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RESEARCH ARTICLE

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Contribution to the floristic knowledge of Mount Pennino massif (Umbria-Marche Apennines, central Italy)

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Abstract

The inventory of the taxa collected in 2021 during the annual field trip of the Working Group for Floristics, Systematics, and Evolution of the Italian Botanical Society is reported. The field trip was held in the Mount Pennino massif, between Umbria and Marche administrative regions (central Italy). The

flora documented for the study area amounts to 413 specific and subspecific taxa (including one hybrid), belonging to 234 genera and 64 families. Thirty-seven taxa are endemic to Italy; 42 are included in the IUCN Red List of the Italian Flora. Only three alien taxa were found. Ten taxa and one hybrid are considered floristic novelties because either new or confirmed for the regional flora of Umbria and/or Marche. Particularly, 6 taxa are new and 4 are confirmed for Umbria; one taxon and one hybrid are new for Marche.

Keywords
Central Apennines, Endemic, Floristic novelties, Herbaria, Italian vascular flora, Marche, Umbria

Introduction

In this paper, the results of the field trip of the Working Group for Floristics, Systematics, and Evolution of the Italian Botanical Society held in 2021 in the Mount Pennino massif (central Apennines), organised by the botanists of the Herbarium Universitatis Camerinensis (School of Biosciences and Veterinary Medicine, University of Camerino, Camerino) are presented. Floristic excursions of this Working Group are traditionally aimed at exploring poorly known areas from the floristic point of view and publishing the related data (e.g. Conti et al. 2007; Domina et al. 2015; Bartolucci et al. 2019; Stinca et al. 2019; Roma-Marzio et al. 2020; Barone et al. 2023).

The incentive for the organization of the field trip has come from the observation of Andrea Batelli (1854–1917), a botanist and professor at the University of Perugia (Gigante et al. 2021):

Mount Pennino is forgotten; it can be called a second-rate mountain in that area of famous mountains. It is the story of the bad neighbours to which it owes his misfortune. On the one hand, Mount Subasio contrasts with the celebrity of history, on the other, the Sibillini Mountains with that of altitude, the pious legend that proclaims the eternal brotherhood of men with nature, and the woolly edelweiss, a reminder of the Alps, are the enemies of the misty colossus. But mediocrity must still have its historians, even more so when it has many reasons to be rightly celebrated (Batelli 1887a).

Batelli explored Mount Pennino and surrounding areas at the end of the 19th century, reporting 104 taxa (1886, 1887b). We must admit that more than 130 years later, the above considerations are still valid, as the knowledge about the vascular flora of this area has not increased so much. A few reports indeed have been published, most of them being single records of taxa new to the flora of Umbria (Falcinelli and Donnini 2007, 2008, 2012; Ballelli et al. 2012; Falcinelli et al. 2013; Gigante et al. 2014; Gubellini et al. 2014; Bartolucci et al. 2016).

The "Anarchive" database (http://www.anarchive.it/anArchive/index.jsp) hosts 60 specimens' records, referred to 46 taxa, collected in Mount Pennino massif by F. Pedrotti (CAME) and V. Marchesoni (CAME, FI) in 1962, G. Zodda (AQUI)

in 1967, A. Gabellini (SIENA) in 1999, F. Falcinelli (PERU) in 2006, 2011, and 2012, F. Falcinelli and D. Donnini (PERU), S. Ballelli, D. Gigante, and R. Venanzoni (PERU), and S. Ballelli, D. Gigante, L. Gubellini, F. Landucci, F. Maneli, and R. Venanzoni (PERU) in 2009.

Thus, in 2021 we decided to address the yearly floristic investigation in such area, because largely unexplored in the recent decades.

Materials and methods

Study area

The study area is localized in the Nocera Umbra (Perugia) and Fiuminata (Macerata) municipalities, in the Rivers Topino and Potenza valleys (WGS84: 43.101210°N, 12.888778°E, coordinate system WGS84; Fig. 1). The altitude ranges from 670 to 1,571 m a.s.l., at the top of Mount Pennino.

From the geological viewpoint, the Mount Pennino massif is characterized by limestone bedrock (Servizio Geologico d'Italia 1966).

Yearly average rainfall ranges between 1,200 and 1,300 mm (data drawn from Bagnara and Annifo meteorological stations, Orsomando et al. 1999) and is concentrated in the autumn–winter period, with a maximum in November–December and a minimum in summer (July). Annual average temperature ranges from about 7.5 to 11.5 °C (data drawn from Rasiglia and Pintura di Bolognola meteorological stations, Orsomando et al. 1999), with the hottest months in summer (July–August) and the coldest in winter (December–January). The investigated area shows a temperate oceanic weak semicontinental to weak euoceanic macrobioclimate, ranging from lower supratemperate to upper supratemperate thermotype and from upper humid to lower hyperhumid ombrotypes (Pesaresi et al. 2017).

The forest vegetation is dominated by coppiced *Fagus sylvatica* L. subsp. *sylvatica* woods and, secondly, by *Quercus cerris* L. and *Ostrya carpinifolia* Scop. woods. Grasslands are characterized by *Bromopsis erecta* (Huds.) Fourr., *Brachypodium rupestre* (Host) Roem. & Schult., *Sesleria nitida* Ten., and *S. juncifolia* Suffren.

Data collection

To maximize vascular flora sampling, the study area (about 700 hectares) was divided into six sectors (Fig. 1) and intensively sampled during the period 24–26 June 2021 by 20 participants (Table 1, Suppl. material 1: 1). The work, together with the floristic list, was coordinated and drawn up by the organisers (F.M. Tardella, R. Pennesi, S. Ballelli, and A. Catorci) with the contribution of all participants to the excursion. The floristic list was prepared according to the protocol already used in previous contributions (e.g. Bartolucci et al. 2019; Stinca et al. 2019; Barone et al. 2023).

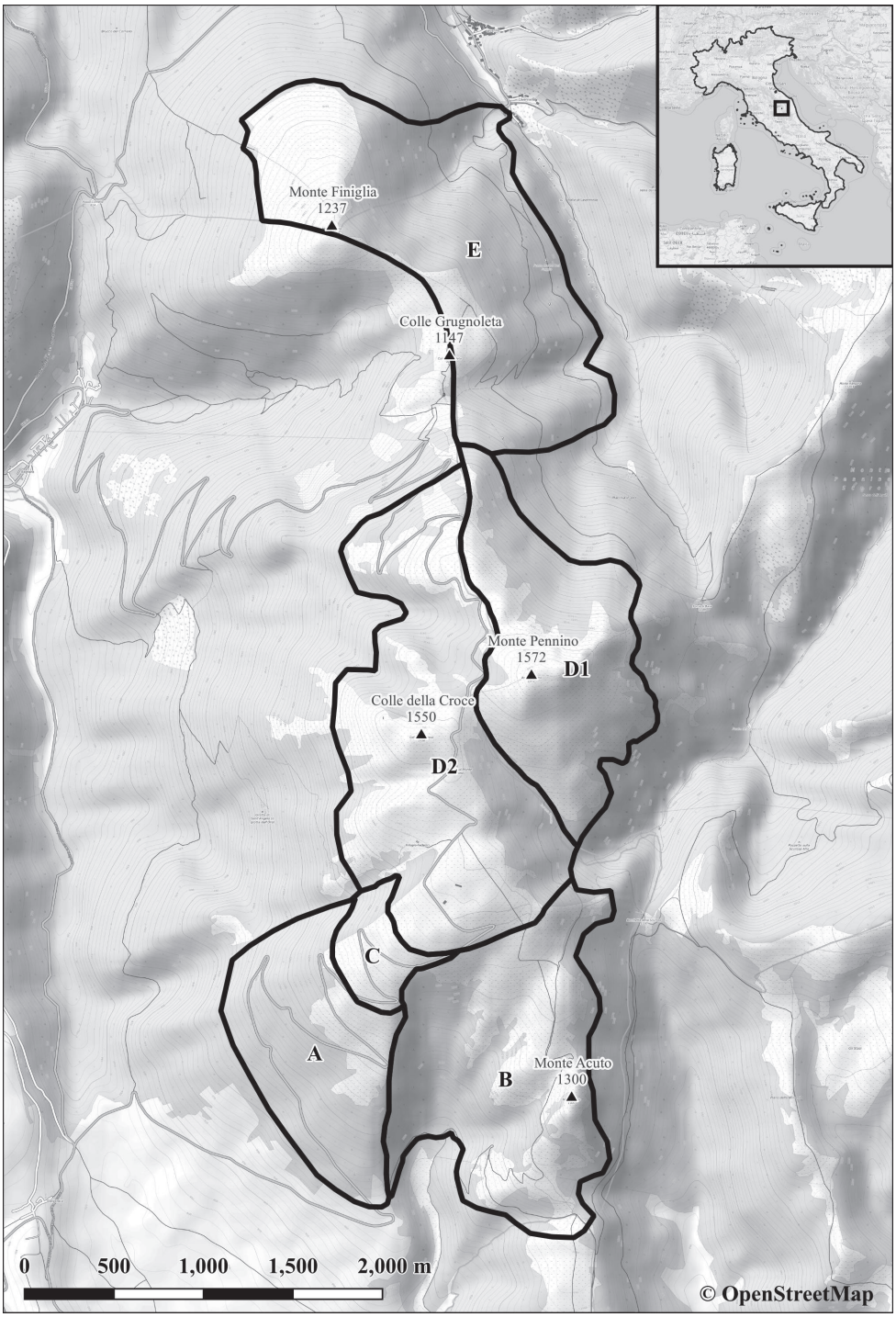

Figure 1. Study area and sampling sites. Data extracted from OpenStreetMap is licensed on terms of the Open Database License (https://www.openstreetmap.org/copyright/en).

Plant identification

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; Pignatti et al. 2017–2019) and other publications (e.g., Conti et al. 2011, 2021; Arrigoni 2014; Rešetnik et al. 2014; Peccenini and Polatschek 2016; Gargano et al. 2023). Herbarium specimens prepared are deposited in public and private herbaria (Suppl. material 1: 2). Each participant prepared a list of the identified specimens and sent it to the organisers, who merged the lists.

A revision of the critical samples collected during the fieldwork was carried out by the participants on 23–25 February 2022, at the Herbarium Universitatis Camerinensis (School of Biosciences and Veterinary Medicine, University of Camerino, Camerino). This revision was followed by specific studies and comparisons of unidentified taxa. Particularly, some herbarium specimens belonging to critical genera were sent to experts for determination: *Anthoxanthum* L., *Brachypodium* P.Beauv., and *Koeleria* Pers. (E. Banfi, Milano); *Anthyllis* L. (F. Conti, Barisciano); *Armeria* Willd. (M. Tiburtini, Pisa); *Hieracium* L. (G. Gottschlich, Tübingen); *Juniperus* L. (F. Roma-Marzio, Pisa); *Orobanche* L. (G. Domina, Palermo); *Thymus* L. (F. Bartolucci, Barisciano).

The nomenclature used to draw up the floristic list (see Suppl. material 1: 3) follows the checklists of the vascular flora native (Bartolucci et al. 2024) and alien (Galasso et al. 2024) to Italy, except for native hybrids, not considered in the above-mentioned checklists. The systematic order of the families follows Bartolucci et al. (2024) and Galasso et al. (2024). Taxa have been ordered alphabetically within each family. For each taxon, the following information is reported: accepted name, endemic or alien status, sampling site (see Table 1), Herbarium (see Suppl. material 1: 2).

Abbreviations or symbols used in the floristic list are:

E Italian endemic (Peruzzi et al. 2014, 2015; Bartolucci et al. 2024);
A alien taxon [CAS (Casual), NAT (Naturalized)] (Galasso et al. 2024);
* taxon confirmed for the regional flora;
** new record for the regional flora.

Results

During the field investigations, 1,461 samples of vascular plants were collected, belonging to 413 species and subspecies, 234 genera, and 64 families (Suppl. material 1: 3), including one hybrid (*Brachypodium retusum* (Pers.) P.Beauv. × *B. rupestre*). Thirty–seven taxa are endemic to Italy, and only three are alien (*Centaurea cyanus* All., *Hordeum vulgare* L. subsp. *vulgare*, and *Matricaria discoidea* DC. subsp. *discoidea*). Forty–two taxa are included in the IUCN Red List of the Italian Flora (Rossi et al. 2013; Orsenigo et al. 2018, 2020). Ten taxa and one hybrid are floristic novelties, because either new or confirmed for the regional flora of Umbria and/or Marche.

Table 1. List of sampling sites, with reference code, locality name, altitude, main habitats, geographic coordinates, and date of collection.

Code	Locality	Habitat	Altitude (m a.s.l.)	Coord. (WGS84)	Date
A	Umbria. Monte Pennino, south-western slope (Nocera Umbra, Perugia)	deciduous woods, grasslands and rocky slopes	1,000–1,300	43.081397°N, 12.874625°E	24 June 2021
B	Umbria. Monte Acuto (Nocera Umbra, Perugia)	deciduous woods and grasslands	1,000–1,400	43.080346°N, 12.887634°E	25 June 2021
C	Umbria. Monte Pennino, south-western slope (Nocera Umbra, Perugia)	grasslands	1,300–1,450	43.087597°N, 12.879627°E	25 June 2021
D1	Marche. Monte Pennino, top (Fiuminata, Macerata)	grasslands	1,300–1,571	43.100159°N, 12.890130°E	25 June 2021; 26 June 2021
D2	Umbria. Monte Pennino, top, and Colle della Croce (Nocera Umbra, Perugia)	deciduous woods, shrublands, grasslands	1,300–1,548	43.097945°N, 12.882154°E	25 June 2021; 26 June 2021
E	Marche. Colle Grugnoleta and Monte Finiglia, northern and north-eastern slopes (Fiuminata, Macerata)	deciduous woods, clearings, hygrophilous vegetation, humid environments	680–1,250	43.122359°N, 12.886932°E	26 June 2021

Anthoxanthum ovatum Lag. and the hybrid *Brachypodium retusum* × *B. rupestre* are new to the flora of Marche.

Six taxa are new to the flora of Umbria: *Anthoxanthum ovatum*, *Dianthus carthusianorum* L. subsp. *carthusianorum*, *Erysimum apenninum* Peccenini & Polatschek, *Hieracium pseudogrovesianum* Gottschl., *Koeleria lucana* Brullo, Giusso & Miniss., *Koeleria pyramidata* (Lam.) P.Beauv.

Four taxa are confirmed for the flora of Umbria: *Cynanchica pyrenaica* (L.) P.Caputo & Del Guacchio subsp. *neglecta* (Guss.) P.Caputo & Del Guacchio, *Polygala nicaeensis* Risso ex W.D.J.Koch subsp. *italiana* (Chodat) Arrigoni, *Stachys germanica* L. subsp. *germanica*, *Trigonella elegans* (Salzm. ex Ser.) Coulot & Rabaute.

Discussion

In the Mount Pennino massif, 413 taxa (species and subspecies) were found. Forty–two of them (10.2% of the total floristic list) are currently included in the IUCN Red List of the Italian Flora (Orsenigo et al. 2018, 2020), 36 of which are endemic (26 Least Concern, 9 Data Deficient, and one Nearly Threatened). Only the recently recognised endemic *Siler montanum* Crantz subsp. *stabianum* (Lacaita) F.Conti & Bartolucci is not included in the Red List. Conversely, only three taxa are alien.

Eleven floristic novelties were reported for the floras of Marche and/or Umbria.

Our records from Umbria and Marche extend the findings of *Anthoxanthum ovatum* in central Italy. Before this study, its Italian distribution was indeed restricted to Toscana, Campania (historical record), Calabria, Sicilia, and Sardegna (Bartolucci et al. 2024).

The records of *Dianthus carthusianorum* subsp. *carthusianorum*, *Erysimum apenninum*, and *Hieracium pseudogrovesianum* in Umbria, as well as the confirmation of *Cynanchica pyrenaica* subsp. *neglecta*, *Stachys germanica* subsp. *germanica*, and *Trigonella elegans* fill a gap in the regional distribution of these taxa in central Italy.

Polygala nicaeensis subsp. *italiana* was reported only for Emilia–Romagna and Toscana, while it is considered doubtful in Piemonte, not confirmed in San Marino (Bartolucci et al. 2024), and one historical record was known for Umbria ("In Appennino Umbro, *leg.* Piccinini 1865" (FI); see Arrigoni 2014).

Our findings of the endemic *Koeleria lucana* in Umbria are noteworthy because they are currently the northernmost records of its distribution range (Bartolucci et al. 2024).

The natural hybrid between *Brachypodium retusum* and *B. rupestre* known also in Toscana (Bonari et al. 2019), was found near the top of Mount Pennino and is reported for the first time in the Marche region.

Some of the specimens collected in the study area, preliminarily attributed to *Centaurea arrigonii* Greuter, require additional investigations aimed at clarifying their taxonomic identity.

In conclusion, the finding of eleven floristic novelties, the percentage of Italian endemic and Red List taxa in the study area, slightly higher than that of other similar mountain territories in the central Apennines (Ballelli et al. 2002, 2020), as well as their number in the Umbrian sector (30, i.e. the 25% of the Italian endemic taxa occurring in Umbria (see Bartolucci et al. 2024) suggest a high conservation value of the flora in this sector of Umbria-Marche Apennines. For this reason and considering that the floristic survey lasted only two and a half days, the study area deserves further investigation.

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Supplementary material 1

Supplementary data

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Data type: docx

Explanation note: 1. Participants in the field trip of the Working Group for Floristics, Systematics, and Evolution of the Italian Botanical Society (24–26 June 2021). 2. Public and private herbaria in which the collected exsiccata are stored. Codes of public herbaria follow the Index Herbariorum (available at http://sweetgum.nybg.org). 3. Inventory of the taxa collected during the field trip held in 2021 in Mount Pennino massif (Umbria-Marche, central Italy). The code of the sampling site (see Table 1 in the main text) and Herbaria (in brackets; code in Suppl. material 1: 2).

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