl. (Fabaceae)**

+ **CAL**: Santa Severina (Crotone), colline alla periferia del centro abitato (WGS84: 39.148707N, 16.912977E), incolti a margine strada, 210 m, 8 May 2019, *L. Bernardo*, *G. Maiorca* (FI, CLU No. 26254). – Species confirmed for the flora of Calabria.

This Mediterranean species was generically reported for Calabria by Pignatti (1982). Lacking any further bibliographic record and/or finding, it was then indicated for Calabria as doubtfully occurring by Conti et al. (2005) and, subsequently, as "recorded by mistake" by Bartolucci et al. (2018b).

L. Bernardo, G. Maiorca, N.G. Passalacqua

***Sedum acre* L. (Crassulaceae)**

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

This species was first reported in Sardegna by Moris (1827), who confused it with *S. alpestre* Vill. and did not report it in following works, then by Corrias and Diana-Corrias (1983). Arrigoni (2015) confirmed its presence on the island based on a herbarium sample collected in Mount Limbara. There, this species is known at least since 1993, and it grows along roadsides, on walls, paths and other disturbed sites from 500 to 1250 m a.s.l.. Recently, it was found also in the State Forest of Fiorentini (Anela, Sassari) and along the Provincial Road SP5, between Aglientu and Vignola (Sassari), growing always in non-natural sites, such as fallow land and roadsides. For this reason, it should be treated as a non-native species, which is naturalized in Sardegna, rather than native, as in Bartolucci et al. (2018b).

G. Bacchetta, G. Calvia, A. Ruggero

***Soleirolia soleirolii* (Req.) Dandy (Urticaceae)**

+ (NAT) **CAL**: Cosenza, Centro storico nel parco comunale "Villa Vecchia" (WGS84: 39.554431N, 16.763299E), rocce umide nei pressi delle fontane, 267 m, 30 May 2019, *L. Bernardo*, *G. Maiorca* (FI, CLU). – Naturalized regional alien species new for the flora of Calabria.

In Italy, *Soleirolia soleirolii* is reported as native only for Sardegna and Toscana, but it occurs as naturalized or casual alien in many other regions (Bartolucci et al. 2018b). It was probably introduced in the Villa Vecchia of Cosenza by gardeners at the edges

of fountain basins from where it spread to the humid environments of the municipal park, where it can now be considered naturalized.

L. Bernardo, G. Maiorca, N.G. Passalacqua

***Stachys thirkei* K.Koch. (Lamiaceae)**

+ **MAR**: Fermo, Monte Rosato (WGS84 43.129556N, 13.702611E), prato arido a sud del bosco su substrato argilloso, 88 m, 6 June 2015, *M. Tiburtini* (FI). – Species new for the flora of Marche.

Stachys thirkei is an E-Mediterranean species spreading from Italy to Turkey (Euro+Med 2006). In Italy, it is reported in Emilia-Romagna and Abruzzo, whereas in other regions, from Toscana to Sicilia, it is considered as recorded by mistake (Bartolucci et al. 2018b), possibly due to misidentification (Falciani 1997). In addition to the population on Mt. Rosato, a second locality was found 5.3 km away (WGS84 43.085333N, 13.725194E), on an arid roadside. Living plants from both populations are cultivated *ex-situ* in the Botanic Garden of the University of Pisa.

M. Tiburtini, F. Roma-Marzio

***Umbilicus rupestris* (Salisb.) Dandy (Crassulaceae)**

+ **MAR**: Cagli (Pesaro e Urbino), vecchi muri di sostegno tra la SP 29 e la SP 54 (WGS84: 43.544925N, 12.646083E), c. 280 m, 20 June 2015, *L. Gubellini* (FI, PESA). – Species confirmed for the flora of Marche.

This species is recorded in almost all the Italian regions, excluding Val d'Aosta and Friuli Venezia Giulia, and it was considered as misreported for Marche (Bartolucci et al. 2018b), because of confusion with *U. horizontalis* (Guss.) DC. In the detected site, this plant grows among limestones of a retaining wall.

L. Gubellini, N. Hofmann

***Valerianella discoidea* (L.) Loisel. (Valerianaceae)**

+ **LIG**: Pompeiana (Imperia), presso la cappella di San Bernardo, margine di mulattiera in oliveto (WGS84: 43.859167N, 7.891111E), 350 m, 16 May 2015, *S. Peccenini* (FI, GE). – Species confirmed for the flora of Liguria.

Valerianella discoidea occurs in all the southern regions of Italy. It has not been recently confirmed for Liguria (Bartolucci et al. 2018b), although it was mentioned in the past (De Notaris 1844; Burnat 1915) and quoted by Pignatti et al. (2018).

S. Peccenini

***Vinca difformis* Pourr. subsp. *difformis* (Apocynaceae)**

– **BAS**. – Species to be excluded from the flora of Basilicata.

In Basilicata, *Vinca difformis* subsp. *difformis* was only indicated by Gavioli (1947) as a very common species in forests and shrublands of the Lucanian Apennines. Despite this, in recent studies the species was never reported (e.g., Aita et al. 1977; Conti et al. 2006; Fascetti et al. 2013; Rosati et al. 2017). In several of the localities indicated by Gavioli (1947) we only detected *V. major* L. subsp. *major*. This must be highlighted since the samples of *V. difformis* by O. Gavioli stored in FI (barcodes FI055689, FI055690) clearly refer to *V. major* subsp. *major*. Similarly, the specimens in HLUC also refer to *V. major* subsp. *major*.

L. Rosati, L. Lastrucci, S. Fascetti

Nomenclatural and distribution updates from other literature sources, and corrigenda

Nomenclatural and distribution updates according to Robson (1993, 1996), Martini et al. (2012), Coulot and Rabaute (2013, 2016), Hilpold et al. (2015), Fraga-Arguimbau (2016), PPG I (2016), Pagitz (2017), Pignatti et al. (2017), Lucchese (2018), Montes-Moreno et al. (2018), Acedo and Llamas (2019), Barberá et al. (2019a, 2019b), Bernardo and Maiorca (2019); Brullo et al. (2019), Buccheri et al. (2019), Carnicero et al. (2019), Conti et al. (2019a, 2019b), Del Guacchio et al. (2019), Di Gristina et al. (2019), Filibeck et al. (2019), Fröhner and Prosser (2019), Gallo (2019), Gonnelli et al. (2019), Gottschlich (2019), Hertel and Presser (2019), Janković et al. (2019), Jiménez-Mejías et al. (2019), Király et al. (2019), La Rosa et al. (2019), Lepší et al. (2019), Llamas and Acedo (2019), López and Devesa (2019), Mascia and Labadessa (2019), Pastore et al. (2019), Peruzzi et al. (2019), Proietti et al. (2019), Prosser and Király (2019), Scafidi and Domina (2019), Sciandrello et al. (2019), Scoppola (2019), Scoppola and Nizzoli (2019), Selvaggi et al. (2019), Sharples and Tripp (2019), Stinca et al. (2019), Zázvorka et al. (2019) and corrigenda to Bartolucci et al. (2018b) are provided in Suppl. material 1.

F. Bartolucci, G. Galasso

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Supplementary material 1

Supplementary data

Authors: Fabrizio Bartolucci, Gabriele Galasso

Data type: species data

Explanation note: **1.** Nomenclatural updates **2.** Distribution updates **3.** Synonyms, misapplied or included names **4.** Notes to Notulae to the Italian native vascular flora: 6 (Bartolucci et al. 2018a).

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RESEARCH ARTICLE

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Chromosome numbers for the Italian flora: 8

Giovanni Astuti[1], Fabrizio Bartolucci[2], Liliana Bernardo[3], Fabio Conti[2], Lorenzo Peruzzi[1]

1 *Dipartimento di Biologia, Università di Pisa, Via Derna 1, 56126, Pisa, Italy* **2** *Centro Ricerche Floristiche dell'Appennino (Università di Camerino – Parco Nazionale del Gran Sasso e Monti della Laga), San Colombo, 67021, Barisciano (L'Aquila), Italy* **3** *Dipartimento di Biologia, Ecologia e Scienze della Terra (DiBEST), Università della Calabria, 87030, Arcavacata di Rende (Cosenza), Italy*

Corresponding author: *Giovanni Astuti* (gastuti@biologia.unipi.it)

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Abstract

In this contribution, new chromosome data obtained on material collected in Italy are presented. It includes three chromosome counts from two taxa endemic to Southern Italy (*Centaurea subtilis* and *Onobrychis alba* subsp. *echinata*) and one species (*Poa ligulata*) occurring in Italy with only one recently discovered population.

Keywords

Abruzzo, Basilicata, cytogeography, cytotaxonomy, Puglia, Southern Italy

How to contribute

Texts concerning new chromosome data should be submitted electronically to Giovanni Astuti (gastuti@biologia.unipi.it), including indications on voucher specimens and methods used.

Chromosome counts

Asteraceae

***Centaurea subtilis* Bertol.**

Chromosome number. 2*n* = 22 (Fig. 1)

Voucher specimen. Italy. Basilicata. Belvedere di Murgia, Altopiano della Murgia Materana (Matera) (WGS84: 40.664530N, 16.616152E), ca. 400 m s.l.m., 25 August 2017, *L. Peruzzi* (PI n°014382).

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

Observations. *Centaurea subtilis* is endemic to Southern Italy, where it has been recorded for only two regions: Puglia and Basilicata. This is the first count for plants from Basilicata; the chromosome number found, 2*n* = 22, is in accordance with the counts previously published for other populations from Puglia (Damboldt and Matthäs 1975, Bianco et al. 1991).

G. Astuti, L. Peruzzi

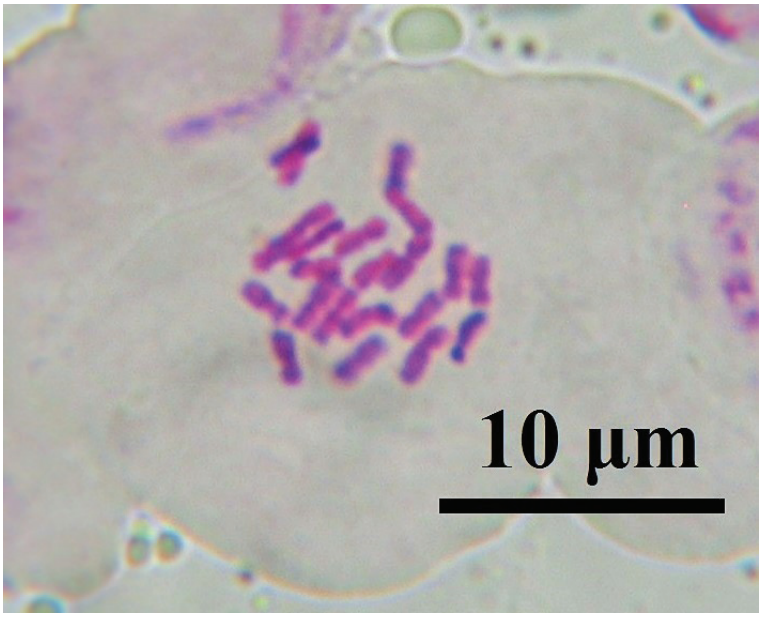

Figure 1. *Centaurea subtilis* Bertol., 2*n* = 22. Scale bar: 10 µm.

Fabaceae

***Onobrychis alba* (Waldst. & Kit.) Desv. subsp. *echinata* (Guss.) P.W.Ball**

Chromosome number. $2n = 14$ (Fig. 2)

Voucher specimen. Italy. Puglia. Gravina di Leucaspide (Statte, Taranto) (WGS84: 40.566319N, 17.190559E), gariga, 150 m s.l.m., 25 June 2019, *L. Bernardo & G. Maiorca* (CLU).

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

Observations. *Onobrychis alba* subsp. *echinata* is endemic to Southern Italy, where it occurs in Puglia, Basilicata, and Calabria. Cenci et al. (2000) reported a chromosome number $2n = 2x = 14$ for all the Italian subspecies of *O. alba*, but without providing any information about the source of these data. Therefore, we report here the

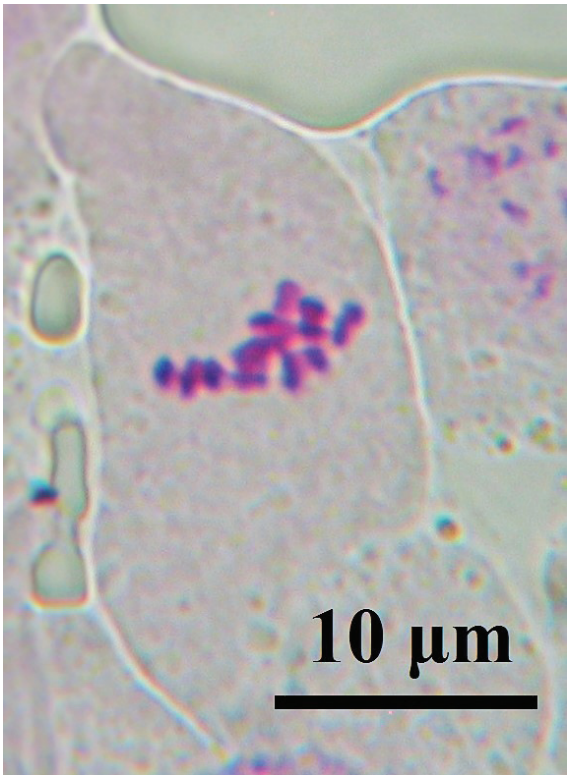

Figure 2. *Onobrychis alba* (Waldst. & Kit.) Desv. subsp. *echinata* (Guss.) P.W.Ball, $2n = 14$. Scale bar: 10 µm.

first count safely attributable to a well-defined population of *O. alba* subsp. *echinata*. This count is, however, in accordance with Cenci et al. (2000). Pedrotti and Cortini Pedrotti (1971) reported the same chromosome number for a population of *O. alba* subsp. *alba* from Umbria. Our count supports the differentiation of this taxon from *O. calabrica* Širj., a tetraploid species with $2n = 4x = 28$ chromosomes, endemic to a small area in south-eastern Calabria (Bernardo et al. 2018).

G. Astuti, L. Bernardo

Poaceae

Poa ligulata Boiss.

Chromosome number. $2n = 14$ (Fig. 3)

Voucher specimen. Italy. Abruzzo. Salendo a Cima delle Murelle in loc. La Carozza (Pennapiedimonte, Chieti) (WGS84: 42.11324N, 14.14273E), rupi e pendii rupestri, 2300 m, 2 August 2011, *F. Bartolucci & F. Conti* (APP n°59214).

Method. Squash preparations were made on root tips obtained from cultivated plants. Root tips were pre-treated with 0.4% colchicine for 4 h and then fixed in Carnoy solution for 1 h. After hydrolysis in 1N HCl at 60 °C, the tips were stained with leuco-basic fuchsine.

Observations. *Poa ligulata* occurs in the Iberian Peninsula and NW Africa (Ortega-Olivencia and Devesa 2018). It was not recorded for the Italian flora until recently (Bartolucci et al. 2018, Conti et al. 2019). This is the first chromosome count for this species in Italy (Bedini et al. 2010 onwards), and it agrees with previous chromosome

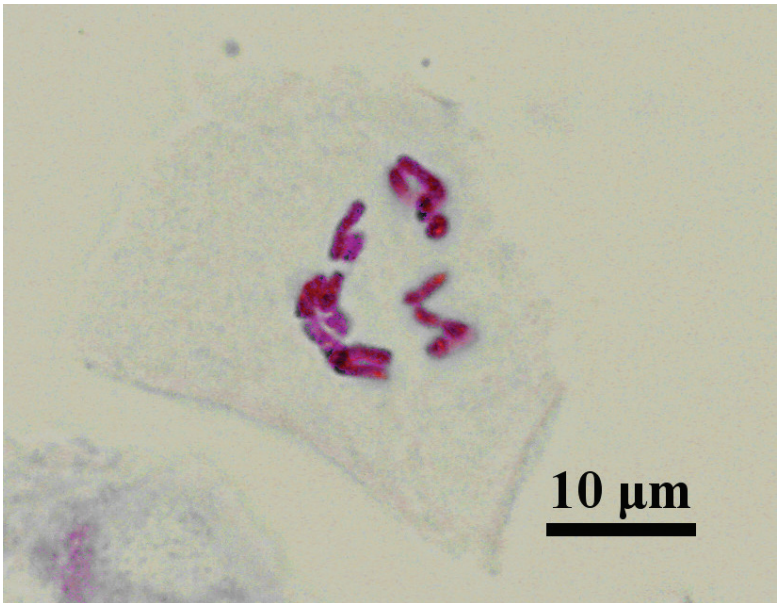

Figure 3. *Poa ligulata* Boiss., $2n = 14$. Scale bar: 10 µm.

numbers published from Spain (Küpfer 1968, Löve and Kjellqvist 1973). On the basis of a preliminary morphological analysis, the population from central Italy shows peculiar features, and a taxonomic study is in progress.

F. Bartolucci & F. Conti

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