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RESEARCH ARTICLE

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A floristic survey of the Tifatini and Trebulani Mountains, southern Italy

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Abstract

Within the framework of ongoing updates to the Italian flora, this paper presents the results of floristic research conducted on the Tifatini and Trebulani Mountains, two limestone hilly-mountain systems in southern Italy. The vascular flora of the study area is largely unknown, with most of the available data dating back to the 19th and early 20th centuries. Data were collected through field surveys carried out between 2015 and 2023, primarily during the scientific excursion of the Working Group for Floristics, Systematics and Evolution of the Italian Botanical Society held in 2017. An opportunistic approach was adopted for floristic sampling; it was performed on 22 sites considered to be representative of the local environmental diversity in terms of physiography, climate, soil, elevation, and land use. The research led to taxonomic identification of 3,987 herbarium specimens, 2,623 of which were collected on the Tifatini Mountains and 1,364 on the Trebulani Mountains. Overall, 706 species and subspecies (including five hybrids) belonging to 121 families were identified. The total floristic list included 18 endemic species to Italy, 42 alien species, three cryptogenic species for the administrative region of Campania, and 47 species included in the IUCN Red List of the Italian flora. In the Tifatini area 591, species have been identified (nine endemics, 40 aliens, three cryptogenics, and 33 included in the IUCN Red List), whereas 369 species have been recorded in the Trebulani area (14 endemics, eight aliens, no cryptogenics, and 33 from the IUCN Red List). Six new species have been detected for the first time and five confirmed for the flora of Campania. The data collected during this survey underscores the importance of a collaborative approach among botanists for assessing the conservation status of the flora of the investigated territories, while also highlighting the occurrence of taxonomically critical groups requiring further investigation.

Keywords

Alien plants, Campania region, endemic taxa, floristic updates, herbarium specimens, Italian vascular flora, local floras, native plants, new floristic records

Introduction

Italy's remarkable plant diversity results from its physiographic, microclimatic, geological, and pedological heterogeneity, together with the wide range of human activities that have shaped the landscape since prehistoric times. In fact, after Turkey, Italy is the country with the second-highest native plant diversity in the Mediterranean Basin (Stinca et al. 2021; Bartolucci et al. 2023). According to the most recent national synthesis, the native vascular flora of Italy, including the enclaves of the Republic of San Marino and the Vatican City State, comprises 8,241 species and

subspecies belonging to 1,111 genera and 153 families (Bartolucci et al. 2024). To these, data on alien vascular plants should be added, amounting to 1,782 taxa (1,673 species, 28 subspecies, 69 hybrids, and 12 cultivars not attributable to a specific binomial) distributed in 786 genera and 159 families (Galasso et al. 2024). Although there has been steady progress in floristic knowledge at national and regional levels (Domina et al. 2025; Stinca 2025), considerable gaps remain at the subregional scale (Domina et al. 2026). This is somewhat surprising considering that local floristic studies provide essential data for assessing current levels of diversity (e.g., Sciandrello et al. 2020), analyzing changes in floristic composition over time (e.g., Erschbamer et al. 2011), and evaluating changes following natural (e.g., Bonanomi et al. 2018) or anthropogenic (e.g., Stinca et al. 2020) disturbances. Furthermore, floristic research can identify rare species worthy of protection (e.g., Souza et al. 2023) and alien species harmful to native biocenoses (e.g., Khorasani et al. 2025). Finally, floristic studies provide insights that support broader taxonomic investigations and may lead to the discovery of taxa new to science (e.g., Rosati et al. 2018). Moreover, these data are essential for policymakers to develop effective land-use planning strategies that not only promote the economic and social development of local communities but also ensure the conservation of natural resources.

With the aim of improving floristic knowledge of poorly investigated areas of the Italian territory, the Working Group for Floristics, Systematics and Evolution (WGFSE) of the Italian Botanical Society has been conducting annual botanical explorations since 2003 using a collaborative approach. These efforts have made a significant contribution to the knowledge of the flora in several areas of northern (e.g., Po valley [Bouvet et al. 2018]), central (e.g., Velino and Aterno valleys [Bartolucci et al. 2019], Sillaro, Santerno and Senio valleys [Roma-Marzio et al. 2020], Mt. Pennino [Tardella et al. 2024]), and southern Italy (e.g., southern Daunia Mountains [Wagensommer et al. 2014], Sicani Mountains [Domina et al. 2015], Aeolian Islands [Barone et al. 2023]). Regarding floristic explorations focused on southern Italy, three were carried out entirely or partially in Campania, namely on the Matese Mountains (Santangelo et al. 2010), Maddalena Mountains (Rosati et al. 2017), and the eastern Irpinia and Vulture-Melfese area (Stinca et al. 2019a).

In this paper, we present the results of floristic research performed on the Tifatini and Trebulani Mountains (Campania, southern Italy). The data shown here are derived from field sampling carried out during the official floristic excursion of the WGFSE held in 2017 (organized by A. Stinca, A. Esposito, L. Rosati, G. Salerno and S. Fascetti), as well as from numerous other explorations performed by one of the organizers (A. Stinca) before and after the 2017 excursion. The specific aim of this research is to contribute to the knowledge of the vascular flora of both geomorphological complexes, which fall within an area where only generic floristic information is available (Domina et al. 2026). We emphasize that updating knowledge on vascular plant distribution is an important research topic, particularly in the Mediterranean region, recognized as a global biodiversity hotspot (Myers et al. 2000).

Materials and methods

Study area

The investigated areas included one of *ca*. 80 km^2 in the Tifatini mountains (also known as Colli Tifatini, hereafter referred to as Tifatini) and one of *ca*. 180 km^2 in the Trebulani Mountains (also known as Colli Coprensi, hereafter Trebulani), both forming part of the Campanian Anti-Apennines. These hilly-mountain systems lie within the Mediterranean biogeographic region (EEA 2026a) and occur in the north of Campania, along the northeastern margin of the Quaternary graben known as the Campania Plain (Fig. 1A).

Mt. Virgo (620 m a.s.l.) and Mt. Tifata (603 m a.s.l.) are the highest peaks of the Tifatini, while Mt. Maggiore with Pizzo San Salvatore (1037 m a.s.l.) and Mt. Friento (770 m a.s.l.) represent the highest elevations within the Trebulani. Both geomorphological complexes consist of carbonate units formed mainly by Cretaceous limestones (Carannante et al. 2010) and are separated by the Volturno River. Characteristic geomorphological features of the Tifatini are collapse sinkholes, locally called "Comole" (i.e., natural depressions or chasms, approximately circular in shape, caused by the frequently sudden collapse of the soil and underlying rocks due to karstification). Among these, the so-called "Comola grande" located in the municipality of Castel Morrone, is considered one of the largest in Italy (Del Prete et al. 2004; Cozzolino et al. 2010).

According to the bioclimatic map of Europe (Rivas-Martínez et al. 2004), the study area exhibits a temperate oceanic sub-Mediterranean bioclimate. Analysis of the climate diagram following Walter and Lieth (1960–1967), based on data for the period 2001–2020 from the meteorological station of Alife (province of Caserta, 41.341880°N, 14.318330°E, 163 m a.s.l., Centro Agrometeorologico Regionale, Regione Campania, https://agricoltura.regione.campania.it/meteo/agrometeo.htm, Fig. 2), indicates a Mediterranean-type climate in the study area. Mean annual rainfall is 1,038 mm concentrated in the autumn-winter period with a maximum in November and a minimum in August. The annual average temperature is 15.6 °C, with the hottest months in summer (July and August) and the coldest in winter (January and December). Therefore, the thermo-pluviometric diagram highlights a two-month summer drought period.

In accordance with the Soil Survey Staff (2022) classification, the soils of the study area belong to two orders, namely Andisols and Inceptisols. The Andisols (derived from pyroclastic deposits linked to the volcanic activity of the Phlegraean Fields and Vesuvius) are clearly predominant, covering both the two mountain ranges and the surrounding flat areas. The Andisols of the reliefs are mostly shallow and rich in skeleton and can be assigned to the land system of "Apennine limestone reliefs with pyroclastic cover" (Di Gennaro 2002). In contrast, the soils of the surrounding areas are very deep and have a medium or fine texture and can be assigned to the land system of "piedmont plain of limestone reliefs" (Di Gennaro 2002). Inceptisols are found only along the Volturno River. They are very deep and have a medium-to-fine texture and can

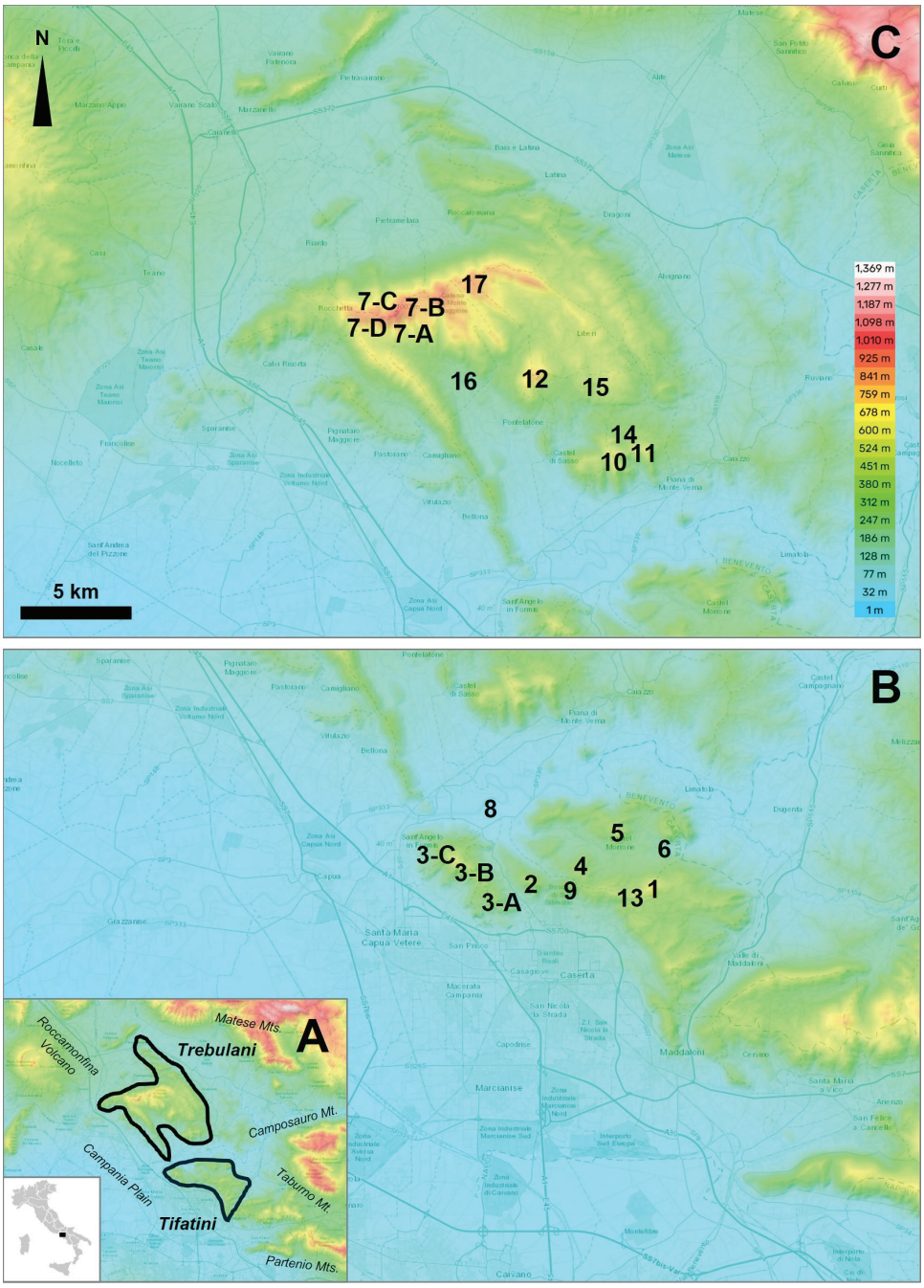

Figure 1. A. Location of the study area in Italy and within the administrative region of Campania; **B.** Location of the selected sampling sites in the Tifatini; **C.** Location of the selected sampling sites in the Trebulani. The basemaps are the Digital Elevation Model with a resolution of 30 m and Carto Light (from https://it-it.topographic-map.com/world/) (for details see Table 1, Suppl. material 1: figs S1, S2).

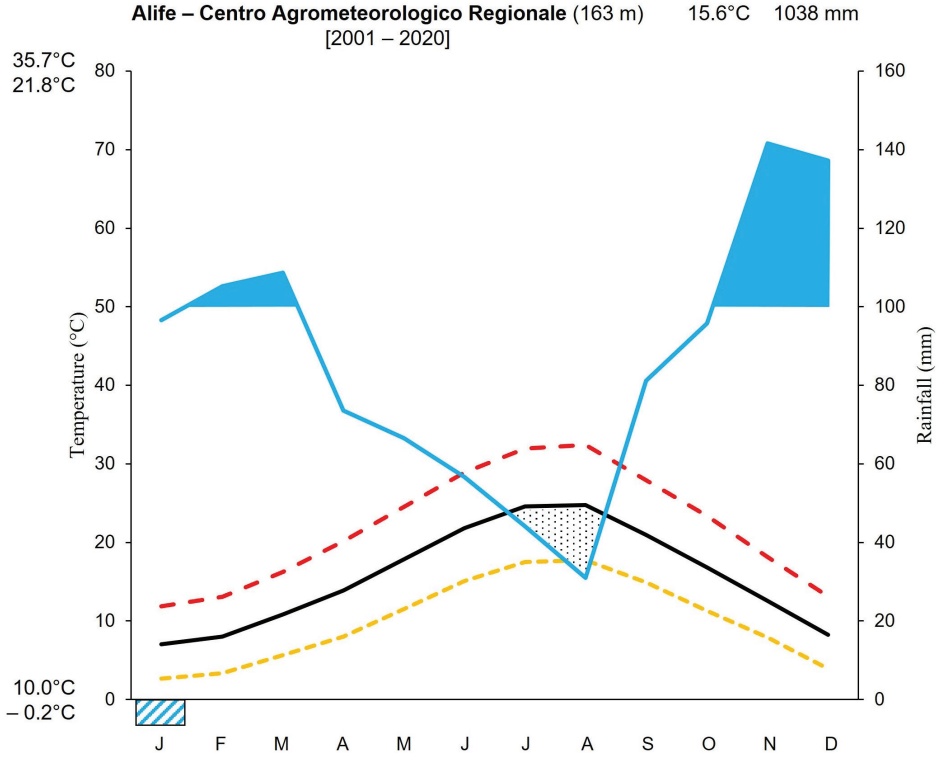

Figure 2. Walter-Lieth climate diagram of the Alife meteorological station, representative of the Tifatini and Trebulani. Blue, black, red and yellow curves refer to average monthly rainfall (mm), average monthly temperature (°C), average monthly maximum temperature (°C) and average monthly minimum temperature (°C), respectively.

be assigned to the land system of "relatively elevated areas of the alluvial plains in the upper and middle reaches of the Volturno and Apennine rivers" (Di Gennaro 2002).

In terms of vegetation, the study area falls entirely within vegetation series whose late-successional stages are represented by forest communities (Filesi et al. 2010). These include holm oak forests of *Cyclamino hederifolii-Quercetum ilicis* Biondi et al., 2003, the thermophilous downy oak forests of *Pistacio terebinthi-Quercetum pubescentis* (Blasi & Di Pietro, 1998) Allegrezza et al. 2003 and the hop-hornbeam submontane mixed forests of *Melittio-Ostryetum carpinifoliae* Avena et al., 1980. The main secondary communities associated with deforestation or traditional land-use practices are mainly characterized by grasslands: semi-mesophilous communities dominated by *Brachypodium rupestre* (Host) Roem. & Schult. referable to the *Polygalo mediterraneae-Bromion erecti* (Biondi et al., 2005) Di Pietro in Di Pietro et al. 2015 (developed on relatively deep soils with a clayey component), and discontinuous dry grasslands with *Bromopsis erecta* (Huds.) Fourr. and *Koeleria splendens* C.Presl of the *Phleo ambigui-Bromenion erecti* Biondi et al. ex Di Pietro 2011 (on the rocky slopes). At lower elevations, a vegetation mosaic develops composed of scrub communities referable to *Oleo-Ceratonion siliquae* Br.-Bl. ex Guinochet et

Drouineau 1944, associated with steppe-like grasslands alternatively dominated by *Ampelodesmos mauritanicus* (Poir.) T.Durand & Schinz or *Hyparrhenia hirta* (L.) Stapf (class *Lygeo sparti-Stipetea tenacissimae* Rivas-Mart. 1978) intermixed with several therophytic communities of *Stipo capensis-Brachypodietea distachyi* Brullo ex B. de Foucault 2001 nom. mut. The latter class replaces the well-known *Tuberarietea guttatae* Rivas Goday et Rivas-Mart. 1963 on neutral-alkaline substrates as reported in the EuroVegChecklist (Mucina et al. 2016) whose nomenclature was updated by Terzi et al. (2026). In areas of low elevation where human activity is more prevalent, partially synanthropic communities of *Securigero securidacae-Dasypyrion villosi* Cano-Ortiz, Biondi et Cano in Cano-Ortiz et al. ex Di Pietro in Di Pietro et al. 2015 can be found (Biondi et al. 2014; Di Pietro et al. 2015).

The Tifatini include three Special Areas of Conservation (SACs, Habitats Directive 92/43/EEC): "Monte Tifata" (SAC code IT8010016, 14.2 km^2), "Bosco di S. Silvestro" (SAC code IT8010004, 0.81 km^2), and "Fiumi Volturno e Calore Beneventano" (SAC code IT8010027, 49.24 km^2). The Trebulani include the Special Area of Conservation "Catena di Monte Maggiore" (SAC code IT8010006, 51.84 km^2) (DM 21 May 2019, Gazzetta Ufficiale Serie Generale n. 129 of 4 June 2019).

The vascular flora of the Tifatini and Trebulani is still poorly known, as most available information dates back to the 19th century (Tenore 1811–1838, 1831; Terracciano 1867, 1872, 1873, 1874, 1877, 1878, 1890) and early 20th century (Grande 1914). In relatively recent times, Montelucci (1963) reported some species only for the Tifatini. Furthermore, very few records are reported in the standard floras (Fiori 1923, 1924, 1925; Pignatti 1982), and all of them are based on previous floristic studies. Some more recent floristic contributions, focused only on single taxonomic groups (Bigazzi and Raffaelli 2000; Del Guacchio 2010; Stinca 2019; Croce et al. 2021) and plant communities (Perrino et al. 2022; Croce 2025), or based solely on historical herbarium data (Moraldo 1986), have not significantly improved the floristic knowledge of this territory.

Data sources

Since the aim of this study was to compile as complete a floristic list as possible for the study area, we adopted an opportunistic approach based on the so-called botanist's "algorithm" (Palmer et al. 2002). Accordingly, 22 sampling sites (11 on the Tifatini, covering 6.91 km^2, and 11 on the Trebulani, covering 7.56 km^2) were pre-selected by the organizers as representative of local environmental diversity in terms of physiography, climate, soil, elevation, and land use (Fig. 1B, C; Table 1, Suppl. material 1: figs S1, S2).

The sites were intensively surveyed between 3 and 6 May 2017 by a team of 31 botanists. Each participant collected plant specimens independently, aiming to obtain at least one specimen of every taxonomically identifiable species occurring within each studied hilly-mountain system (i.e., Tifatini and Trebulani). Further surveys were conducted by one of the organizers (A. Stinca) on earlier and later dates (Table 1). Site n. 9 was sampled most frequently because it was also surveyed for vegetation studies (Perrino et al. 2022).

To draw up the floristic list, we followed the same workflow used in previous floristic studies (e.g., Stinca et al. 2019a) (Fig. 3). After collection and drying of the plant

samples, taxonomic identification was initially carried out by the individual researchers using standard floras (e.g., Tutin et al. 1968, 1972, 1976, 1980, 1993; Pignatti 1982; Pignatti et al. 2017a, 2017b, 2018, 2019) and other taxonomic references (e.g., Bigazzi and Raffaelli 2000; Kirschner 2002; Brullo et al. 2009; Conti et al. 2021; Rico 2021; Jiménez-López et al. 2022). Each participant then compiled his/her own floristic list (i.e., partial floristic list) and shared it with the organizers (following a pre-established format). The merging of all partial floristic lists produced the provisional total floristic list of the study area, comprising 4,123 herbarium specimens. A critical analysis of this latter list highlighted the presence of 1,705 specimens whose identification was uncertain or required verification (i.e., critical specimens). The review of these herbarium specimens was performed during a dedicated workshop held in Caserta (at the Consorzio di Tutela Mozzarella di Bufala Campana DOP) on 22–24 March 2018 (Fig. 4). Some specimens (103) belonging to well-known critical groups of the Italian flora, for which doubts remained regarding their identification, were sent to specialists for critical revision: *Asplenium*, *Polypodium* (D. Marchetti, Massa), *Myosotis* (L. Cecchi, Florence), *Orobanche*, *Phelipanche* (G. Domina, Palermo), and *Ornithogalum* (L. Peruzzi, Pisa). All identified herbarium specimens were deposited in public and private herbaria (Table 2).

In the final floristic list (Suppl. material 1: table S1), all taxa (i.e., families, genera, species and subspecies) are arranged alphabetically. Taxon nomenclature and circumscription follow the Italian checklists of the native (Bartolucci et al. 2024) and alien vascular flora (Galasso et al. 2024). The nomenclature of formally described native hybrids not included in the aforementioned papers follows Kretzschmar et al. (2007) for *Anacamptis* ×*gennarii* (Rchb.) H.Kretzschmar, Eccarius & H.Dietr., and POWO (2026a) for *Orchis* ×*bivonae* Tod. Any synonyms, mainly derived from Bartolucci et al. (2024) and Galasso et al. (2024), are also reported for taxa that have undergone recent nomenclatural changes, as clarification of synonymy remains useful. Synonyms are preceded by the following symbols: ≡ for homotypic synonyms (nomenclatural synonyms); = for heterotypic synonyms (taxonomic synonyms); – for misapplied names. For each species recorded during our field surveys, the sampling site(s) (Table 1) and the herbarium code(s) of the voucher specimen(s) (Table 2) are provided (herbarium acronyms follow Thiers 2026). In addition, the following information may be provided:

+ CAM** = species recorded for the first time in Campania;
+ CAM* = species confirmed for the flora of Campania;
E = Italian endemic species (Peruzzi et al. 2014, 2015; Bartolucci et al. 2024);
C = cryptogenic species in Campania (Bartolucci et al. 2024);
A = alien species with indication of its status in the study area (i.e., CAS = casual, NAT = naturalized; INV = invasive), and period of introduction in Italy (i.e., ARC = archaeophyte, NEO = neophyte) (definitions follow Galasso et al. 2024, which in turn was based on Pyšek et al. 2004).

The floristic lists derived from our surveys in the Tifatini and Trebulani were compared to lists of total, endemic, alien, cryptogenic, and conservation-interest species.

Table 1. List of the sampling sites and relative details.

Site n.	Hilly-mountain system	Locality (Municipality)	Main environments	Minimum and maximum elevation (m a.s.l.)	Area (km^2)	Geographic coordinates (decimal degrees WGS84)	Cell ID in the EEA reference grid [1]	Main sampling dates [2]	Additional sampling dates [3]
1	Tifatini	Mt. Virgo (Castel Morrone)	Pastures, rocky slopes, shrublands, broadleaf forests, coniferous reforestations, ruderal environments	370–620	2.02	41.104882°N, 14.378801°E	10kmE468N201 10kmE469N201	3 May 2017	19 February 2017; 23 April 2017; 10 April 2018
2	Tifatini	Mt. San Leucio(Caserta)	Pastures, rocky slopes, shrublands, broadleaf forests, ruderal environments	160–462	1.91	41.106607°N, 14.318964°E	10kmE468N201	3 May 2017	31 October 2016; 21 February 2017
3-A	Tifatini	Mt. Marmolelle [from Masseria Troia to Mt. Marmolelle] (Caserta)	Pastures, rocky slopes, cliffs, shrublands, broadleaf forests, ruderal environments	150–411	0.34	41.105800°N, 14.294081°E	10kmE468N201	4 May 2017	12 March 2017; 30 December 2023
3-B	Tifatini	Mt. Tifata Cresta [ridge from Mt. Marmolelle to Mt. Tifata] (San Prisco)	Pastures, rocky slopes, cliffs, shrublands, broadleaf forests	411–603	0.48	41.114872°N, 14.279727°E	10kmE468N201	4 May 2017	12 March 2017; 30 December 2023
3-C	Tifatini	Mt. Tifata SW slopes [from Mt. Tifata to Basilica di Sant'Angelo in Formis] (Capua)	Pastures, rocky slopes, cliffs, shrublands, ruderal environments	90–435	0.30	41.115460°N, 14.267285°E	10kmE468N201	4 May 2017	12 March 2017
4	Tifatini	Comola grande (Castel Morrone)	Limestone cliffs, broadleaf forests, cultivated fields, ruderal environments	150–220	0.08	41.117492°N, 14.339732°E	10kmE468N201	4 May 2017	26 February 2017
5	Tifatini	Castello (Castel Morrone)	Pastures, rocky slopes, coniferous reforestation, ruderal environments	440–492	0.60	41.126164°N, 14.361577°E	10kmE468N201	4 May 2017	26 February 2017

Site n.	Hilly-mountain system	Locality (Municipality)	Main environments	Minimum and maximum elevation (m a.s.l.)	Area (km²)	Geographic coordinates (decimal degrees WGS84)	Cell ID in the EEA reference grid [1]	Main sampling dates [2]	Additional sampling dates [3]
6	Tifatini	Vallone Ciummiento (Castel Morrone)	Riparian environments, broadleaf forests, cultivated fields, ruderal environments	115–180	0.12	41.120729°N, 14.387538°E	10kmE469N201	4 May 2017	26 February 2017
7-A	Trebulani	Mt. Maggiore S slopes [from Croce to San Salvatore] (Rocchetta e Croce)	Broadleaf forests, cliffs, ruderal environments	570–857	0.13	41.231570°N, 14.191629°E	10kmE467N202	5 May 2017	30 March 2017; 1 May 2018
7-B	Trebulani	Pizzo San Salvatore [from San Salvatore to Pizzo San Salvatore] (Pietramelara)	Broadleaf forests, rocky slopes, cliffs	858–1037	0.11	41.237100°N, 14.196752°E	10kmE467N202	5 May 2017	30 March 2017
7-C	Trebulani	Madonna di Fradeianne [from the detour to Pizzo San Salvatore to Madonna di Fradeianne] (Pietramelara)	Broadleaf forests, cliffs	890–925	0.11	41.238203°N, 14.187013°E	10kmE467N202	5 May 2017	30 March 2017; 1 May 2018
7-D	Trebulani	Mt. Maggiore SW slopes [between Madonna di Fradeianne and Croce] (Rocchetta e Croce)	Broadleaf forests, rocky slopes, shrublands, ruderal environments	570–924	0.14	41.233018°N, 14.184930°E	10kmE467N202	5 May 2017	30 March 2017; 1 May 2018
8	Tifatini	River Volturno in locality Salicelle (Capua)	Riparian environments, slowly flowing freshwater, arable land	27–30	0.65	41.136400°N, 14.298567°E	10kmE468N201	5 May 2017	26 March 2017

Site n.	Hilly-mountain system	Locality (Municipality)	Main environments	Minimum and maximum elevation (m a.s.l.)	Area (km^2)	Geographic coordinates (decimal degrees WGS84)	Cell ID in the EEA reference grid [1]	Main sampling dates [2]	Additional sampling dates [3]
9	Tifatini	Casino Leonetti (Caserta)	Pastures, shrublands, ruderal environments	315–374	0.21	41.106281°N, 14.337296°E	10kmE468N201		25 November 2015; 2, 15 April 2016; 5, 30 May 2016; 1, 15 June 2016; 1, 25 August 2016; 31 October 2016; 10 April 2018; 20 October 2018; 18 May 2021
10	Trebulani	Mt. Caruso (Castel di Sasso)	Pastures, rocky slopes	500–592	0.64	41.182297°N, 14.307855°E	10kmE468N201	6 May 2017	26 March 2017
11	Trebulani	Mt. Santa Croce (Piana di Monte Verna)	Pastures, rocky slopes, broadleaf forests	500–580	1.21	41.183187°N, 14.327256°E	10kmE468N202 10kmE468N201	6 May 2017	
12	Trebulani	Mt. Friento (Castel di Sasso)	Broadleaf forests, coniferous reforestations, pastures, rocky slopes	470–770	3.54	41.212406°N, 14.267839°E	10kmE467N202 10kmE468N202	6 May 2017	26 March 2017
13	Tifatini	Caserta Vecchia (Caserta)	Anthropic and ruderal environments	350–414	0.20	41.096720°N, 14.368673°E	10kmE468N201		21 May 2017
14	Trebulani	Buonomini (Castel di Sasso)	Cultivated fields, roadsides	323	0.07	41.197342°N, 14.308149°E	10kmE468N202	6 May 2017	
15	Trebulani	Mt. Niuza (Liberi)	Broadleaf forests, roadsides	465	0.11	41.216412°N, 14.294838°E	10kmE468N202	6 May 2017	
16	Trebulani	Formicola in the center (Formicola)	Anthropic and ruderal environments	197	0.40	41.209767°N, 14.231917°E	10kmE467N202	5 May 2017	
17	Trebulani	Pizzo Madama Marta (Roccaromana)	Broadleaf forests, rocky slopes, cliffs	630–956	1.10	41.246211°N, 14.219639°E	10kmE467N202		16 March 2017

[1] EEA (2026b).
[2] carried out during the official floristic excursion of the WGFSE.
[3] performed by one of the organizers (A. Stinca).

Figure 3. Workflow for floristic data collection and processing.

In addition, the biogeographical relevance of the study areas was assessed by comparing their flora with that of Campania (Bartolucci et al. 2024; Galasso et al. 2024), focusing only on species currently recorded as present in the region.

Table 2. Public and private herbaria in which the collected *exsiccata* are deposited. The acronyms of public herbaria follow Thiers (2026).

Herbarium code	Herbarium name	Type	Institution	Location
APP	Herbarium Apenninicum	Public	Floristic Research Center of the Apennine	Via Provinciale km 4.2, 67021 Barisciano (L'Aquila), Italy
HCA	Herbarium Capitanatae	Public	University of Foggia	Via Napoli 25, 71100 Foggia, Italy
HFLA	Herbarium Flaminio	Public	Sapienza University of Rome	Via E. Gianturco 2, 00196 Rome, Italy
HLUC	Herbarium Lucanum	Public	University of Basilicata	Via Ateneo Lucano 10, 85100 Potenza, Italy
IS	Herbarium Universitatis Aeserniae	Public	University of Molise	Contrada Fonte Lappone, 86090 Pesche (Isernia), Italy
IT	Herbarium Austroitalicum	Public	University of Campania Luigi Vanvitelli	Via A. Vivaldi 43, 81100 Caserta, Italy
MSNM	Herbarium Musaei Civici Historia Naturalis Mediolanensis	Public	Natural History Museum of Milan	Corso Venezia 55, 20121 Milan, Italy
NAP	Herbarium Neapolitanum	Public	University of Naples Federico II	Via Foria 223 80139 Naples, Italy
PI	Herbarium Horti Botanici Pisani	Public	University of Pisa	Via L. Ghini 13, 56126 Pisa, Italy
REGGIO	Erbario Università "Mediterranea" di Reggio Calabria	Public	"Mediterranean" University of Reggio Calabria	Via Melissari, 89124 Reggio Calabria, Italy
RO	Herbarium Horti Romani	Public	Sapienza University of Rome	Piazzale A. Moro 5, 00185 Rome, Italia
RO-HLat	Herbarium Horti Romani - Herbarium Edda Lattanzi	Public	Sapienza University of Rome	Piazzale A. Moro 5, 00185 Rome, Italia
SIENA	Herbarium Universitatis Senensis	Public	University of Siena	Via P.A. Mattioli 4, 53100 Siena, Italy
URT	Erbario Università Roma Tre	Public	Roma Tre University	Viale G. Marconi 44, 00146 Rome, Italy
UTV	Erbario Università della Tuscia	Public	University of Tuscia	Via S. Camillo de Lellis, 01100 Viterbo, Italy
Herb. Cancellieri	Herbarium Laura Cancellieri	Private		Rome, Italy
Herb. Caruso	Herbarium Giuseppe Caruso	Private		Catanzaro, Italy
Herb. Salerno	Herbarium Giovanni Salerno	Private		Castel San Lorenzo (Salerno), Italy
Herb. Soldano	Herbarium Adriano Soldano	Private		Vercelli, Italy
Herb. Sperandii	Herbarium Marta Gaia Sperandii	Private		Rome, Italy

Results

This research allowed the taxonomic identification of 3,987 herbarium specimens (about 96% of those collected; the remaining specimens were incomplete and unidentifiable), of which 2,623 were collected on the Tifatini and 1,364 on the Trebulani. More than 25% of the identified samples are deposited in the Herbarium Austroitalicum (IT, 1,033 exsiccata), followed by Herbarium Horti Romani (RO, including RO-HLat., 518) and Herbarium Apenninicum (APP, 413). In addition, one species was documented only by digital photographs (i.e., *Silybum marianum* [L.] Gaertn.). Overall, 706 species (including five hybrid taxa) were identified, belonging to 121 families (Suppl. material 1: table S1). The hybrids recorded in the study are *Acer campestre* L. × *A. opalus* Mill. subsp. *obtusatum* (Waldst. & Kit. ex Willd.) Gams, *Anacamptis* ×*gennarii* (Rchb.) H.Kretzschmar,

Figure 4. Programme of the workshop held in 2018 in Caserta for the revision of critical specimens collected in the study area.

Eccarius & H.Dietr., *Brachypodium retusum* (Pers.) P.Beauv. × *B. rupestre* (Host) Roem. & Schult., *Orchis* ×*bivonae* Tod. [Suppl. material 1: table S1], and *Vitis* ×*koberi* Ardenghi, Galasso, Banfi & Lastrucci. In addition, four putative hybrids within the *Quercus pubescens* complex were detected. The recorded total flora includes 14 ferns and fern allies, one gymnosperm (i.e., *Cupressus sempervirens* L.), and 691 angiosperms.

A total of 591 species were identified in the Tifatini, whereas 369 were recorded in the Trebulani. In the study areas, 18 species (2.5% of the total recorded flora) were found to be endemic to Italy: the Tifatini host nine of these species (1.5% of their flora), while the Trebulani have 14 (3.8% of their flora) (Table 3).

The study allowed us to ascertain the presence of 47 species (6.6% of the total flora detected) evaluated according to IUCN criteria (Rossi et al. 2013, 2020; Orsenigo et al. 2018, 2021): 33 were found on the Tifatini (5.6% of their flora) and as many on the Trebulani (8.9% of their flora).

Three species (0.4% of the total recorded flora), all found on the Tifatini, are considered cryptogenic in the Campania region: *Gladiolus byzantinus* Mill., *Oxalis corniculata* L., *Setaria italica* (L.) P.Beauv. subsp. *viridis* (L.) Thell.

Six species (0.7% of the total recorded flora), five of which recorded only on the Tifatini, were found to be new floristic records for Campania (Table 4).

This research also allowed us to confirm five taxa for the flora of Campania (Table 5).

With regard to the non-native flora, a total of 42 species were documented (5.9% of the total recorded flora): 40 on the Tifatini (6.8% of their flora) and only 8 on the Trebu-

Table 3. List of Italian endemics recorded on the Tifatini and Trebulani.

Taxon	Tifatini	Trebulani
Acer cappadocicum Gled. subsp. *lobelii* (Ten.) A.E.Murray		+
Alnus cordata (Loisel.) Duby	+	
Arabis collina Ten. subsp. *rosea* (DC.) Minuto		+
Carduus nutans L. subsp. *perspinosus* (Fiori) Arènes		+
Cerastium lacaitae Barberis, Bechi & Miceli		+
Cerastium tomentosum L.		+
Crocus biflorus Mill.	+	
Cymbalaria glutinosa Bigazzi & Raffaelli subsp. *brevicalcarata* Bigazzi & Raffaelli (Suppl. material 1: fig. S3)	+	+
Globularia cordifolia L. subsp. *neapolitana* (O.Schwarz) Milletti ex Del Guacchio, Innangi & P.Caputo		+
Linaria purpurea (L.) Mill.	+	+
Micromeria graeca (L.) Benth. ex Rchb. subsp. *tenuifolia* (Ten.) Nyman	+	
Ophrys holosericea (Burm.f.) Greuter subsp. *appennina* (Romolini & Soca) Kreutz	+	+
Ophrys sphegodes Mill. subsp. *classica* (Devillers-Tersch. & Devillers) Kreutz	+	+
Ornithogalum exscapum Ten.	+	+
Polygala flavescens DC. subsp. *flavescens*		+
Rhinanthus wettsteinii (Sterneck) Soó	+	
Siler montanum Crantz subsp. *stabianum* (Lacaita) F.Conti & Bartolucci		+
Viola cassinensis Strobl subsp. *pseudogracilis* (A.Terracc.) Bartolucci, Galasso & Wagens. (Suppl. material 1: fig. S3)		+

Table 4. List of species recorded for the first time in Campania.

Taxon	Tifatini	Trebulani
Lysimachia loeflingii F.J.Jiménez-López & M.Talavera	+	
Nassella neesiana (Trin. & Rupr.) Barkworth	+	
Phelipanche schultzii (Mutel) Pomel	+	
Poa angustifolia L.	+	
Ulmus minor Mill. subsp. *canescens* Bartolucci & Galasso	+	+
Valerianella pumila (L.) DC.	+	

Table 5. List of species confirmed for Campania.

Taxon	Tifatini	Trebulani
Allium guttatum Steven subsp. *sardoum* (Moris) Stearn	+	
Carex praecox Schreb.	+	+
Helianthemum nummularium (L.) Mill. subsp. *nummularium*	+	+
Lathyrus inconspicuus L.		+
Luzula sylvatica (Huds.) Gaudin subsp. *sieberi* (Tausch) K.Richt.		+

lani (2.2% of their flora) (Table 6). Among these, only *Ailanthus altissima* and *Broussonetia papyrifera* are included in the "List of invasive alien species of Union concern" established under Regulation (EU) n. 1143/2014 and subsequent amendments (EC 2026).

The floristic comparison between the study areas and the Campania region (Table 7) shows that the Tifatini include higher percentages of native (22.9%) and alien (8.9%) species, whereas the Trebulani include a higher proportion of endemic species (7.8%).

Discussion

More than 20 years after the publication of the previous assessment of the state of floristic knowledge in Italy (Scoppola and Blasi 2005), little progress has been made in understanding the distribution of vascular flora in the administrative region of Campania (Domina et al. 2026). Indeed, apart from a few floras (i.e., Motti and Salerno 2006; De Natale and Strumia 2007; Nazzaro et al. 2007; Corazzi 2008; Croce et al. 2008, 2011; Stinca and Motti 2009; Croce et al. 2019) and several floristic contributions (e.g., Rosati et al. 2012, 2017; Stinca et al. 2012, 2013, 2017a, 2017b, 2019a, 2019b; Stinca and Motti 2013; Salerno and Stinca 2017; Stinca 2017, 2019; Motti et al. 2018; Del Guacchio et al. 2020; Croce et al. 2021), which overall have certainly improved the botanical knowledge of some parts of the region, most areas that in 2005 were considered almost unexplored, or for which only generic knowledge was available, remain poorly known today. As the largest knowledge gaps are mainly in the northern (i.e., province of Caserta) and eastern sectors (i.e., provinces of Avellino and Benevento) of the region, our study attempts to fill at least part of this gap. On the other hand, while botanists are attracted to mountain ranges with a wide altitudinal

Table 6. List of alien species recorded on the Tifatini and Trebulani with indication of their status in in each area.

Taxon	Tifatini	Trebulani
Acacia dealbata Link subsp. *dealbata*	A CAS (NEO)	
Actinidia deliciosa (A.Chev.) C.F.Liang & A.R.Ferguson	A CAS (NEO)	
Ailanthus altissima (Mill.) Swingle	A INV (NEO)	
Amorpha fruticosa L.	A NAT (NEO)	
Antirrhinum tortuosum Bosc ex Lam.	A NAT (NEO)	
Aristolochia sempervirens L.	A NAT (NEO)	
Avena sativa L. subsp. *sativa*	A CAS (ARC)	
Avena sterilis L.	A NAT (ARC)	A NAT (ARC)
Bidens subalternans DC.	A INV (NEO)	
Broussonetia papyrifera (L.) Vent.	A NAT (NEO)	
Cestrum parqui L'Hér.	A NAT (NEO)	
Chamaerops humilis L. subsp. *humilis*	A CAS	
Crepis sancta (L.) Bornm. subsp. *nemausensis* (P.Fourn.) Babc.	A INV (NEO)	
Cupressus sempervirens L.		A NAT (ARC)
Erigeron bonariensis L.	A INV (NEO)	
Erigeron canadensis L.	A INV (NEO)	
Euphorbia prostrata Aiton	A INV (NEO)	
Galega officinalis L.		A NAT (ARC)
Hyacinthus orientalis L.	A CAS (ARC)	
Ipomoea purpurea (L.) Roth	A NAT (NEO)	
Iris germanica L.	A NAT (ARC)	A NAT (ARC)
Ligustrum lucidum W.T.Aiton	A NAT (NEO)	
Lolium temulentum L.	A NAT (ARC)	
Malus domestica (Suckow) Borkh.	A NAT (ARC)	A NAT (ARC)
Mespilus germanica L.	A NAT (ARC)	A NAT (ARC)
Nassella neesiana (Trin. & Rupr.) Barkworth	A CAS (NEO)	
Oxalis articulata Savigny	A NAT (NEO)	
Oxalis pes-caprae L.	A INV (NEO)	
Parthenocissus quinquefolia (L.) Planch.	A NAT (NEO)	
Prunus amygdalus Batsch	A CAS (ARC)	
Prunus cerasus L.	A CAS (ARC)	A CAS (ARC)
Rhaphiolepis bibas (Lour.) Galasso & Banfi	A CAS (NEO)	
Robinia pseudoacacia L.	A INV (NEO)	
Solanum chenopodioides Lam.	A NAT (NEO)	
Solanum lycopersicum L.	A CAS (NEO)	
Sulla coronaria (L.) B.H.Choi & H.Ohashi	A NAT	
Tradescantia fluminensis Vell.	A INV (NEO)	
Trifolium incarnatum L. subsp. *incarnatum*	A NAT (ARC)	
Veronica persica Poir.	A INV (NEO)	A INV (NEO)
Vicia faba L.	A CAS (ARC)	
Vitis ×koberi Ardenghi, Galasso, Banfi & Lastrucci	A NAT (NEO)	
Yucca gloriosa L.	A NAT (NEO)	

range (which generally have a higher degree of naturalness) and coastal areas (often easier to reach), they are generally less interested in studying flat and hilly areas as these are considered of little conservation interest. However, the latter areas are precisely

Table 7. Comparison of the floristic composition of the study areas (Tifatini and Trebulani) with that of the Campania region, in terms of native, alien, and endemic vascular plant species currently present in the region. Percentages refer to the proportion of the regional flora represented in each study area.

Floristic parameter	Campania	Tifatini (%)	Trebulani (%)
Native species (excluding hybrids)	2408	551 (22.9)	361 (15.0)
Alien species	450	40 (8.9)	8 (1.8)
Endemic species	179	9 (5.0)	14 (7.8)

those with the highest rates of land-use change and urbanization, both in Campania (di Gennaro and Innamorato 2005) and throughout Italy (Romano et al. 2017) and, therefore, deserve greater conservation attention from policymakers.

The data obtained in this study indicate that the Tifatini and Trebulani host a rich and noteworthy vascular flora. Since we selected an equal number of sampling sites (11 in each area), which covered a very similar total surface area (6.91 km^2 in the Tifatini and 7.56 km^2 in the Trebulani), we suggest that the difference in species richness recorded between the two hilly-mountain systems (591 species in the Tifatini and 369 in the Trebulani) may be partly related to differences in sampling effort (Gotelli and Colwell 2001), as suggested by the higher number of specimens collected in the Tifatini Mountains (2,623 vs. 1,364). In this regard, we emphasize that most of the data presented here were collected during a four-day WGFSE floristic excursion held in 2017, during which only the last two days were devoted to surveys in the Trebulani Mountains. This unequal allocation of survey time likely resulted in lower sampling intensity in that area and may partly explain the observed differences in species richness. During floristic surveys, previously recorded species are generally not repeatedly recorded once detected within the same survey session, resulting in a progressive focus on the detection of additional taxa. This leads to a natural saturation in species detection, consistent with the species accumulation theory (Gotelli and Colwell 2001; Chao et al. 2014).

Despite the limitations of the study outlined above, we consider it useful to evaluate the biogeographical relevance of the study areas by comparing their flora with that of Campania as a whole (Bartolucci et al. 2024; Galasso et al. 2024), focusing only on species recorded as currently present in the region. The comparison highlights the contribution of the Tifatini and Trebulani to the overall floristic diversity of the region and the consistency of their taxonomic structure with regional patterns. In particular, the higher proportion of endemic species on the Trebulani suggests a potentially greater biogeographical and conservation relevance of this area.

Overall, the observed floristic composition closely corresponds to the vegetation units identified across the Tifatini and Trebulani, which are characterised by a mosaic of forest formations and thermophilous to xeric grassland communities. This correspondence suggests that habitat diversity and the spatial arrangement of these vegetation types play an important role in structuring local plant diversity patterns within the study area. In particular, the coexistence of relatively mesic woodland patches, open

grasslands, and rocky xeric habitats contributes to the observed floristic heterogeneity, supporting a mixture of widespread Mediterranean taxa and habitat-specialised species.

Concerning the native taxa, *Cymbalaria glutinosa* subsp. *brevicalcarata* is the most phytogeographically significant species recorded in the study area. It is a rare endemic subspecies restricted to Campania, known from a few localities in the Lattari Mountains (where its *locus classicus* occurs [Peruzzi et al. 2015]), Cilento, Matese, and Trebulani Mountains (Bigazzi and Raffaelli 2000). Our exploration, in addition to confirming this taxon on the Trebulani (sampling sites n. 7-A, 7-B and 7-C), also reports its occurrence on the Tifatini (sites n. 3-B and 4). We note that, in agreement with Conti et al. (2005), the record of this taxon for Abruzzo by Bigazzi and Raffaelli (2000) is incorrect, as the Municipality of San Gregorio Matese falls within the administrative boundaries of Campania. It is also noteworthy that we recorded the endemic *Globularia cordifolia* subsp. *neapolitana* on the Trebulani (site n. 7-C), whose global distribution is restricted to a few localities in the Lattari Mountains, Island of Capri, Picentini Mountains, and Mt. Camposauro (Stinca et al. 2019c and references therein).

Except for *Siler montanum* subsp. *stabianum*, a recently re-evaluated taxon (Conti et al. 2021), all other recorded Italian endemic taxa are included in the IUCN Red List of the Italian Flora (Rossi et al. 2013, 2020; Orsenigo et al. 2018, 2021), together with the following non-endemics: *Allium neapolitanum* Cirillo, *A. pendulinum* Ten., *A. roseum* L. subsp. *roseum*, *Ampelodesmos mauritanicus* (Poir.) T.Durand & Schinz, *Arisarum proboscideum* (L.) Savi, *Bellevalia romana* (L.) Sweet, *Carex olbiensis* Jord., *Colchicum lusitanum* Brot., *Drymochloa drymeja* (Mert. & W.D.J.Koch) Holub, *Galanthus nivalis* L., *Gastridium phleoides* (Nees & Meyen) C.E.Hubb., *Hermodactylus tuberosus* (L.) Mill., *Koeleria splendens* C.Presl, *Legousia falcata* (Ten.) Fritsch, *Lysimachia loeflingii* F.J.Jiménez-López & M.Talavera, *Melica minuta* L., *Ophrys lutea* Cav. subsp. *lutea*, *O. lutea* Cav. subsp. *sicula* (Tineo) Soldano, *O. tenthredinifera* Willd., *Orchis italica* Poir., *O. pauciflora* Ten., *O. provincialis* Balb. ex Lam. & DC., *Phagnalon rupestre* (L.) DC. subsp. *rupestre*, *Pulmonaria hirta* L., *Serapias bergonii* E.G.Camus, *S. lingua* L., *Himantoglossum adriaticum* H.Baumann, *Selaginella denticulata* (L.) Spring, *Sesleria autumnalis* (Scop.) F.W.Schultz, *S. juncifolia* Suffren. All Red List species have been assessed as least concern (LC), apart from *Cymbalaria glutinosa* subsp. *brevicalcarata*, *Globularia cordifolia* subsp. *neapolitana*, *Legousia falcata*, *Melica minuta*, and *Polygala flavescens* subsp. *flavescens* which have received the assessment of data deficient (DD). Among the 34 orchid taxa recorded in the study area, *Himantoglossum adriaticum* (sampling site n. 13; not included in any Natura 2000 site) is listed in Annexes II and IV of the Habitats Directive 92/43/EEC and is therefore noteworthy. Similarly, *Galanthus nivalis* (sites n. 6, 17 and 7-C) is listed in Annex V.

Our floristic survey, in addition to documenting six species new to Campania and confirming the presence of five others in the region, has also provided material for further studies. In particular, the specimen of *Gastridium phleoides* collected during this study and preserved in the Herbarium Austroitalicum (IT), together with a specimen from Cilento, enabled Scoppola (2019) to confirm the occurrence of this species in Campania. Interestingly, our record from Tifatini (sampling site n. 9) confirms a historical collection by Loreto Grande dating back almost a century (i.e., Tifati

[Puccianello], 3 July 1927, L. Grande, RO, sub *Gastridium ventricosum*) (Scoppola 2019). It should also be noted that, based on specimens collected in the study area and preserved in the Herbarium Austoitalicum (IT), Stinca (2019) reported *Vitis* ×*koberi* Ardenghi, Galasso, Banfi & Lastrucci for the first time in Campania.

As for the fernlike *Ophioglossum lusitanicum* L., it is considered a rare species in Campania (Stinca 2023). In the study area, it forms small plant communities that were recently described as a new association named *Euphorbio exiguae-Ophioglossetum lusitanici* Perrino, Stinca & Tomaselli (Perrino et al. 2022).

Regarding the genus *Hyparrhenia*, following the taxonomic framework proposed by Tison and de Foucault (2014), Pignatti et al. (2017a, 2019), and Rico (2021), almost all specimens collected in the study area exhibit morphological traits attributable to *Hyparrhenia sinaica* (Delile) Llauradó ex G.López, which would, therefore, represent a new record for Campania. This SW-Steno-Mediterranean taxon is considered a valid species by several authors (e.g., POWO 2026b; Gianguzzi et al. 2023; Verloove et al. 2024), although it has recently been included within *H. hirta* (L.) Stapf (Bartolucci et al. 2024).

Concerning the non-native flora, 26 species were neophytes and nine were considered invasive in the study area as well as in Campania (i.e., *Ailanthus altissima*, *Bidens subalternans*, *Crepis sancta* subsp. *nemausensis*, *Erigeron bonariensis*, *Erigeron canadensis*, *Euphorbia prostrata*, *Oxalis pes-caprae*, *Robinia pseudoacacia*, *Tradescantia fluminensis*, and *Veronica persica*). With regard to *Cestrum parqui*, although it is considered invasive in Campania (Galasso et al. 2024), in the study area it shows limited spread from environments of deliberate introduction (e.g., roadsides and fields) and should be regarded as naturalized. We emphasize that, although *Chamaerops humilis* subsp. *humilis* and *Sulla coronaria* are well-known native species to the Mediterranean region (including Italy), both are cultivated in the study area (A. Stinca, pers. comm.). Therefore, the populations recorded on Tifatini likely spread from nearby cultivated individuals and can be regarded as non-native. The occurrence of non-native species in the study area is not unexpected, as large portions of the territory, particularly the Tifatini, are embedded within a highly anthropized landscape characterised by agricultural land use, infrastructure development, and fire disturbance. This condition is consistent with the broader pattern of intense urbanisation and land consumption documented for the province of Caserta and surrounding areas (Mauro et al. 2023), where urban sprawl and fragmentation of rural landscapes have progressively increased in recent decades. This interpretation aligns with previous studies highlighting the role of human-mediated disturbance in promoting plant invasions in southern Italy (Olivares et al. 2019; Motti et al. 2021). Although Mediterranean ecosystems have been described as relatively resistant to plant invasions due to their climatic and biotic characteristics (Arianoutsou et al. 2013), recent evidence indicates a progressive increase in alien species in the region, including southern Italy, largely driven by land-use change and habitat modification (Rosati et al. 2020; Stinca et al. 2021; Musarella et al. 2024). Within this framework, the higher number of alien taxa recorded in the Tifatini compared to the Trebulani may reflect differences in the intensity and spatial distribution of anthropogenic disturbance across the two systems.

Despite recent advances in plant taxonomy and in agreement with observations from a previous WGFSE floristic excursion (e.g., Stinca et al. 2019a), several taxonomic groups of the Italian and European flora remain critical and require further investigation, including *Anthyllis vulneraria* and *Centaurea deusta* (e.g., Stinca et al. 2019d). Regarding the *Quercus pubescens* complex, a taxonomically challenging group well known to Italian botanists (e.g., Di Pietro et al. 2020), some individuals found in the study area showed morphological characteristics intermediate between *Q. pubescens* and other white oak species (i.e., *Q. frainetto* Ten., *Q. robur* L. subsp. *robur*, and *Q. petraea* [Matt.] Liebl. subsp. *petraea*), suggesting introgressive hybridization between these taxa. Our findings, therefore, support the results of previous studies conducted in Italy (e.g., Salvini et al. 2009; Fortini et al. 2015). For some groups analyzed in this study (e.g., *Bromus hordeaceus* complex, *Cerastium brachypetalum* complex, *Carex flacca* complex, *Micromeria graeca* complex, *Pilosella piloselloides* complex), limited knowledge of diagnostic characters distinguishing taxa, together with current taxonomic treatments that allow different subspecies to coexist in the same areas and habitats, suggests that the present taxonomic framework is inadequate and does not reflect the modern concept of subspecies (Wilson and Brown 1953; Patten and Unitt 2002).

Conclusions

The floristic data presented in this paper, although not exhaustive of the plant biodiversity of the Tifatini and Trebulani Mountains, provide a valuable contribution to the knowledge of the vascular flora of both geomorphological complexes. Until now, limited information has been available for these areas, most of it dating back to the second half of the 19th and early 20th centuries. Finally, we believe that our study provides an important baseline for improving floristic knowledge of the area and for supporting its conservation and sustainable management.

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References

Arianoutsou M, Delipetrou P, Vilà M, Dimitrakopoulos PG, Celesti-Grapow L, Wardell-Johnson G, Henderson L, Fuentes N, Ugarte-Mendes E, Rundel PW (2013) Comparative Patterns of Plant Invasions in the Mediterranean Biome. PLoS ONE 8(11): e79174. https://doi.org/10.1371/journal.pone.0079174

Barone G, Bajona E, Bartolucci F, Cancellieri L, Caruso G, Conti F, Domina G, Fascetti S, Franzoni J, Laface VLA, Pinzani L, Rosati L, Scoppola A, Stinca A, Tilia A, Crisafulli A (2023) Contribution to the floristic knowledge of Lipari and Panarea Islands (Sicilia, Italy). Italian Botanist 16: 59–71. https://doi.org/10.3897/italianbotanist.16.113415

Bartolucci F, Cancellieri L, Conti F, Banfi E, Bouvet D, Celestini M, Ciaschetti G, Di Pietro R, Falcinelli F, Fascetti S, Galasso G, Lattanzi E, Masin RR, Pennesi R, Rosati L, Stinca A, Tilia A, Forte TGW, Scoppola A (2019) Contribution to the floristic knowledge of Velino and Aterno valleys (Lazio-Abruzzo, central Italy). Italian Botanist 7: 93–100. https://doi.org/10.3897/italianbotanist.7.34697

Bartolucci F, Galasso G, Peruzzi L, Conti F (2023) Report 2021 on plant biodiversity in Italy: native and alien vascular flora. Natural History Sciences. Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale di Milano 10(1): 41–50. https://doi.org/10.4081/nhs.2022.623

Bartolucci F, Peruzzi L, Galasso G, Alessandrini A, Ardenghi NMG, Bacchetta G, Banfi E, Barberis G, Bernardo L, Bouvet D, Bovio M, Calvia G, Castello M, Cecchi L, Del Guacchio E, Domina G, Fascetti S, Gallo L, Gottschlich G, Guarino R, Gubellini L, Hofmann N, Iberite M, Jiménez-Mejías P, Longo D, Marchetti D, Martini F, Masin RR, Medagli P, Peccenini S, Prosser F, Roma-Marzio F, Rosati L, Santangelo A, Scoppola A, Selvaggi A, Selvi F, Soldano A, Stinca A, Wagensommer RP, Wilhalm T, Conti F (2024) A second update to the checklist of the vascular flora native to Italy. Plant Biosystems 158(2): 219–296. https://doi.org/10.1080/11263504.2024.2320126

Bigazzi M, Raffaelli M (2000) Taxonomy of two *Cymbalaria* species (Scrophulariaceae) endemic to Italy: *C. glutinosa* sp. nov. and *C. pubescens* Q. & C. Presl) Cuf. Webbia 54(2): 193–205. https://doi.org/10.1080/00837792.2000.10670679

Biondi E, Blasi C, Allegrezza M, Anzellotti I, Azzella MM, Carli E, Casavecchia S, Copiz R, Del Vico E, Facioni L, Galdenzi D, Gasparri R, Lasen C, Pesaresi S, Poldini L, Sburlino G, Taffetani F, Vagge I, Zitti S Zivkovic L (2014) Plant communities of Italy: the vegetation prodrome. Plant Biosystems 148(4): 728–814. https://doi.org/10.1080/11263504.2014.948527

Bonanomi G, Incerti G, Abd El-Gawad AM, Sarker TC, Stinca A, Motti R, Cesarano G, Teobaldelli M, Saulino L, Cona F, Chirico GB, Mazzoleni S, Saracino A (2018) Windstorm disturbance triggers multiple species invasion in an urban Mediterranean forest. iForest 11: 64–71. https://doi.org/10.3832/ifor2374-010

Bouvet D, Pistarino A, Soldano A, Banfi E, Barbo M, Bartolucci F, Bovio M, Cancellieri L, Conti F, Di Pietro R, Faraoni F, Fascetti S, Galasso G, Gangale C, Lattanzi E, Peccenini S, Perrino EV, Rizzieri Masin R, Romano VA, Rosati L, Salerno G, Stinca A, Tilia A, Uzunov D (2018) Contribution to the floristic knowledge of the head of the Po Valley (Piedmont, north Italy). Italian Botanist 5: 57–69. https://doi.org/10.3897/italianbotanist.5.24546

Brullo S, Giusso Del Galdo GP, Minissale P (2009) Taxonomic revision of the *Koeleria splendens* C. Presl group (Poaceae) in Italy based on morphological characters. Plant Biosystems 143(1): 140–161. https://doi.org/10.1080/11263500802709764

Carannante G, Cesarano M, Pappone G, Putignano ML (2010) Note Illustrative della Carta Geologica d'Italia alla scala 1:50.000, F. 431 Caserta Est. ISPRA - Servizio Geologico d'Italia, Roma. https://doi.org/10.15161/oar.it/211746

Chao A, Gotelli NJ, Hsieh TC, Sander EL, Ma KH, Colwell RK, Ellison AM (2014) Rarefaction and extrapolation with Hill numbers: a framework for sampling and estimation in species diversity studies. Ecological Monographs 84(1): 45–67. https://doi.org/10.1890/13-0133.1

Conti F, Abbate G, Alessandrini A, Blasi C [Eds] (2005) An annotated checklist of the Italian vascular flora. Palombi Editori, Roma, 420 pp.

Conti F, Bartolucci F, Bacchetta G, Pennesi R, Lakušić D, Niketić M (2021) A taxonomic revision of the *Siler montanum* group (Apiaceae) in Italy and the Balkan Peninsula. Willdenowia 51(3): 321–347. https://doi.org/10.3372/wi.51.51301

Corazzi G (2008) Contributo alla conoscenza della flora del Sannio: il complesso montuoso del Camposauro (Benevento, Campania). Webbia 63(2): 215–250. https://doi.org/10.1080/00837792.2008.10670843

Cozzolino L, Minieri G, Villano D, Villano R, Santo A (2010) Prime considerazioni sui sinkhole carsici del versante meridionale del Monte Tifata. In: Mitrano T (Ed.) Atti del II Convegno Regionale di Speleologia "Campania Speleologica 2010", 3–6 giugno 2010. Caselle in Pittari (Salerno), 187–194.

Croce A (2025) Heterotopic European beech (*Fagus sylvatica* L.) stands on Roccamonfina volcano and adjacent areas (Campania-Latium, central-southern Italy): presence assessment and conservation issues. BORNH Bulletin of Regional Natural History 5(2): 1–15. https://doi.org/10.6093/2724-4393/12857

Croce A, La Valva V, Motti R, Nazzaro R, Strumia S (2008) La flora vascolare del Vulcano di Roccamonfina (Campania, Italia). Webbia 63(2): 251–291. https://doi.org/10.1080/00837792.2008.10670844

Croce A, Nazzaro R, Strumia S (2011) La flora dei laghi di Corree e di Vairano (Caserta, Italia). Informatore Botanico Italiano 43(2): 173–184.

Croce A, Stinca A, Santangelo A, Esposito A (2019) Exploring vascular flora diversity of two protected sandy coastal areas in southern Italy. Rendiconti Lincei. Scienze Fisiche e Naturali 30: 323–336. https://doi.org/10.1007/s12210-019-00789-6

Croce A, Borzacchiello V, Perillo R (2021) Le orchidee dei monti Tifatini (Campania). GIROS Orchidee Spontanee d'Europa 64(1): 99–121.

De Natale A, Strumia S (2007) La flora della costa sabbiosa del Parco Nazionale del Cilento e Vallo di Diano (Salerno). Webbia 62(1): 53–75. https://doi.org/10.1080/00837792.2007.10670816

Del Guacchio E (2010) Appunti di floristica campana: novità e precisazioni. Informatore Botanico Italiano 42(1): 35–46.

Del Guacchio E, De Natale A, Stinca A (2020) Notes to the non-native flora of Campania (Southern Italy). Atti della Società Toscana di Scienze Naturali, Memorie Serie B 127: 39–49. https://doi.org/10.2424/ASTSN.M.2020.07

Del Prete S, De Riso R, Santo A (2004) Primo contributo sui sinkholes di origine naturale in Campania. In: 1° Seminario "Stato dell'arte sullo studio dei fenomeni di sinkholes e ruolo delle amministrazioni statali e locali nel governo del territorio", 20–21 May 2004. Agenzia per la Protezione dell'Ambiente e per i servizi Tecnici (APAT), Dipartimento Difesa del Suolo, Roma, 361–376.

di Gennaro A (2002) I Sistemi di Terre della Campania. Risorsa, Regione Campania, Napoli, 64 pp.

di Gennaro A, Innamorato FP (2005) La grande trasformazione. Il territorio rurale della Campania 1960–2000. Clean Edizioni, Napoli, 128 pp.

Di Pietro R, Theurillat JP, Capelo J, Fernández-González F, Terzi M, Carni A, Mucina L (2015) Nomenclature and syntaxonomic notes on some high-rank syntaxa of the European grassland vegetation. Lazaroa 36: 79–106. https://doi.org/10.5209/rev_LAZA.2015.v36.50835

Di Pietro R, Conte AL, Di Marzio P, Gianguzzi L, Spampinato G, Caldarella O, Fortini P (2020) A multivariate morphometric analysis of diagnostic traits in southern Italy and Sicily pubescent oaks. Folia Geobotanica 55: 163–183. https://doi.org/10.1007/s12224-020-09378-0

Domina G, Marino P, Castellano G, Amato F, Cambria S, Cancellieri L, Crisafulli A, Cristaudo A, Faraoni F, Galesi R, Guarino R, Lattanzi E, Lavezzo P, Longo D, Maiorca G, Peccenini S, Perrino EV, Salerno G, Scolastri A, Soldano A, Stinca A, Wagensommer RP, Xibilia L, Raimondo FM (2015) Contributo alla conoscenza floristica dei monti Sicani (Sicilia): resoconto dell'escursione del Gruppo di Floristica (S.B.I.) nel 2012. Informatore Botanico Italiano 47(2): 155–177.

Domina G, Abeli T, Alessandrini A, Angiolini C, Argenti C, Astuti G, Bacchetta G, Bagella S, Ballelli S, Banfi E, Barberis G, Barone G, Bernardo L, Bertolli A, Bianchi E, Bonari G, Bouvet D, Bovio M, Briozzo I, Brullo C, Brullo S, Calvia G, Caria MC, Caputo P, Caruso G, Casazza G, Cecchi L, Cibei C, Cogoni D, Conti F, Crisafulli A, Croce A, Dagnino D, Del Guacchio E, Di Gristina E, Di Marzio P, Fanfarillo E, Farris E, Fascetti S, Fenu G, Ferrando U, Ferretti G, Fiaschi T, Fortini P, Fois M, Franzoni J, Galasso G, Galesi R, Ganz C, Gargano D, Giacò A, Gianguzzi L, Giardini M, Giusso Del Galdo G, Guarino R, Gubellini L, Hofmann N, Iamonico D, Iberite M, Laface VLA, Lallai A, Lastrucci L, Lavezzo P, Lazzaro L, Longo D, Lucchese F, Maiorca G, Manca M, Marchetti D, Marsili S, Martini F, Mascia F, Medagli P, Mondello F, Montagnani C, Mugnai M, Musarella CM, Nicolella G, Orsenigo S, Passalacqua NG, Peccenini S, Pennesi R, Peruzzi L, Picone RM, Pinzani L, Podda L, Prosser F, Rivieccio G, Roma-Marzio F, Rosati L, Salerno G, Santangelo A, Sciandrello S, Selvaggi A, Selvi F, Spampinato G, Stinca A, Tardella FM, Tavilla G, Tilia A, Tondi G, Tognon G, Urbani M, Villani M, Wilhalm T, Zappa E, Bartolucci F (2025) Refining the inventory of the vascular flora of Italy: Unconfirmed, doubtful, excluded or extinct taxa. Phytotaxa 723(1): 1–137. https://doi.org/10.11646/phytotaxa.723.1.1

Domina G, Bacchetta G, Bartolucci F, D'Antraccoli M, Peruzzi L, Stinca A, Alessandrini A, Bernardo L, Boscutti F, Bouvet D, Bovio M, Calvia G, Cambria S, Conti F, Dagnino D, Del Guacchio E, Galasso G, Gigante D, Di Gristina E, Fascetti S, Falcinelli F, Fortini P, Gargano D, Gubellini L, Iamonico D, Iberite M, Longo D, Lucchese F, Mainetti A, Masin R, Medagli P, Orsenigo S, Perrino EV, Podda L, Prosser F, Quaglini LA, Rosati L, Santangelo A, Scoppola A, Selvaggi A, Spampinato G, Strumia S, Tardella FM, Turco A, Villani

M, Wilhalm T, Barone G (2026) Mapping the advancements in floristic knowledge of Italy (2005–2025). Plant Biosystems 160: 213. https://doi.org/10.1007/s44473-026-00207-4

EC (2026) Invasive alien species. https://environment.ec.europa.eu/topics/nature-and-biodiversity/invasive-alien-species_en [accessed 10.01.2026]

EEA (2026a) Biogeographical and marine regions in the EU. https://www.eea.europa.eu/en/analysis/maps-and-charts/biogeographical-and-marine-regions-in [accessed 10.01.2026]

EEA (2026b) EEA Reference grid. Last modified 5 Nov 2025. https://www.eea.europa.eu/en/datahub/datahubitem-view/3c362237-daa4-45e2-8c16-aaadfb1a003b [accessed 18.01.2026]

Erschbamer B, Unterluggauer P, Winkler E, Mallaun M (2011) Changes in plant species diversity revealed by long-term monitoring on mountain summits in the Dolomites (northern Italy). Preslia 83: 387–401.

Filesi L, Rosati L, Paura B, Cutini M, Strumia S, Blasi C (2010) Le Serie di Vegetazione della regione Campania. In: Blasi C (Ed) La Vegetazione d'Italia. Palombi & Partners S.r.l., Roma, 351–373.

Fiori A (1923) Nuova Flora d'Italia, Vol. 1 (fascicolo 2). Tipografia di M. Ricci, Firenze 161–320.

Fiori A (1924) Nuova Flora d'Italia, Vol. 1 (fascicolo 4). Tipografia di M. Ricci, Firenze 481–640.

Fiori A (1925) Nuova Flora d'Italia, Vol. 2 (fascicolo 1). Tipografia di M. Ricci, Firenze 1–60.

Fortini P, Di Marzio P, Di Pietro R (2015) Differentiation and hybridization of *Quercus frainetto*, *Q. petraea*, and *Q. pubescens* (Fagaceae): insights from macro-morphological leaf traits and molecular data. Plant Systematics and Evolution 301: 375–385. https://doi.org/10.1007/s00606-014-1080-2

Galasso G, Conti F, Peruzzi L, Alessandrini A, Ardenghi NMG, Bacchetta G, Banfi E, Barberis G, Bernardo L, Bouvet D, Bovio M, Castello M, Cecchi L, Del Guacchio E, Domina G, Fascetti S, Gallo L, Guarino R, Gubellini L, Guiggi A, Hofmann N, Iberite M, Jiménez-Mejías P, Longo D, Marchetti D, Martini F, Masin RR, Medagli P, Musarella CM, Peccenini S, Podda L, Prosser F, Roma-Marzio F, Rosati L, Santangelo A, Scoppola A, Selvaggi A, Selvi F, Soldano A, Stinca A, Wagensommer RP, Wilhalm T, Bartolucci F (2024) A second update to the checklist of the vascular flora alien to Italy. Plant Biosystems 158 (2) 297–340. https://doi.org/10.1080/11263504.2024.2320129

Gianguzzi L, Guarino R, Bazan G, Di Pietro R, Acosta ATR, Bajona E, Bolliger P, Bonomi C, Camuffo A, Console C, Fascetti S, Fortini P, Frattaroli A, Mei G, Mondello F, Olivari S, Rizzieri M, Rosati L, Sarmati S, Scuderi L, Simonazzi M, Spampinato G, Viegi L, Stinca A (2023) Itineraries of the Working Group for Vegetation Science of the Italian Botanical Society – 1 (2022): Excursion to the Egadi Islands, Mount San Giuliano and Mount Cofano (Trapani, western Sicily, Italy). Italian Botanist 16: 1–57. https://doi.org/10.3897/italianbotanist.16.103989

Gotelli NJ, Colwell RK (2001) Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. Ecology Letters 4: 379–391. https://doi.org/10.1046/j.1461-0248.2001.00230.x

Grande L (1914) Un'escursione sui Monti di Formicola. Bullettino dell'Orto Botanico della Regia Università di Napoli 4: 239–264.

Jiménez-López FJ, Viruel J, Arista M, Ortiz PL, Talavera M (2022) Molecular approaches reveal speciation between red and blue flowered plants in the Mediterranean *Lysimachia arvensis*

and *Lysimachia monelli* (Primulaceae). Botanical Journal of the Linnean Society 199(2): 557–577. https://doi.org/10.1093/botlinnean/boab081

Khorasani M, Gholizadeh H, Brundu G, Naqinezhad A (2025) *Asclepias curassavica* L. (Apocynaceae) a naturalized neophyte threatening the Hyrcanian biodiversity hotspot in North Iran. BioInvasions Records 14(4): 807–817. https://doi.org/10.3391/bir.2025.14.4.05

Kirschner J (2002) Juncaceae 1: *Rostkovia* to *Luzula*. In: Orchard AE (Ed.) Species Plantarum: Flora of the World. Vol. 6. Australian Biological Resources Study, Canberra, 237 pp.

Kretzschmar H, Eccarius W, Dietrich H (2007) The Orchid Genera *Anacamptis*, *Orchis* and *Neotinea*, 2nd edn. Echinomedia Verlag, Bürgel, 429 pp.

Mauro G, De Felice P, Caiazzo S, Lodato F, De Simone CS (2023) Google Earth Engine (GEE) to Study Land Take and Urban Green Space Area in Caserta Plain (Southern Italy). Bollettino della Società Geografica Italiana 6(1): 65–91. https://doi.org/10.36253/bsgi-1900

Montelucci G (1963) Gite autunnali sui Monti Tifatini (Caserta). Giornale Botanico Italiano 70(5–6): 621–628.

Moraldo B (1986) Il genere *Stipa* L. (Gramineae) in Italia. Webbia 40(2): 203–278. https://doi.org/10.1080/00837792.1986.10670388

Motti R, Salerno G (2006) La flora del complesso dei monti Vesole, Soprano, Sottano e Chianello (Appennino campano, Salerno). Webbia 61(2): 325–357. https://doi.org/10.1080/00837792.2006.10670809

Motti R, Esposito A, Stinca A (2018) New additions to the exotic vascular flora of Campania (southern Italy). Annali di Botanica 8: 75–85. https://doi.org/10.4462/annbotrm-14156

Motti R, Zotti M, Bonanomi G, Cozzolino A, Stinca A, Migliozzi A (2021) Climatic and anthropogenic factors affect *Ailanthus altissima* invasion in a Mediterranean region. Plant Ecology 222: 1347–1359. https://doi.org/10.1016/j.foreco.2023.121058

Mucina L, Bültmann H, Dierßen K, Theurillat J-P, Raus T, Čarni A, Šumberová K, Willner W, Dengler J, García RG, Chytrý M, Hájek M, Di Pietro R, Iakushenko D, Pallas J, Daniëls FJA, Bergmeier E, Santos Guerra A, Ermakov N, Valachovič M, Schaminée JHJ, Lysenko T, Didukh YP, Pignatti S, Rodwell JS, Capelo J, Weber HE, Solomeshch A, Dimopoulos P, Aguiar C, Hennekens SM, Tichý L (2016) Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Applied Vegetation Science 19: 3–264. https://doi.org/10.1111/avsc.12257

Musarella CM, Laface VLA, Angiolini C, Bacchetta G, Bajona E, Banfi E, Barone G, Biscotti N, Bonsanto D, Calvia G, Capuano A, Caruso G, Crisafulli A, Del Guacchio E, Di Gristina E, Domina G, Fanfarillo E, Fascetti S, Fiaschi T, Galasso G, Mascia F, Mazzacuva G, Mei G, Minissale P, Motti R, Perrino EV, Picone RM, Pinzani L, Podda L, Potenza G, Rosati L, Stinca A, Tavilla G, Villano C, Wagensommer RP, Spampinato G (2024) New alien plant taxa for italy and europe: an update. Plants 13: 620. https://doi.org/10.3390/plants13050620

Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403: 853–858. https://doi.org/10.1038/35002501

Nazzaro R, Menale B, La Valva V (2007) Check-list della flora del Monte Taburno (Campania). Delpinoa 47(2005): 37–55.

Olivares G, Peña-Ahumada B, Peñailillo J, Payacán C, Moncada X, Saldarriaga-Córdoba M, Matisoo-Smith E, Chung K-F, Seelenfreund D, Seelenfreund A (2019) Human mediated

translocation of Pacific paper mulberry [*Broussonetia papyrifera* (L.) L'Hér. ex Vent. (Moraceae)]: Genetic evidence of dispersal routes in Remote Oceania. PLoS ONE 14(6): e0217107. https://doi.org/10.1371/journal.pone.0217107

Orsenigo S, Montagnani C, Fenu G, Gargano D, Peruzzi L, Abeli T, Alessandrini A, Bacchetta G, Bartolucci F, Bovio M, Brullo C, Brullo S, Carta A, Castello M, Cogoni D, Conti F, Domina G, Foggi B, Gennai M, Gigante D, Iberite M, Lasen C, Magrini S, Perrino EV, Prosser F, Santangelo A, Selvaggi A, Stinca A, Vagge I, Villani MC, Wagensommer RP, Wilhalm T, Tartaglini N, Duprè E, Blasi C, Rossi G (2018) Red Listing plants under full national responsibility: extinction risks and threats in the vascular flora endemic to Italy. Biological Conservation 224: 213–222. https://doi.org/10.1016/j.biocon.2018.05.030

Orsenigo S, Fenu G, Gargano D, Montagnani C, Abeli T, Alessandrini A, Bacchetta G, Bartolucci F, Carta A, Castello M, Cogoni D, Conti F, Domina G, Foggi B, Gennai M, Gigante D, Iberite M, Peruzzi L, Pinna MS, Prosser F, Santangelo A, Selvaggi A, Stinca A, Villani M, Wagensommer RP, Tartaglini N, Duprè E, Blasi C, Rossi G (2021) Red list of threatened vascular plant species in Italy. Plant Biosystems 155(2): 310–335. https://doi.org/10.1080/11263504.2020.1739165

Palmer MW, Earls PG, Hoagland BW, White PS, Wohlgemuth T (2002) Quantitative tools for perfecting species lists. Environmetrics 13: 121–137.

Patten MA, Unitt P (2002) Diagnosability versus Mean Differences of Sage Sparrow Subspecies. The Auk 119(1): 26–35. https://doi.org/10.2307/4090009

Perrino EV, Tomaselli V, Wagensommer RP, Silletti GN, Esposito A, Stinca A (2022) *Ophioglossum lusitanicum* L.: New Records of Plant Community and 92/43/EEC Habitat in Italy. Agronomy 12(12): 3188. https://doi.org/10.3390/agronomy12123188

Peruzzi L, Conti F, Bartolucci F (2014) An inventory of vascular plants endemic to Italy. Phytotaxa 168(1): 1–75. https://doi.org/10.11646/phytotaxa.168.1.1

Peruzzi L, Domina G, Bartolucci F, Galasso G, Peccenini S, Raimondo FM, Albano A, Alessandrini A, Banfi E, Barberis G, Bernardo L, Bovio M, Brullo S, Brundu G, Brunu A, Camarda I, Conti F, Croce A, Iamonico D, Iberite M, Iiriti G, Longo D, Manca A, Marsili S, Medagli P, Pistarino A, Salmeri C, Santangelo A, Scassellati E, Selvi F, Soldano A, Stinca A, Vacca G, Villani MC, Wagensommer RP, Passalacqua NG (2015) An inventory of the names of vascular plants endemic to Italy, their loci classici and types. Phytotaxa 196(1): 1–217. https://doi.org/10.11646/phytotaxa.196.1.1

Pignatti S (1982) Flora d'Italia, Vols 1–3. Edagricole, Bologna, 970 pp. Vol. 1, 732 pp. Vol. 2, 780 pp. Vol. 3.

Pignatti S, Guarino R, La Rosa M (2017a) Flora d'Italia, Vol. 1. Edagricole, Bologna, 1064 pp.

Pignatti S, Guarino R, La Rosa M (2017b) Flora d'Italia, Vol. 2. Edagricole, Bologna, 1178 pp.

Pignatti S, Guarino R, La Rosa M (2018) Flora d'Italia, Vol. 3. Edagricole, Bologna, 1288 pp.

Pignatti S, Guarino R, La Rosa M (2019) Flora d'Italia, Vol. 4. Edagricole, Bologna, 1054 pp.

POWO (2026a) Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:648405-1 [accessed 29.05.2026]

POWO (2026b) Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:977194-1 [accessed 15.02.2026]

Pyšek P, Richardson DM, Rejmánek M, Webster GL, Williamson M, Kirschner J (2004) Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. Taxon 53(1): 131–143. https://doi.org/10.2307/4135498

Rico E (2021) *Hyparrhenia*. In: Romero Zarco C, Rico E, Crespo MB, Devesa JA, Buira A, Aedo C (Eds) Flora iberica. Vol. 19 (2). Real Jardín Botánico, CSIC, Madrid, 1262–1269.

Rivas-Martínez S, Penas Á, Díaz TE (2004) Bioclimatic map of Europe (scale 1:16.000.000). Cartographic Service, University of León, Spain.

Roma-Marzio F, D'Antraccoli M, Angeloni D, Bartolucci F, Bernardo L, Cancellieri L, Caruso G, Conti F, Dolci D, Gestri G, Gubellini L, Hofmann N, Laface VLA, Lattanzi E, Lavezzo P, Maiorca G, Montepaone G, Musarella CM, Noto D, Perrino EV, Proietti E, Masin RR, Scoppola A, Stinca A, Tiburtini M, Tilia A, Peruzzi L (2020) Contribution to the floristic knowledge of Sillaro, Santerno, and Senio high valleys (Toscana, Italy). Italian Botanist 10: 101–111. https://doi.org/10.3897/italianbotanist.10.60118

Romano B, Zullo F, Fiorini L, Marucci A, Ciabò S (2017) Land transformation of Italy due to half a century of urbanization. Land Use Policy 67: 387–400. https://doi.org/10.1016/j.landusepol.2017.06.006

Rosati L, Salerno G, Del Vico E, La Penna MR, Villani MC, Filesi L, Fascetti S, Lattanzi E (2012) Un aggiornamento alla flora del Cilento e della Campania. Informatore Botanico Italiano 44(1): 111–119.

Rosati L, Romano V, Bartolucci F, Bernardo L, Bouvet D, Cancellieri L, Caruso G, Conti F, Faraoni F, Banfi E, Galasso G, Lattanzi E, Lavezzo P, Peccenini S, Perrino EV, Salerno G, Sciandra A, Soldano A, Stinca A, Totta C, Fascetti S (2017) Contribution to the floristic knowledge of the Maddalena Mountains (Basilicata and Campania, southern Italy). Italian Botanist 3: 73–82. https://doi.org/10.3897/italianbotanist.3.12519

Rosati L, Coppi A, Farris F, Fascetti S, Becca G, Peregrym M, Tan K, Selvi F (2018) The genus *Gymnospermium* (Berberidaceae) in Italy: identity and relationships of the populations at the western limit of the genus range. Plant Biosystems 153(6): 796–808. https://doi.org/10.1080/11263504.2018.1549613

Rosati L, Fascetti S, Romano VA, Potenza G, Lapenna MR, Capano A, Nicoletti P, Farris E, Lange PJ, Vico ED, Facioni L, Fanfarillo E, Lattanzi E, Cano-Ortiz A, Marignani M, Fogu MC, Bazzato E, Lallai E, Laface VLA, Musarella CM, Spampinato G, Mei G, Misano G, Salerno G, Esposito A, Stinca A (2020) New chorological data for the Italian vascular flora. Diversity 12: 22. https://doi.org/10.3390/d12010022

Rossi G, Montagnani C, Gargano D, Peruzzi L, Abeli T, Ravera S, Cogoni A, Fenu G, Magrini S, Gennai M, Foggi B, Wagensommer RP, Venturella G, Blasi C, Raimondo FM, Orsenigo S (2013) Lista Rossa della Flora Italiana. 1. Policy Species e altre specie minacciate. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma, 58 pp.

Rossi G, Orsenigo S, Gargano D, Montagnani C, Peruzzi L, Fenu G, Abeli T, Alessandrini A, Astuti G, Bacchetta G, Bartolucci F, Bernardo L, Bovio M, Brullo S, Carta A, Castello M, Cogoni D, Conti F, Domina G, Foggi B, Gennai M, Gigante D, Iberite M, Lasen C, Magrini S, Nicolella G, Pinna MS, Poggio L, Prosser F, Santangelo A, Selvaggi A, Stinca A, Tartaglini N, Troia A, Villani MC, Wagensommer RP, Wilhalm T, Blasi C (2020) Lista

Rossa della Flora Italiana. 2 Endemiti e altre specie minacciate. Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Roma, 94 pp.

Salerno G, Stinca A (2017) First European record of *Solandra maxima* (Sessé & Moc.) P.S.Green (Solanaceae). Annali di Botanica 7: 67–70. https://doi.org/10.4462/annbotrm-13848

Salvini D, Bruschi P, Fineschi S, Grossoni P, Kjær ED, Vendramin GG (2009) Natural hybridisation between *Quercus petraea* (Matt.) Liebl. and *Quercus pubescens* Willd. within an Italian stand as revealed by microsatellite fingerprinting. Plant Biology 11: 758–765. https://doi.org/10.1111/j.1438-8677.2008.00158.x

Santangelo A, Bernardo L, Bertani G, Bronzo E, Cancellieri L, Costalonga S, Croce A, Del Vico E, Fascetti S, Fortini P, Gangale C, Gubellini L, Iocchi M, Lapenna MR, Lattanzi E, Lavezzo P, Lupini F, Magrini S, Marino R, Paura B, Peccenini S, Peruzzi L, Rosati L, Salerno G, Scoppola A, Strumia S, Tardella FM, Uzunov D (2010) Contributo alla conoscenza floristica del Massiccio del Matese: resoconto dell'escursione del Gruppo di Floristica (S.B.I.) nel 2007. Informatore Botanico Italiano 42(1): 109–143.

Sciandrello S, Minissale P, Giusso del Galdo G (2020) Vascular plant species diversity of Mt. Etna (Sicily): endemicity, insularity and spatial patterns along the altitudinal gradient of the highest active volcano in Europe. PeerJ 8: e9875. https://doi.org/10.7717/peerj.9875

Scoppola A (2019) An annotated key to the species of *Gastridium* (Poaceae) with distributional novelties to the Italian territory. Natural History Sciences. Atti Soc. it. Sci. nat. Museo civ. Stor. nat. Milano 6(2): 29–36. https://doi.org/10.4081/nhs.2019.429

Scoppola A, Blasi C [Eds] (2005) Stato delle conoscenze sulla flora vascolare d'Italia. Palombi Editori, Roma, 253 pp.

Soil Survey Staff (2022) Keys to Soil Taxonomy. 13th edn. United States Department of Agriculture (USDA), Natural Resources Conservation Service, USA, 401 pp.

Souza I, Blum CT, Scheer MB, Higuchi P (2023) First records of *Hydrocotyle itatiaiensis* Brade (Araliaceae) in the state of Paraná, southern Brazil. Check List 19(4): 467–472. https://doi.org/10.15560/19.4.467

Stinca A (2017) *Orchis italica* Poir. (Orchidaceae): rediscovery after four centuries of a presumably extinct species in Mt. Vesuvius, Italy. Annali di Botanica 7: 71–74. https://doi.org/10.4462/annbotrm-13294

Stinca A (2019) The genus *Vitis* L. (Vitaceae) in Campania (Southern Italy), with emphasis on alien units. Annali di Botanica 9: 107–112. https://doi.org/10.13133/2239-3129/14792

Stinca A (2023) Vegetation features of two vascular plant species presumed extinct and recently rediscovered in the natural habitat of community interest 8320 from Mt. Vesuvius, Italy. Plant Sociology 60(1): 13–23.https://doi.org/10.3897/pls2023601/02

Stinca A (2025) Exclusion of *Saxifraga taygetea* Boiss. & Heldr. (Saxifragaceae) and *Vinca major* L. subsp. *balcanica* (Pénzes) Kozuharov & A.V.Petrova (Apocynaceae) from the vascular flora of Italy. Check List 21(6): 1271–1288. https://doi.org/10.15560/21.6.1271

Stinca A, D'Auria G, Motti R (2012) Integrazioni alla flora vascolare aliena della Campania (Sud Italia). Informatore Botanico Italiano 44(2): 287–293.

Stinca A, Motti R (2009) The vascular flora of the Royal Park of Portici (Naples, Italy). Webbia 64(2) 235–266. https://doi.org/10.1080/00837792.2009.10670861

Stinca A, Motti R (2013) Aggiornamenti floristici per il Somma-Vesuvio e l'Isola di Capri (Campania, Sud Italia). Informatore Botanico Italiano 45(1): 35–43.

Stinca A, D'Auria G, Salerno G Motti R (2013) Ulteriori integrazioni alla flora vascolare aliena della Campania (Sud Italia). Informatore Botanico Italiano 45(1): 71–81.

Stinca A, Chianese G, D'Auria G, Del Guacchio E, Fascetti S, Perrino EV, Rosati L, Salerno G, Santangelo A (2017a) New alien vascular species for the flora of southern Italy. Webbia 72(2): 295–301. https://doi.org/10.1080/00837792.2017.1349236

Stinca A, Ravo M, Giacanelli V, Conti F (2017b) Integrazioni alla flora vascolare dell'Isola di Capri (Campania, Sud Italia). Atti della Società Toscana di Scienze Naturali, Memorie Serie B 123(2016): 41–64. https://doi.org/10.2424/ASTSN.M.2016.05

Stinca A, Chianese G, D'Auria G, Fascetti S, Ravo M, Romano VA, Salerno G, Astuti G, Bartolucci F, Bernardo L, Bonari G, Bouvet D, Cancellieri L, Carli E, Caruso G, Catalano I, Cennamo GD, Ciaschetti G, Conti F, Di Pietro R, Fortini P, Gangale C, Lapenna MR, Lattanzi E, Marcucci R, Peccenini S, Pennesi R, Perrino EV, Peruzzi L, Roma-Marzio F, Scoppola A, Tilia A, Villani M, Rosati L (2019a) Contribution to the floristic knowledge of eastern Irpinia and Vulture-Melfese area (Campania and Basilicata, southern Italy). Italian Botanist 8: 1–16. https://doi.org/10.3897/italianbotanist.8.37818

Stinca A, Ravo M, Giacanelli V, Conti F (2019b) Additions to the vascular flora of the islands of Procida and Vivara (Campania, southern Italy). Atti della Società Toscana di Scienze Naturali, Memorie Serie B 125(2018): 87–93. https://doi.org/10.2424/ASTSN.M.2018.14

Stinca A, Bernardo L, Peruzzi L (2019c) Appennino Meridionale. In: Conti F, Bartolucci F, Di Martino L, Manzi A (Eds) La flora endemica minacciata delle montagne italiane. Club Alpino Italiano, Milano, 282–366.

Stinca A, Conti F, Bartolucci F (2019d) Typification of the name *Centaurea deusta* Ten. (Asteraceae). Phytotaxa 399(4): 296–299. https://doi.org/10.11646/phytotaxa.399.4.6

Stinca A, Ravo M, Marzaioli R, Marchese G, Cordella A, Rutigliano FA, Esposito A (2020) Changes in Multi-Level Biodiversity and Soil Features in a Burned Beech Forest in the Southern Italian Coastal Mountain. Forests 11(9): 983. https://doi.org/10.3390/f11090983

Stinca A, Musarella CM, Rosati L, Laface VLA, Licht W, Fanfarillo E, Wagensommer RP, Galasso G, Fascetti S, Esposito A, Fiaschi T, Nicolella G, Chianese G, Ciaschetti G, Salerno G, Fortini P, Di Pietro R, Perrino EV, Angiolini C, De Simone L, Mei G (2021) Italian vascular flora: new findings, updates and exploration of floristic similarities between regions. Diversity 13(11): 600. https://doi.org/10.3390/d13110600

Tardella FM, Pennesi R, Ballelli S, Cancellieri L, Caruso G, Falcinelli F, Fascetti S, Galasso G, Gigante D, Laface VLA, Lattanzi E, Lavezzo P, Musarella CM, Pinzani L, Quattrini G, Rosati L, Spada F, Stinca A, Tilia A, Catorci A (2024) Contribution to the floristic knowledge of Mount Pennino massif (Umbria-Marche Apennines, central Italy). Italian Botanist 18: 1–11. https://doi.org/10.3897/italianbotanist.18.128215

Tenore M (1811–1838) Flora Neapolitana, Vols 1–5. Stamperia Reale, Napoli, 324 pp. Vol. 1; Tipografia del Giornale Enciclopedico, Napoli, 398 pp. Vol. 2; Stamperia Francese, Napoli, 412 pp. Vol. 3; Stamperia Francese, Napoli, 358 pp. Vol. 4; Stamperia e Cartiera del Fibreno, Napoli, 379 pp. Vol. 5.

Tenore M (1831) Sylloge plantarium vascularium Florae Neapolitanae hucusque detectarum. Typografia Fibreni, Napoli, 639 pp.

Terracciano N (1867) Su di alcune piante della Flora Napolitana. Annali dell'Accademia degli Aspiranti Naturalisti di Napoli, terza serie, 4(1866): 82–88.

Terracciano N (1872) Relazione intorno alle peregrinazioni botaniche fatte per disposizione della Deputazione Provinciale di Terra di Lavoro in certi luoghi della provincia. Nobile e C., Caserta, 240 pp.

Terracciano N (1873) Seconda relazione intorno alle peregrinazioni botaniche fatte nella Provincia di Terra di Lavoro. Nobile e C., Caserta, 125 pp.

Terracciano N (1874) Terza relazione intorno alle peregrinazioni botaniche fatte nella Provincia di Terra di Lavoro per disposizione della Deputazione Provinciale. Nobile e C., Caserta, 107 pp.

Terracciano N (1877) Nota intorno ad una novella varietà di *Calystegia sylvatica*. Nuovo Giornale Botanico Italiano 9(1): 21–23.

Terracciano N (1878) Quarta relazione intorno alle peregrinazioni botaniche fatte nella Provincia di Terra di Lavoro. Nobile e C., Caserta, 133 pp.

Terracciano N (1890) Intorno ad alcune piante della flora di Terra di Lavoro. Atti della R. Accademia delle Scienze Fisiche e Matematiche di Napoli 4(2): 1–10.

Terzi M, Fernández-González F, Di Pietro R, Theurillat J-P (2026) Critical revision of the nomenclature of Mediterranean therophytic grasslands of the class *Stipo-Trachynietea distachyae*. Rendiconti Lincei. Scienze Fisiche e Naturali 37: 205–222. https://doi.org/10.1007/s12210-025-01396-4

Thiers B (2026) Index herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. https://sweetgum.nybg.org/science/ih/ [accessed 15.02.2026]

Tison JM, de Foucault B (2014) Flora Gallica. Flore de France. Biotope Éditions, Mèze, 1195 pp.

Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA [Eds] (1968) Flora Europaea, Vol. 2. Cambridge University Press, Cambridge, 465 pp.

Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA [Eds] (1972) Flora Europaea, Vol. 3. Cambridge University Press, Cambridge, 381 pp. https://doi.org/10.2307/1218149

Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA [Eds] (1976) Flora Europaea, Vol. 4. Cambridge University Press, Cambridge, 515 pp.

Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA [Eds] (1980) Flora Europaea, Vol. 5. Cambridge University Press, Cambridge, 463 pp.

Tutin TG, Burges NA, Chater AO, Edmondson JR, Heywood VH, Moore DM, Valentine DH, Walters SM, Webb DA [Eds] (1993) Flora Europaea, Vol. 1. 2nd edn. Cambridge University Press, Cambridge, 581 pp.

Verloove F, Silva JJG, Leliaert F (2024) Critical notes on grasses (Poaceae) of Madeira, Portugal. Phytotaxa 670(1): 1–17. https://doi.org/10.11646/phytotaxa.670.1.1

Wagensommer RP, Marrese M, Perrino EV, Bartolucci F, Cancellieri L, Carruggio F, Conti F, Di Pietro R, Fortini P, Galasso G, Lattanzi E, Lavezzo P, Longo D, Peccenini S, Rosati L,

Russo G, Salerno G, Scoppola A, Soldano A, Stinca A, Tilia A, Turco A, Medagli P, Forte L (2014) Contributo alla conoscenza floristica della Puglia: resoconto dell'escursione del Gruppo di Floristica (S.B.I.) nel 2011 nel settore meridionale dei Monti della Daunia. Informatore Botanico Italiano 46(2): 175–208.

Walter H, Lieth J (1960–1967) Klimadiagramm-Weltatlas. VEB Gustav Fischer Verlag, Jena [unnumbered pages].

Wilson EO, Brown WL (1953) The Subspecies Concept and Its Taxonomic Application. Systematic Zoology 2(3): 97–111. https://doi.org/10.2307/2411818

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Artificial Intelligence (AI) use

The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI.
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Data availability

All data supporting the findings of this study are included in the Suppl. material 1: table S1. The voucher specimens examined in this study are deposited in the herbaria listed in Table 2 and are available for study upon reasonable request to the respective herbarium curators.

Supplementary material 1

Supplementary information

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