

Contribution to the knowledge of the bryological flora of Molise (Southern Italy)

Silvio Scortegagna¹

¹ Viale Europa Unita, 86/B, I-36015 Schio (Vicenza), Italy

Corresponding author: Silvio Scortegagna (si.sco@libero.it)

Academic editor: Lorenzo Peruzzi | Received 2 December 2024 | Accepted 17 December 2024 | Published 27 December 2024

Citation: Scortegagna S (2024) Contribution to the knowledge of the bryological flora of Molise (Southern Italy). Italian Botanist 18: 259–270. <https://doi.org/10.3897/italianbotanist.18.143357>

Abstract

Molise is one of the least known Italian administrative regions from a bryological point of view. The data collected during some bryological excursions in Molise are here reported. The list includes 88 species, of which 26 are new or confirmed for the regional flora: *Antitrichia curtispindula*, *Cryphaea heteromalla*, *Dialytrichia mucronata*, *Eurhynchium striatum*, *Fabronia pusilla*, *Frullania tamarisci*, *Fontinalis antipyretica*, *Gymnostomum aeruginosum*, *Isoetecium myosuroides*, *Leptodon smithii*, *Lewinskya speciosa*, *Marchantia quadrata*, *Neckera pumila*, *Nogopterium gracile*, *Oxyrrhynchium hians*, *Plagiomnium rostratum*, *Plagiothecium nemorale*, *Plasteurhynchium striatulum*, *Porella arboris-vitae*, *Schistidium crassipilum*, *Scleropodium touretii*, *Scorpiurium circinatum*, *Syntrichia papillosa*, *Syntrichia virescens*, *Thuidium tamariscinum*, *Tortella flavovirens* var. *flavovirens*.

Keywords

Bryophytes, Molise, southern Italy, Biodiversity, Floristic data

Introduction

According to the most recent checklist of the Italian Bryological Flora (Aleffi et al. 2023), Molise is, together with Basilicata, the least known Italian administrative region with regard to this systematic group. At the time of publication of the checklist, in fact, only 157 species of mosses and 25 of liverworts and hornworts were known, with a negligible increase in knowledge compared to the checklists of the end of the last century (Cortini Pedrotti 1992; Aleffi and Schumacker 1995). For comparison, the Italian bryological flora consists of 1220 species in total, of which 301 are liverworts and hornworts and 919 moss species, excluding subspecies and varieties.

This contribution collects miscellaneous data from some excursions in Molise, with the aim of filling, at least in part, this gap.

Materials and methods

The records of bryophytes collected during some excursions in Molise are listed. All specimens were collected and identified by the author and are preserved in his personal herbarium. Nomenclature and regional distribution are consistent with the checklist of the Italian Bryological Flora by Aleffi et al. (2023). The collection sites and the main ecological data for all specimens are reported in the floristic inventory. Species new or confirmed for Molise are marked by an asterisk.

The samples were collected in the following sites. Geological notes are taken from the Geological Map of Italy at a scale of 1:100,000, sheets 148 – Vasto, 153 – Agnone, 161 – Isernia, and 162 – Campobasso.

- Collemeluccio (Pescolanciano – Isernia): forest with a prevalence of silver fir with turkey oak and beech in the cooler exposures. Schistose sandstones, limestones, marls and clays (Miocene).
- Surroundings of Carpinone (Isernia): hills, ravines and waterfalls along the Carpino stream and its tributaries. Scaly limestones and marls (Cretaceous), whitish calcarenites and breccias alternating with marls and clays (Eocene-Oligocene), marls, flint limestones and calcarenites (Eocene-Miocene).
- M. Capraro, surroundings of the Garden of the Apennine Flora of Capracotta (Isernia): beech forests, shrubs, pastures and rocks. Organogenic limestones and calcareous marls (Miocene).
- Montedimezzo (Vastogirardi – Isernia): forest dominated by turkey oak, beech, locally with silver fir plantations. Scaly limestones, marls, clays, with calcirudites and calcarenites in the upper part (Oligocene).
- Petacciato Marina (Petacciato – Campobasso): coastal sand dunes (Pleistocene).
- S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia): surroundings of the Abbey and agricultural and forestry environments adjacent to the sources of the Volturno river. Travertines and Quaternary deposits.
- Saepinum-Altilia (Saepinum – Campobasso): Archaeological site of a Roman settlement at the foot of the Matese Massif. Fluvial-lacustrine deposits consisting of yellowish marls and incoherent sands (Quaternary).
- Santuario Italico di Pietrabbondante (Isernia): Archaeological site of a monumental Samnite cult complex built with limestone blocks. Micaceous sandstones alternating with silty clays with arenaceous lenses (Miocene).
- Valle Fiorita, Le Mainarde (Pizzone – Isernia): beech forests and pastures on dolomitic or calcareous-dolomitic substrate (Jurassic), micritic limestones (Jurassic – Cretaceous) and Quaternary moraine deposits.
- Venafro (Isernia): urban center.

Floristic inventory

MARCHANTIIDAE

Apopellia endiviaefolia (Dicks.) Nebel & D.Quandt (Pelliaceae) – Collemeluccio (Pescolanciano – Isernia), 41.713289°N, 14.341452°E, m 910, stream, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.596206°N, 14.325515°E, m 660, riverbed, 22 July 2023.

Conocephalum conicum (L.) Lindb. (Conocephalaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595795°N, 14.325796°E, m 670, wet limestone, 22 July 2023.

Frullania dilatata (L.) Dumort. (Frullaniaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023; Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691022°N, 13.970888°E, m 1480, *Acer pseudoplatanus* bark, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595127°N, 14.327225°E, m 660, *Acer campestre* bark, 22 July 2023; S. Donato (Carpinone – Isernia), 41.606914°N, 14.324097°E, m 840, *Ulmus minor* bark, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759301°N, 14.213789°E, m 1040, *Fagus sylvatica* bark, 23 July 2023; Venafro (Isernia), 41.483172°N, 14.038686°E, m 250, *Ligustrum lucidum* bark, 24 July 2023.

**Frullania tamarisci* (L.) Dumort. (Frullaniaceae) – Collemeluccio (Pescolanciano – Isernia), 41.710659°N, 14.347213°E, m 960, *Quercus cerris* bark, 21 July 2023. Species confirmed for the bryoflora of Molise. Epiphytic species, reported in all Italian regions although not recently confirmed everywhere.

Lejeunea cavifolia (Ehrh.) Lindb. (Lejeuneaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, limestone in a gorge, 22 July 2023.

Lophocolea heterophylla (Schrad.) Dumort. (Lophocoleaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708221°N, 14.353014°E, m 920, rotting stump, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.765041°N, 14.215632°E, m 1030, rotting log, 23 July 2023.

**Marchantia quadrata* Scop. (Marchantiaceae) – Montedimezzo (Vastogirardi – Isernia), 41.760218°N, 14.210153°E, m 1010, limestone, 23 July 2023. Species new for the bryoflora of Molise. Common lithophilous species, occurring in almost all Italian regions.

Metzgeria furcata (L.) Dumort. (Metzgeriaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691242°N, 13.970067°E, m 1570, *Fagus sylvatica* bark, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.708232°N, 14.352978°E, m 930, *Pyrus pyraster* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595902°N, 14.325103°E, m 640, *Acer campestre* bark, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.760078°N, 14.207411°E, m 990, *Abies alba* bark, 23 July 2023.

Plagiochila porelloides (Torrey ex Nees) Lindenb. var. *porelloides* (Plagiochilaceae) – Montedimezzo (Vastogirardi – Isernia), 41.759652°N, 14.215372°E, m 1050, *Fagus sylvatica* forest, 23 July 2023.

- **Porella arboris-vitae* (With.) Grolle (Porellaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595899°N, 14.325057°E, m 630, limestone in a gorge, 22 July 2023. Species new for the bryoflora of Molise. Occurring in most Italian regions but less widespread in the southern ones (absent in Apulia and Basilicata, no recent confirmation in Calabria and Sicily).
- Porella cordaeana* (Huebener) Moore (Porellaceae) – Collemeluccio (Pescolanciano – Isernia), 41.709271°N, 14.348962°E, m 960, *Acer campestre* bark, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.757923°N, 14.222516°E, m 1090, *Fagus sylvatica* bark, 23 July 2023.
- Porella platyphylla* (L.) Pfeiff. (Porellaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.692884°N, 13.976827°E, m 1460, *Fagus sylvatica* bark, 20 July 2023; Carpinone (Carpinone – Isernia), 41.594300°N, 14.327743°E, m 650, limestone, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759582°N, 14.215802°E, m 1040, *Fagus sylvatica* bark, 23 July 2023.
- Radula complanata* (L.) Dumort. (Radulaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595902°N, 14.325103°E, m 640, *Acer campestre* bark, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.757968°N, 14.220791°E, m 1090, *Acer campestre* bark, 23 July 2023.

BRYIDAE

- Alleniella complanata* (Hedw.) S.Olsson, Enroth & D.Quandt (Neckeraceae) – Collemeluccio (Pescolanciano – Isernia), 41.708764°N, 14.355037°E, m 910, *Abies alba* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595902°N, 14.325080°E, m 630, *Acer campestre* bark, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759652°N, 14.216534°E, m 1050, *Fagus sylvatica* bark, 23 July 2023.
- Anomodon viticulosus* (Hedw.) Hook & Taylor (Anomodontaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.711649°N, 14.344926°E, m 960, sandstone in *Quercus cerris* forest, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.596139°N, 14.325433°E, m 620, limestone in riverbed, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.764931°N, 14.224414°E, m 1080, limestone in *Fagus sylvatica* forest, 23 July 2023.
- **Antitrichia curtipendula* (Hedw.) Brid. (Antitrichaceae) – Montedimezzo (Vastogirardi – Isernia), 41.758233°N, 14.219474°E, m 1060, *Fagus sylvatica* bark, 23 July 2023. Species confirmed for the bryoflora of Molise. Occurring in all central-southern regions except Umbria and without confirmation also in Apulia. It is an indicator species of “forest continuity” and therefore typical of old-growth forests even in the Mediterranean environment (Brunialti et al. 2010).
- Barbula unguiculata* Hedw. (Pottiaceae) – Carpinone (Isernia), 41.595265°N, 14.327999°E, m 650, limestone, 22 July 2023.
- Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen (Brachytheciaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691242°N, 13.970067°E, m

- 1570, rotting stump, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.708221°N, 14.353014°E, m 920, rotting stump, 21 July 2023.
- Brachythecium glareosum* (Bruch ex Spruce) Schimp. (Brachytheciaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, limestone in a gorge, 22 July 2023.
- Brachythecium tommasinii* (Sendtn. ex Boulay) Ignatov & Huttunen (Brachytheciaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023.
- Calliergonella cuspidata* (Hedw.) Loeske (Pylaisiaceae) – Montedimezzo (Vastogirardi – Isernia), 41.760474°N, 14.209178°E, m 990, wet meadow, 23 July 2023.
- Cirriphyllum crasinervium* (Taylor) Loeske & M.Fleisch (Brachytheciaceae) – Collemeluccio (Pescolanciano – Isernia), 41.712074°N, 14.343940°E, m 940, sandstone in *Quercus cerris* forest, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, gorge, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759987°N, 14.207582°E, m 990, sandstone in *Abies alba* forest, 23 July 2023.
- Cratoneuron filicinum* (Hedw.) Spruce (Amblystegiaceae) – M. Capraro (Capracotta – Isernia), 41.808247°N, 14.258868°E, m 1430, fountain, 21 July 2023; S. Pietro Avellana (Isernia), 41.791451°N, 14.182452°E, m 960, fountain, 23 July 2023.
- **Cryphaea heteromalla* (Hedw.) D.Mohr (Cryphaeaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023. Species new for the bryoflora of Molise. Uncommon species in central-southern Italy, absent or not confirmed in Umbria, Marche, Apulia and Basilicata.
- Ctenidium molluscum* (Hedw.) Mitt. (Myuriaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595899°N, 14.325057°E, m 630, limestone in a gorge, 22 July 2023.
- **Dialytrichia mucronata* (Brid.) Broth. (Pottiaceae) – Carpino Waterfall (Carpinone – Isernia), 41.596167°N, 14.325479°E, m 670, riverbed, 22 July 2023. Species new for the bryoflora of Molise. Widespread in most of Italy but, in the South, absent or not confirmed in Apulia, Basilicata and Calabria.
- Dicranum scoparium* Hedw. (Dicranaceae) – Montedimezzo (Vastogirardi – Isernia), 41.765284°N, 14.214614°E, m 1000, *Fagus sylvatica* forest, 23 July 2023.
- Didymodon acutus* (Brid.) K.Saito (Pottiaceae) – M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023.
- Encalypta streptocarpa* Hedw. (Encalyptaceae) – M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023.
- Eucladium verticillatum* (Brid.) Bruch & Schimp. (Pottiaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595725°N, 14.326035°E, m 630, limestone in a gorge, 22 July 2023.
- **Eurhynchium striatum* (Hedw.) Schimp. (Brachytheciaceae) – Montedimezzo (Vastogirardi – Isernia), 41.759432°N, 14.216534°E, m 1060, soil in *Fagus sylvatica* forest, 23 July 2023. Species new for the bryoflora of Molise. Common and widespread species, recorded for all Italian regions except Molise but not recently confirmed in Basilicata.
- Exsertotheca crispa* (Hedw.) S.Olsson, Enroth & D.Quandt (Neckeraceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023; Collemeluccio (Pescolanciano

- Isernia), 41.708429°N, 14.352935°E, m 900, *Abies alba* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595709°N, 14.324656°E, m 640, limestone in a gorge, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.760078°N, 14.207411°E, m 990, *Abies alba* bark, 23 July 2023.
- **Fabronia pusilla* Raddi (Fabroniaceae) – S. Donato (Carpinone – Isernia), 41.606914°N, 14.324097°E, m 840, *Ulmus minor* bark, 22 July 2023; Venafro (Isernia), 41.483807°N, 14.038659°E, m 250, *Quercus ilex* bark, 24 July 2023. Species new for the bryoflora of Molise. Epiphytic species, recorded for all southern Italian regions except Molise, and not recently confirmed in Apulia.
- Fissidens taxifolius* Hedw. (Fissidentaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708421°N, 14.352954°E, m 910, soil in *Abies alba* and *Quercus cerris* forest, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.763878°N, 14.214164°E, m 1020, slope, 23 July 2023.
- Flexitrichum flexicaule* (Schwägr.) Ignatov & Fedosov (Flexitrichaceae) – M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023.
- **Fontinalis antipyretica* Hedw. (Fontinalaceae) – Collemeluccio (Pescolanciano – Isernia), 41.713289°N, 14.341452°E, m 910, stream, 21 July 2023; Venafro (Isernia), 41.484137°N, 14.042546°E, m 220, stream, 24 July 2023. Species confirmed for the bryoflora of Molise. Typically rheophilic species, occurring in all regions, but not confirmed for Campania, and Basilicata in southern Italy.
- Grimmia pulvinata* (Hedw.) Sm. (Grimmiaceae) – Santuario Italico (Pietrabbondante – Isernia), 41.73965°N, 14.38737°E, m 1010, wall, 21 July 2023; Carpino (Isernia), 41.593098°N, 14.328484°E, m 680, 22 July 2023; Archaeological site of Saepinum-Altilia (Sepino – Campobasso), 41.432723°N, 14.618568°E, travertine, m 550, 22 July 2023.
- **Gymnostomum aeruginosum* Sm. (Pottiaceae) – Montedimezzo (Vastogirardi – Isernia), 41.759640°N, 14.212513°E, m 1040, road embankment, 23 July 2023. Species new for the bryoflora of Molise. Lithophilous species, quite common in northern Italy but absent or not confirmed for Umbria, Lazio, Campania, and Basilicata in central-southern Italy.
- Homalothecium lutescens* (Hedw.) H. Rob. (Brachytheciaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023; M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023; Carpino (Isernia), 41.594312°N, 14.327453°E, m 630, limestone, 22 July 2023.
- Homalothecium sericeum* (Hedw.) Schimp. (Brachytheciaceae) – S. Vincenzo al Volturno (Rocchetta al Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023; Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691090°N, 13.973024°E, m 1500, limestone in *Fagus sylvatica* forest, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.708115°N, 14.353047°E, m 940, *Fagus sylvatica* bark, 21 July 2023; Carpino (Isernia), 41.593418°N, 14.326554°E, m 650, limestone, 22 July 2023; Archaeological site of Saepinum-Altilia (Sepino – Campobasso), 41.432934°N, 14.618218°E, *Quercus ilex* bark, m 550, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759825°N, 14.210826°E, m 1020, *Quercus cerris* bark, 23 July 2023.

- Hypnum andoi* A.J.E.Sm. (Hypnaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023; Collemeluccio (Pescolaniano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.596139°N, 14.325433°E, m 620, riverbed, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.760078°N, 14.207411°E, m 990, *Abies alba* bark, 23 July 2023.
- Hypnum cupressiforme* Hedw. var. *cupressiforme* (Hypnaceae) – Archaeological site of Saepinum-Altilia (Sepino – Campobasso), 41.432880°N, 14.618264°E, m 540, wall, 22 July 2023.
- Isothecium alopecuroides* (Dubois) Isov. (Lembophyllaceae) – Collemeluccio (Pescolaniano – Isernia), 41.708764°N, 14.355037°E, m 910, *Abies alba* bark, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759301°N, 14.213789°E, m 1040, *Fagus sylvatica* bark, 23 July 2023.
- **Isothecium myosuroides* Brid. (Lembophyllaceae) – Collemeluccio (Pescolaniano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023. Species new for the bryoflora of Molise. Uncommon and localized species, absent in Abruzzo and Basilicata, concerning southern Italy.
- Kindbergia praelonga* (Hedw.) Ochyra (Brachytheciaceae) – Collemeluccio (Pescolaniano – Isernia), 41.708421°N, 14.352954°E, m 910, soil in *Abies alba* and *Quercus cerris* forest, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595795°N, 14.325796°E, m 670, limestone (riverbed), 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759266°N, 14.213635°E, m 1040, *Fagus sylvatica* forest, 23 July 2023.
- **Leptodon smithii* (Hedw.) F.Weber & D.Mohr (Neckeraceae) – Collemeluccio (Pescolaniano – Isernia), 41.710659°N, 14.347213°E, m 960, *Quercus cerris* bark, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595746°N, 14.326148°E, m 640, limestone in a gorge, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.763857°N, 14.214217°E, m 1010, *Acer campestre* bark, 23 July 2023; Venafro (Isernia), 41.483985°N, 14.038472°E, m 240, *Quercus ilex* bark, 24 July 2023. Species new for the bryoflora of Molise. Epiphytic and lithophilous species, common and sometimes abundant, especially on bark, more common and occurring in all the regions of southern Italy.
- Lescuraea incurvata* (Hedw.) E.Lawton (Leskeaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023.
- Leucodon sciuroides* (Hedw.) Schwägr. (Leucodontaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023; Carpino Valley, Schioppo Waterfall (Carpinone – Isernia), 41.592008°N, 14.329460°E, m 680, *Acer campestre* bark, 22 July 2023; Archaeological site of Saepinum-Altilia (Sepino – Campobasso), 41.432880°N, 14.618264°E, *Quercus ilex* bark, m 550, 22 July 2023.
- Lewinskya affinis* (Schrad. ex Brid.) F.Lara, Garilleti & Goffinet (Orthotrichaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023.

- **Lewinskya speciosa* (Nees) F.Lara, Garilleti & Goffinet (Orthotrichaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708232°N, 14.352978°E, m 930, *Pyrus pyraster* bark, 21 July 2023. Species new for the bryoflora of Molise. Epiphytic species, widespread, albeit scattered, throughout Italy. It is absent in Umbria, Apulia, and Sardinia, and is not confirmed for Lazio.
- Lewinskya striata* (Hedw.) F.Lara, Garilleti & Goffinet (Orthotrichaceae) – S. Vincenzo al Volturno (Rocchetta a Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023; Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691690°N, 13.976543°E, m 1450, *Fagus sylvatica* bark, 20 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.757283°N, 14.227680°E, m 1110, *Hedera helix* bark, 23 July 2023.
- Mnium stellare* Hedw. (Mniaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691090°N, 13.973024°E, m 1500, limestone in *Fagus sylvatica* forest, 20 July 2023.
- **Neckera pumila* Hedw. (Neckeraceae) – Collemeluccio (Pescolanciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.758233°N, 14.219474°E, m 1060, *Fagus sylvatica* bark, 23 July 2023. Species new for the bryoflora of Molise. Rare species, associated with well-preserved forest environments. In southern Italy it occurs only in Abruzzo, Campania, Apulia, Calabria, and the major islands.
- **Nogopterium gracile* (Hedw.) Crosby & W.R.Buck (Leucodontaceae) – Collemeluccio (Pescolanciano – Isernia), 41.711649°N, 14.344926°E, m 960, sandstone in *Quercus cerris* forest, 21 July 2023. Species new for the bryoflora of Molise. Species occurring in all central-southern Italian regions, although not confirmed in Abruzzo.
- Orthotrichum anomalum* Hedw. (Orthotrichaceae) – Santuario Italice (Pietrabbondante – Isernia), 41.73965°N, 14.38737°E, m 1010, limestone wall, 21 July 2023.
- Orthotrichum cupulatum* Hoffm. ex Brid. var. *cupulatum* (Orthotrichaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023; Santuario Italice (Pietrabbondante – Isernia), 41.73965°N, 14.38737°E, m 1010, limestone wall, 21 July 2023.
- Orthotrichum diaphanum* Schrad. ex Brid. (Orthotrichaceae) – S. Donato (Carpinone – Isernia), 41.596139°N, 14.324110°E, m 820, *Acer campestre* bark, 22 July 2023.
- Orthotrichum stramineum* Hornsch. ex Brid. (Orthotrichaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691022°N, 13.970888°E, m 1480, *Acer pseudoplatanus* bark, 20 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759301°N, 14.213789°E, m 1040, *Fagus sylvatica* bark, 23 July 2023.
- **Oxyrrhinchium hians* (Hedw.) Loeske (Brachytheciaceae) – Carpinone Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, gorge, 22 July 2023. Species new for the bryoflora of Molise. A common species throughout Italy and occurring in all regions.
- Palustriella commutata* (Hedw.) Ochyra (Amblystegiaceae) – Carpinone Valley, Schioppo Waterfall (Carpinone – Isernia), 41.592292°N, 14.331917°E, m 690, travertine, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.760378°N, 14.210020°E, m 1040, fountain, 23 July 2023; S. Pietro Avellana (Isernia), 41.791451°N, 14.182452°E, m 960, fountain, 23 July 2023.

- Plagiomnium affine* (Blandow ex Funck) T.J.Kop. (Mniaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595795°N, 14.325796°E, m 670, limestone, 22 July 2023.
- **Plagiomnium rostratum* (Schrad.) T.J.Kop. (Mniaceae) – Carpino Waterfall (Carpinone – Isernia), 41.596167°N, 14.325479°E, m 670, riverbed, 22 July 2023. Species new for the bryoflora of Molise. A very common species throughout Italy and occurring in all regions.
- Plagiomnium undulatum* (Hedw.) T.J.Kop. (Mniaceae) – Montedimezzo (Vastogirardi – Isernia), 41.760218°N, 14.210153°E, m 1020, wet slope, 23 July 2023.
- **Plagiothecium nemorale* (Mitt.) A.Jaeger (Plagiotheciaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691090°N, 13.973024°E, m 1500, limestone in *Fagus sylvatica* forest, 20 July 2023. Species new for the bryoflora of Molise. Very common in northern Italy, it is however not so widespread in the South, where it occurs only in Campania, Calabria, Sardinia, and Sicily.
- Plasteurhynchium meridionale* (Schimp.) M.Fleisch (Brachytheciaceae) – Carpino Valley, Schioppo Waterfall (Carpinone – Isernia), 41.591650°N, 14.328361°E, m 680, limestone in *Quercus cerris* forest, 22 July 2023.
- **Plasteurhynchium striatulum* (Spruce) M.Fleisch (Brachytheciaceae) – Collemeluccio (Pescolanciano – Isernia), 41.711649°N, 14.344926°E, m 960, sandstone in *Quercus cerris* forest, 21 July 2023. Species new for the bryoflora of Molise. A very common lithophilous species throughout Italy and occurring in all regions.
- Pseudoscleropodium purum* (Hedw.) M.Fleisch (Brachytheciaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708421°N, 14.352954°E, m 910, *Abies alba* and *Quercus cerris* forest, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, gorge (soil), 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.760474°N, 14.209178°E, m 990, meadow, 23 July 2023.
- Pterigynandrum filiforme* Hedw. (Pterigynandraceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691690°N, 13.976543°E, m 1450, *Fagus sylvatica* bark, 20 July 2023; Collemeluccio (Pescolanciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759652°N, 14.216534°E, m 1050, *Fagus sylvatica* bark, 23 July 2023.
- Ptychostomum capillare* (Hedw.) Holyoak & N.Pedersen (Bryaceae) – Petacciato Marina (Petacciato – Campobasso), 42.03455°N, 14.856025°E, coastal sand dune, 24 July 2023.
- Ptychostomum imbricatum* (Müll.Hal.) Holyoak & N.Pedersen (Bryaceae) – M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023; Petacciato Marina (Petacciato – Campobasso), 42.03455°N, 14.856025°E, coastal sand dune, 24 July 2023.
- Pulviger a lyellii* (Hook. et Taylor) Plášek, Sawicki & Ochyra (Orthotrichaceae) – Collemeluccio (Pescolanciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.759301°N, 14.213789°E, m 1040, *Fagus sylvatica* bark, 23 July 2023.
- Rhynchostegiella tenella* (Dicks.) Limpr. (Brachytheciaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595746°N, 14.326148°E, m 640, limestone in a gorge, 22 July 2023; Venafro (Isernia), 41.484437°N, 14.040032°E, m 240, wall, 24 July 2023.

- Rhynchostegium murale* (Hedw.) Schimp. (Brachytheciaceae) – Le Mainarde, Valle Fiorita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus sylvatica* forest, 20 July 2023.
- Rhynchostegium riparioides* (Hedw.) Cardot (Brachytheciaceae) – M. Capraro (Capracotta – Isernia), 41.808247°N, 14.258868°E, m 1430, fountain, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.596167°N, 14.325479°E, m 670, riverbed, 22 July 2023.
- Schistidium apocarpum* (Hedw.) Bruch & Schimp. (Grimmiaceae) – M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023.
- **Schistidium crassipilum* H.H.Blom (Grimmiaceae) – S. Donato (Carpinone – Isernia), 41.597420°N, 14.327143°E, m 710, limestone, 22 July 2023. Species new for the bryoflora of Molise. The Italian distribution of this species is not yet fully known, although it occurs in all southern regions.
- Sciuro-hypnum reflexum* (Starke) Ignatov & Huttunen (Brachytheciaceae) – Montedimezzo (Vastogirardi – Isernia), 41.765041°N, 14.215632°E, m 1030, rotting log, 23 July 2023.
- **Scleropodium touretii* (Brid.) L.F.Koch (Brachytheciaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595117°N, 14.327231°E, m 650, gorge, 22 July 2023. Species new for the bryoflora of Molise. Occurring in all southern Italian regions.
- **Scorpiurium circinatum* (Bruch.) M.Fleisch. & Loeske (Brachytheciaceae) – Carpino Waterfall (Carpinone – Isernia), 41.595797°N, 14.325848°E, m 670, travertine, 22 July 2023; Carpino Valley, Schioppo Waterfall (Carpinone – Isernia), 41.592322°N, 14.331873°E, m 700, travertine, 22 July 2023; Venafro (Isernia), 41.484437°N, 14.040032°E, m 240, wall, 24 July 2023. Species new for the bryoflora of Molise. Species widespread throughout Italy and occurring in all southern regions.
- **Syntrichia papillosa* (Wilson) Jur. (Pottiaceae) – S. Vincenzo al Volturno (Rocchetta al Volturno – Isernia), 41.648760°N, 14.084814°E, m 540, *Populus nigra* bark, 20 July 2023. Species new for the bryoflora of Molise. This is a species that becomes progressively rarer in southern Italy, where it occurs only in Abruzzo, Basilicata, Calabria, and Sicily.
- Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr var. *ruralis* (Pottiaceae) – Santuario Italicco (Pietrabbondante – Isernia), 41.73965°N, 14.38737°E, m 1010, limestone wall, 21 July 2023; M. Capraro (Capracotta – Isernia), 41.808316°N, 14.259019°E, m 1420, limestone, 21 July 2023; Carpinone (Isernia), 41.593875°N, 14.326723°E, m 650, 22 July 2023; Archaeological site of Saepinum-Altília (Sepino – Campobasso), 41.432878°N, 14.6182798°E, soil, m 550, 22 July 2023; Montedimezzo (Vastogirardi – Isernia), 41.764896°N, 14.225773°E, m 1090, *Fagus sylvatica* bark, 23 July 2023; Venafro (Isernia), 41.483905°N, 14.039010°E, m 240, wall, 24 July 2023.
- **Syntrichia virescens* (De Not.) Ochyra (Pottiaceae) – S. Donato (Carpinone – Isernia), 41.606914°N, 14.324097°E, m 840, *Ulmus minor* bark, 22 July 2023. Species new for the bryoflora of Molise. Epiphytic species with very irregular distribution in Italy. It is recorded only for Abruzzo, Apulia, Sardinia, and Sicily in southern Italy.

- Thamnobryum alopecurum* (Hedw.) Gangulee (Neckeraceae) – Collemeluccio (Pescolan-
ciano – Isernia), 41.712074°N, 14.343940°E, m 940, sandstone in *Quercus cer-
ris* forest, 21 July 2023; Carpino Waterfall (Carpinone – Isernia), 41.595959°N,
14.325360°E, m 610, limestone in a gorge, 22 July 2023; Montedimezzo (Vasto-
girardi – Isernia), 41.758205°N, 14.219485°E, m 1060, limestone, 23 July 2023.
- **Thuidium tamariscinum* (Hedw.) Schimp. (Thuidiaceae) – Collemeluccio (Pescolan-
ciano – Isernia), 41.708421°N, 14.352954°E, m 910, *Abies alba* and *Quercus cerris*
forest, 21 July 2023. Species new for the bryoflora of Molise. Common species in
northern Italy, it is becoming increasingly rare southwards, where it is confirmed
only for Abruzzo. It is not confirmed in Campania, Apulia, and Calabria.
- **Tortella flavovirens* (Bruch.) Broth. var. *flavovirens* (Pottiaceae) – Petacciato Marina
(Petacciato – Campobasso), 42.03455°N, 14.856025°E, coastal sand dune, 24
July 2023. Species new for the bryoflora of Molise. Psammophilous species, wide-
spread on coastal dunes and recorded for all coastal regions.
- Tortella tortuosa* (Hedw.) Limpr. var. *tortuosa* (Pottiaceae) – Le Mainarde, Valle Fior-
ita (Pizzone – Isernia), 41.691701°N, 13.977099°E, m 1450, limestone in *Fagus
sylvatica* forest, 20 July 2023; M. Capraro (Capracotta – Isernia), 41.808316°N,
14.259019°E, m 1420, limestone, 21 July 2023.
- Trichostomum brachydontium* Bruch (Pottiaceae) – Carpino Valley, Schioppo Waterfall
(Carpinone – Isernia), 41.592337°N, 14.331937°E, m 690, limestone in a gorge, 22
July 2023; Venafro (Isernia), 41.484437°N, 14.040032°E, m 240, wall, 24 July 2023.
- Zygodon rupestris* Schimp. ex Lorentz (Orthotrichaceae) – Collemeluccio (Pescolan-
ciano – Isernia), 41.708628°N, 14.352580°E, m 920, *Abies alba* bark, 21 July 2023;
Montedimezzo (Vastogirardi – Isernia), 41.760047°N, 14.207716°E, m 1010,
Juglans regia bark, 23 July 2023; Venafro (Isernia), 41.483807°N, 14.038659°E,
m 230, *Quercus ilex* bark, 24 July 2023.

Discussion

In total, 88 species of bryophytes (13 liverworts and 75 mosses) were found. Of these, 23 are new to the flora of Molise (Aleffi et al. 2023): *Marchantia quadrata*, *Porella arboris-vitae*, *Cryphaea heteromalla*, *Dialytrichia mucronata*, *Eurhynchium striatum*, *Fabronia pusilla*, *Gymnostomum aeruginosum*, *Isothecium myosuroides*, *Leptodon smithii*, *Lewinskya speciosa*, *Neckera pumila*, *Nogopterium gracile*, *Oxyrrhynchium hians*, *Plagiomnium rostratum*, *Plagiothecium nemorale*, *Plasteurhynchium striatulum*, *Schistidium crassipilum*, *Scleropodium touretii*, *Scorpiurium circinatum*, *Syntrichia papillosa*, *Syntrichia virescens*, *Thuidium tamariscinum*, *Tortella flavovirens* var. *flavovirens*. Three species are confirmed for the region (Aleffi et al. 2023): *Frullania tamarisci*, *Antitrichia curtipendula*, *Fontinalis antipyretica*.

All observed species are classified as LC (Least Concern) in the European Red List (Hodgetts et al. 2019) and in the Italian Red-Lists of liverworts (Puglisi et al. 2023) and mosses (Puglisi et al. 2024). In most cases, these species are widely distributed in other regions of central-southern Italy. Less common, and missing from many southern re-

gions, are instead *Porella arboris-vitae*, *Isothecium myosuroides*, and *Syntrichia virescens*. Noteworthy is the presence of *Antitrichia curtipendula* and *Neckera pumila*, two species linked to mature or even old-growth forests, that are locally abundant in the two Natural Reserves of Collemeluccio and Montedimezzo.

Acknowledgements

Financial support by Fondazione per la Flora Italiana for the publication fee is gratefully acknowledged.

References

- Aleffi M, Schumacker R (1995) Check-list and red-list of the liverworts (Marchantiophyta) and hornworts (Anthocerotophyta) of Italy. *Flora Medit.* 5: 73–161.
- Aleffi M, Cogoni A, Poponessi S (2023) An updated Checklist of the Bryophytes of Italy, including the Republic of San Marino and Vatican City State. *Plant Biosystems* 157(6): 1259–1307. <https://doi.org/10.1080/11263504.2023.2284136>
- Brunialti G, Frati L, Aleffi M, Marignani M, Rosati L, Burrascano S, Ravera S (2010) Lichens and bryophytes as indicators of old-growth features in Mediterranean forests. *Plant Biosystems* 144(1): 221–233. <https://doi.org/10.1080/11263500903560959>
- Cortini Pedrotti C (1992) Check-list of the Mosses of Italy. *Flora Medit.* 2: 119–221.
- Hodgetts N, Cáliz M, Englefield E, Fettes N, Garcia Criado M, Patin L, Nieto A, Bergamini A, Bisang I, Baisheva E, Campisi P, Cogoni A, Hallingbäck T, Konstantinova N, Lockhart N, Sabovljevic M, Schnyder N, Schröck C, Sérgio C, Sim Sim M, Vrba J, Ferreira CC, Afonina O, Blockeel T, Blom H, Caspari S, Gabriel R, Garcia C, Garilleti R, Gonzalez Mancebo J, Goldberg I, Hedenäs L, Holyoak D, Hugonnot V, Huttunen S, Ignatov M, Ignatova E, Infante M, Juutinen R, Kiebacher T, Köckinger H, Kučera J, Lönnell N, Lüth M, Martins A, Maslovsky O, Papp B, Porley R, Rothero G, Söderström L, Ștefănuț S, Syrjanen K, Untereiner A, Vaňa JF, Vanderpoorten A, Vellak K, Aleffi M, Bates J, Bell N, Brugués M, Cronberg N, Denyer J, Duckett J, During HJ, Enroth J, Fedosov V, Flatberg K-I, Ganeva A, Gorski P, Gunnarsson U, Hassel K, Hespanhol H, Hill M, Hodd R, Hylander K, Ingerpuu N, Laaka-Lindberg S, Lara F, Mazimpaka V, Mežaka A, Müller F, Orgaz JD, Patiño J, Pilkington S, Puche F, Ros RM, Rumsey F, Segarra-Moragues JG, Seneca A, Stebel A, Virtanen R, Weibull H, Wilbraham J, Żarnowiec J (2019) A miniature world in decline: European Red List of Mosses, Liverworts and Hornworts. IUCN, Brussels, Belgium.
- Puglisi M, Campisi P, Aleffi M, Bacilliere G, Bonini I, Cogoni A, Dia MG, Miserere L, Privitera M, Tiburtini M, Poponessi S (2024) Red-list of Italian bryophytes. 2. Mosses. *Plant Biosystems* 158(5): 1031–1056. <https://doi.org/10.1080/11263504.2024.2386330>
- Puglisi M, Campisi P, Aleffi M, Bonini I, Cogoni A, Dia MG, Miserere L, Privitera M, Tiburtini M, Poponessi S (2023) Red-list of Italian bryophytes. 1. Liverworts and hornworts. *Plant Biosystems* 157(4): 746–757. <https://doi.org/10.1080/11263504.2023.2200791>