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ORIGINAL RESEARCH PAPER

An annotated checklist of macrofungi in broadleaf Mediterranean forests (NW Italy)

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Abstract

Three different broadleaf Mediterranean forests, each characterized by the dominance of *Castanea sativa*, *Quercus cerris*, and *Fagus sylvatica*, respectively, were intensively surveyed over 3 consecutive years to record a list of macrofungi. A total of 5,065 sporomata and 300 species (seven Ascomycota and 293 Basidiomycota) belonging to 18 orders, 59 families, and 117 genera were recorded. The ecology, community composition, and geographic distribution of the identified species are discussed and new records for Italy are also provided.

Keywords

fungi biodiversity; checklist; rare species; chestnut wood; oak wood; beech forest

Introduction

Fungi are among the most important organisms on Earth, both in terms of a high species richness and their functional roles in aquatic and terrestrial ecosystems. They play a crucial role in the nutrient cycles and establish important pathogenic and/or mutualistic interactions with plants and animals. In the soil system, fungi affect forest ecosystem functions by driving the carbon cycle, decomposing the organic matter, mediating nutrient and water uptake, and maintaining soil structure and forest food webs [1,2]. Thus far, our knowledge on fungal diversity is incomplete since only a small fraction (~100,000 spp.) of the estimated (~5.1 million spp.) existing species on Earth has been described [3–5]. This is due to the cryptic and ephemeral nature of the reproductive structures of macrofungi (named sporomata/fruitletting bodies [6]), as well as the need of a wide taxonomical knowledge for species identification and a high field sampling effort [7–10].

The knowledge of the macrofungal component represents a useful tool for the establishment of priorities for sites of conservation and an indicator of forest perturbations [11,12]. It has been widely demonstrated that environmental changes affect the species richness and composition of the macrofungal communities [13,14].

In this study, we report the results achieved by mycological investigations carried out over three consecutive years in three broadleaf Mediterranean forests dominated by *Castanea sativa* Mill., *Quercus cerris* L., and *Fagus sylvatica* L., respectively and located in Northwest Italy (Liguria). The knowledge of macrofungal diversity in Italy is fragmented and several areas and habitats remain unexplored [15–17]. Liguria, in particular, is characterized by a peculiar geomorphology and climate that allow the coexistence of a great richness and diversity of habitats. Forests cover a remarkable percentage of the whole territory (ca. 62%), and broadleaf woods represent the prevalent vegetation type (ca. 87%) [18].

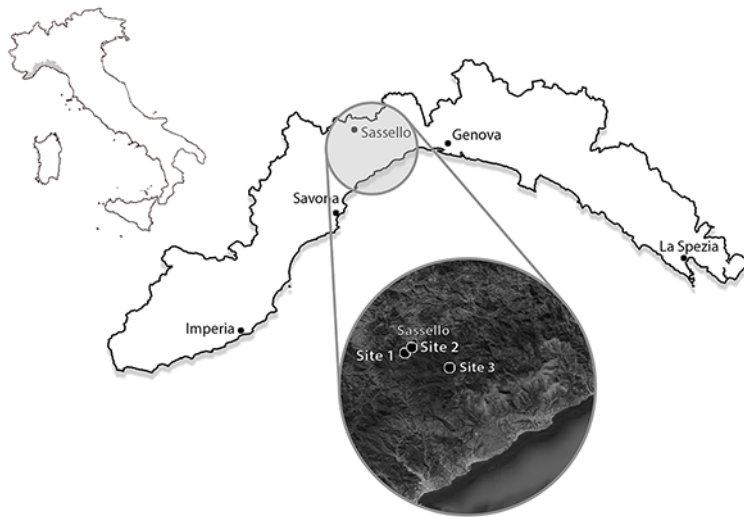


Fig. 1 Geographic location of the study sites.

The aim of this study was to increase our knowledge of the macrofungal diversity associated with broadleaf Mediterranean forests. Specifically, we intended to: *(i)* provide a detailed list of species, *(ii)* provide information on ecology and taxonomy of the recorded species, *(iii)* estimate the frequency of geographic distribution on the national territory, and *(iv)* detect uncommon and rare species.

Material and methods

Study area

Three broadleaf forests were selected in Liguria (NW Italy) in the province of Savona (municipality of Sassello) (Fig. 1). Site 1 is located in the loc. Badani (44°27'56" N,

8°28'44" E) and is characterized by a young chestnut coppice of approximately 8,800 m². The altitude ranges from 420 to 450 m a.s.l. The tree layer is dominated by *Castanea sativa*. A lower frequency of other woody species such as *Sorbus torminalis* (L.) Crantz and *Populus tremula* L. occurs in this site. The percentage cover of the shrub layer is very low (7%), whereas the herbaceous species are abundant (15%). The area is under human intervention (i.e., by cutting and thinning) to remove the undergrowth vegetation and facilitate the collection of chestnuts. Site 2, in the loc. La Maddalena (44°30'14" N, 8°29'17" E), is classified as high forest and covers a total area of about 7,500 m² with altitude of 340–380 m a.s.l. The whole area is dominated by *Quercus cerris*. Other woody species, such as *S. torminalis* and *P. tremula*, occur with lower frequency in the site. The percentage cover of the shrub layer is very low (5%), whereas the herbaceous layer cover is very high (70%). The forest belongs to the *Lathyro montani-Quercetum cerridis* (Barbero et Bono, 1971) Ubaldi 1988 association. Site 3, in the loc. Vereira (44°27'3" N, 8°32'42" E), covers a total area of about 10,000 m² and it is also classified as high forest. The altitude is 1,000 m a.s.l. The area is dominated by *Fagus sylvatica*, followed by *S. torminalis* and *P. tremula* at lower frequency. The percentage cover of the shrub and herbaceous layer are very low (10% and 7%, respectively). The forest belongs to the *Trochiscantho-Fagetum* Gentile 1974 association.

Geologically, Site 1 and 3 are characterized by soils developed mainly on calceschists, whereas Site 2 lies in a complex area characterized by four different parent rocks: serpentineschists, calceschists, chlorite-actinolite schists, and conglomerates. The climate is ascribed to the temperate oceanic sub-Mediterranean type for all the three sites [19] with the mean annual temperature of 12°C [from 0°C (min) in January to 25°C (max) in July]. The mean annual rainfall is 912 mm [33 mm (min) in July, 122 mm (max) in October] [20].

Sampling and data collection

Mycological investigations, targeted to epigeous macrofungi, were carried out over 3 consecutive years (2012–2014). Sampling was performed three/four times per month in fall (early September – late November) and in spring (April and June) in 20 circular (4-m radius) plots (60 in total) selected in each study site along line-transects and following a standardized sampling method for macrofungi [21]. Each plot was 20 m away from the next one. The total sample area was approximately 1,000 m² for each site.

Species identification was performed by analyzing the macro- and microscopical characteristics of the collected specimens and the relevant literature [22–34]. The systematic classification followed previous studies [6,35]. Nomenclature and author abbreviations were used in accordance with [36–38]. Some specimens were deposited

in the personal collection of F. Boccardo at GDOR (Herbarium of the Museo Civico di Storia Naturale Giacomo Doria, Mycology Section, Genoa, Italy).

The identified macrofungal species were split into functional groups as described previously [39], based on their primary mode of nutrition: ectomycorrhizal (ECM), soil (humus or litter) decay (SHL), parasitic (P), and wood decay (WD). Further, with reference to national checklists [15,40], a value of geographic distribution was given for each species. Accordingly, all species were split in four classes: widespread (w) – species recorded on more than 65% of Italian territory; common (c) – species recorded on 40–65%; not common (nc) – species recorded on 20–40%; rare (r) – species recorded on less than 20% of Italian territory. With the symbol of asterisk (*) we specified species that are not listed in the available national checklists.

Results

List of the species

Based on the macro- and microscopic examination, the species listed below were identified. For each species the ecology, vegetation of the study site(s), distribution in Italy, and the abundance (i.e., number of ascomata, stromata, or basidiomata) were recorded.

Division Ascomycota

ORDER HELOTIALES, FAMILY HELOTIACEAE

1. *Bisporella citrina* (Batsch) Korf & S. E. Carp.; WD; beech forest; w; two ascomata.

ORDER HELOTIALES, FAMILY LEOTIACEAE

2. *Leotia lubrica* (Scop.) Pers.; ECM; chestnut wood; c; 10 ascomata.

ORDER PEZIZALES, FAMILY PEZIZACEAE

3. *Peziza badia* Pers.; ECM; chestnut wood; c; 10 ascomata.
4. *Peziza phyllogena* Cooke; ECM; oak wood; c; two ascomata.

ORDER PEZIZALES, FAMILY PYRONEMATAACEAE

5. *Tarzetta catinus* (Holmsk.) Korf & J. K. Rogers; ECM; oak wood; c; one ascoma.

ORDER XYLARIALES, FAMILY DIATRYPACEAE

6. *Diatrype bullata* (Hoffm.) Fr.; WD; beech forest; c; numerous stromata.

ORDER XYLARIALES, FAMILY XYLARIACEAE

7. *Xylaria hypoxylon* (L.) Grev.; WD; beech forest; w; 52 stromata.

Division Basidiomycota

ORDER AGARICALES, FAMILY AGARICACEAE

8. *Agrocybe praecox* (Pers.) Fayod; SHL; oak wood; w; three basidiomata.
9. *Lepiota clypeolaria* (Bull.) P. Kumm.; SHL; oak wood; w; two basidiomata.
10. *Lycoperdon perlatum* Pers.; SHL; chestnut wood, oak wood, beech wood; w; 34 basidiomata.
11. *Lycoperdon pratense* Pers.; SHL; oak wood; w; six basidiomata.
12. *Lycoperdon pyriforme* Willd.; WD; chestnut; w; two basidiomata.
13. *Macrolepiota excoriata* (Schaeff.) Wasser; SHL; oak wood; c; two basidiomata.
14. *Macrolepiota konradii* (Huijsman ex P. D. Orton) M. M. Moser; SHL; chestnut wood; c; three basidiomata.
15. *Macrolepiota mastoidea* (Fr.) Singer; SHL; oak wood; c; one basidioma.
16. *Macrolepiota procera* (Scop.) Singer; SHL; oak wood; w; six basidiomata.

ORDER AGARICALES, FAMILY AMANITACEAE

17. *Amanita caesarea* (Scop.) Pers.; ECM; oak wood; w; seven basidiomata.
18. *Amanita citrina* (Schaeff.) Pers.; ECM; chestnut wood, oak wood, beech forest; w; 85 basidiomata.
19. *Amanita dryophila* Cons. & Contu; ECM; oak wood; r; two basidiomata.
20. *Amanita excelsa* f. *spissa* (Fr.) Neville & Poumarat; ECM; beech forest; c; four basidiomata.
21. *Amanita gemmata* (Fr.) Bertill.; ECM; chestnut wood, beech forest; c; 32 basidiomata.
22. *Amanita muscaria* (L.) Lam.; ECM; chestnut wood, beech forest; c; 43 basidiomata.
23. *Amanita pantherina* (DC.) Krombh.; ECM; chestnut wood, oak wood, beech forest; w; 32 basidiomata.
24. *Amanita phalloides* (Fr.) Link; ECM; oak wood, beech forest; w; 16 basidiomata.
25. *Amanita rubescens* Pers.; ECM; chestnut wood, oak wood, beech forest; w; 95 basidiomata.
26. *Amanita spadicea* Pers.; ECM; beech forest; r; one basidioma.
27. *Amanita submembranacea* (Bon) Gröger; ECM; beech forest; nc; one basidioma.
28. *Amanita vaginata* (Bull.) Lam.; ECM; chestnut wood, oak wood, beech forest; c; 50 basidiomata.

ORDER AGARICALES, FAMILY CORTINARIACEAE

29. *Cortinarius atrovirens* Kalchbr.; ECM; oak wood; c; five basidiomata.
30. *Cortinarius bulliardii* (Pers.) Fr.; ECM; oak wood; w; one basidioma.
31. *Cortinarius caerulescens* (Schaeff.) Fr.; ECM; chestnut wood, beech forest; w; four basidiomata.
32. *Cortinarius caesiopallescens* Bidaud, Moëgne-Locc. & Reumaux; ECM; oak wood; *; seven basidiomata.
33. *Cortinarius chromataphilus* Rob. Henry; ECM; oak wood; r; 17 basidiomata.
34. *Cortinarius citrinolilacinus* (M. M. Moser) M. M. Moser; ECM; chestnut wood, beech forest; c; 11 basidiomata.
35. *Cortinarius claroflavus* Rob. Henry; ECM; oak wood; r; one basidioma.
36. *Cortinarius dionysae* Rob. Henry; ECM; chestnut wood; c; one basidioma.
37. *Cortinarius diosmus* Kühner; ECM; oak wood; c; 10 basidiomata.
38. *Cortinarius helianthemorum* Bidaud & Cheype; ECM; oak wood; *; 30 basidiomata.
39. *Cortinarius infractus* (Pers.) Fr.; ECM; oak wood; w; two basidiomata.
40. *Cortinarius largus* Fr.; ECM; beech forest; w; one basidioma.
41. *Cortinarius melanotus* Kalchbr.; ECM; chestnut wood, oak wood; c; seven basidiomata.
42. *Cortinarius olidoamethysteus* Rob. Henry & Ramm; ECM; chestnut wood; *; three basidiomata.
43. *Cortinarius olidus* J. E. Lange; ECM; oak wood; c; three basidiomata.
44. *Cortinarius ophiopus* Peck; ECM; beech forest; *; 10 basidiomata.
45. *Cortinarius praestans* (Cordier) Gillet; ECM; oak wood, beech forest; w; eight basidiomata.
46. *Cortinarius purpurascens* Fr.; ECM; chestnut wood, beech forest; c; four basidiomata.
47. *Cortinarius rigens* (Pers.) Fr.; ECM; chestnut wood, oak wood; w; nine basidiomata.
48. *Cortinarius rufo-olivaceus* (Pers.) Fr.; ECM; chestnut wood; w; one basidioma.
49. *Cortinarius scaurus* (Fr.) Fr.; ECM; beech forest; r; three basidiomata.
50. *Cortinarius torvus* (Fr.) Fr.; ECM; beech forest; w; 10 basidiomata.
51. *Cortinarius trivialis* J. E. Lange; ECM; oak wood; w; 48 basidiomata.
52. *Cortinarius turmalis* Fr.; ECM; beech forest; w; 13 basidiomata.
53. *Cortinarius variicolor* (Pers.) Fr.; ECM; chestnut wood, beech forest; w; eight basidiomata.
54. *Cortinarius violaceus* (L.) Gray; ECM; chestnut wood; w; one basidioma.

ORDER AGARICALES, FAMILY ENTOLOMATACEAE

55. *Alboleptonia sericella* (Fr.) Largent & R. G. Benedict; SHL; oak wood; *; 10 basidiomata.
56. *Clitopilus cystidiatus* Hauskn. & Noordel.; ECM; chestnut wood, oak wood, beech forest; c; 47 basidiomata.
57. *Clitopilus prunulus* (Scop.) P. Kumm.; ECM; chestnut wood; w; 17 basidiomata.

58. *Entoloma aprile* (Britzelm.) Sacc.; ECM; oak wood; c; two basidiomata.
59. *Entoloma bloxamii* (Berk. & Broome) Sacc.; ECM; oak wood; w; five basidiomata.
60. *Entoloma cinchonense* Murrill; SHL; oak wood; *; 10 basidiomata.
61. *Entoloma clandestinum* (Fr.) Noordel.; ECM; oak wood; r; 10 basidiomata.
62. *Entoloma euchroum* (Pers.) Donk; WD; chestnut wood; nc; 10 basidiomata.
63. *Entoloma griseocyaneum* (Fr.) P. Kumm.; SHL; oak wood; r; five basidiomata.
64. *Entoloma hirtipes* (Schumach.) M. M. Moser; SHL; chestnut wood; c; six basidiomata.
65. *Entoloma lividoalbum* (Kühner & Romagn.) Kubička; ECM; chestnut wood; w; one basidioma.
66. *Entoloma rhodopolium* (Fr.) P. Kumm.; ECM; chestnut wood, oak wood; w; 89 basidiomata.
67. *Entoloma sepium* (Noulet & Dass.) Richon & Roze; ECM; oak wood; c; one basidioma.
68. *Entoloma sinuatum* (Bull.) P. Kumm.; ECM; oak wood; c; 25 basidiomata.
69. *Rhodocybe truncata* (Schaeff.) Singer; ECM; beech forest; w; five basidiomata.

ORDER AGARICALES, FAMILY HYDNANGIACEAE

70. *Laccaria amethystina* Cooke; ECM; chestnut wood, oak wood, beech forest; w; 119 basidiomata.
71. *Laccaria bicolor* (Maire) P. D. Orton; ECM; chestnut wood, beech forest; w; 42 basidiomata.
72. *Laccaria laccata* (Scop.) Cooke; ECM; chestnut wood, oak wood, beech forest; w; 187 basidiomata.

ORDER AGARICALES, FAMILY HYGROPHORACEAE

73. *Hygrophorus cossus* (Sowerby) Fr.; ECM; chestnut wood, beech forest; w; 16 basidiomata.
74. *Hygrophorus eburneus* (Bull.) Fr.; ECM; oak wood; c; 12 basidiomata.
75. *Hygrophorus personii* Arnolds; ECM; oak wood; w; 20 basidiomata.

ORDER AGARICALES, FAMILY INOCYBACEAE

76. *Crepidotus applanatus* (Pers.) P. Kumm.; WD; oak wood; w; one basidioma.
77. *Crepidotus cesatii* (Rabenh.) Sacc.; WD; beech forest; w; four basidiomata.
78. *Crepidotus mollis* (Schaeff.) Staude; WD; oak wood; w; 85 basidiomata.
79. *Inocybe calamistrata* (Fr.) Gillet; ECM; chestnut wood; nc; six basidiomata.
80. *Inocybe cincinnata* (Fr.) Quél.; ECM; oak wood; nc; 25 basidiomata.
81. *Inocybe geophylla* (Bull.) P. Kumm.; ECM; chestnut wood; w; 10 basidiomata.
82. *Inocybe glabripes* Ricken; ECM; oak wood; r; six basidiomata.
83. *Inocybe rimosa* (Bull.) P. Kumm.; ECM; chestnut wood, oak wood; w; 14 basidiomata.

ORDER AGARICALES, FAMILY LYOPHYLLACEAE

84. *Calocybe gambosa* (Fr.) Donk; ECM; oak wood; w; 10 basidiomata.
85. *Lyophyllum decastes* (Fr.) Singer; SHL; chestnut wood; w; two basidiomata.

ORDER AGARICALES, FAMILY MARASMIACEAE

86. *Marasmius bulliardii* Quél.; SHL; chestnut wood, oak wood, beech forest; w; 50 basidiomata.
87. *Marasmius collinus* (Scop.) Singer; SHL; oak wood; w; 10 basidiomata.
88. *Marasmius oreades* (Bolton) Fr.; SHL; oak wood, beech forest; w; 26 basidiomata.
89. *Marasmius rotula* (Scop.) Fr.; SHL; beech forest; w; one basidioma.
90. *Marasmius wynneae* Berk. & Broome; SHL; beech forest; c; three basidiomata.

ORDER AGARICALES, FAMILY MYCENACEAE

91. *Mycena alcalina* (Fr.) P. Kumm.; SHL; chestnut wood; c; three basidiomata.
92. *Mycena crocata* (Schrad.) P. Kumm.; SHL; chestnut wood, beech forest; w; 63 basidiomata.
93. *Mycena galericulata* (Scop.) Gray; WD; chestnut wood; w; three basidiomata.

94. *Mycena galopus* (Pers.) P. Kumm.; SHL; chestnut wood, beech forest; w; 12 basidiomata.
95. *Mycena haematopus* (Pers.) P. Kumm.; WD; chestnut wood; w; 13 basidiomata.
96. *Mycena inclinata* (Fr.) Quél.; WD; chestnut wood, beech forest; w; 15 basidiomata.
97. *Mycena leptcephala* (Pers.) Gillet; SHL; chestnut wood, beech forest; w; five basidiomata.
98. *Mycena pelianthina* (Fr.) Quél.; SHL; beech forest; w; 93 basidiomata.
99. *Mycena polygramma* (Bull.) Gray; SHL; chestnut wood, beech forest; w; 18 basidiomata.
100. *Mycena pura* (Pers.) P. Kumm.; SHL; oak wood, beech forest; w; 29 basidiomata.
101. *Mycena rosea* Gramberg; SHL; chestnut wood, oak wood, beech forest; w; 28 basidiomata.
102. *Mycena vitilis* (Fr.) Quél.; SHL; chestnut wood, oak wood; w; 27 basidiomata.
103. *Panellus stipticus* (Bull.) P. Karst; WD; chestnut wood, beech forest; w; 29 basidiomata.

ORDER AGARICALES, FAMILY OMPHALOTACEAE

104. *Gymnopus androsaceus* (L.) Della Maggiora & Trassinelli; SHL; beech forest; w; one basidioma.
105. *Gymnopus brassicolens* (Romagn.) Antonín & Noordel.; SHL; chestnut wood, beech forest; w; 19 basidiomata.
106. *Gymnopus dryophilus* (Bull.) Murrill; SHL; chestnut wood, beech forest; w; 45 basidiomata.
107. *Gymnopus fusipes* (Bull.) Gray; SHL; oak wood; w; one basidioma.
108. *Gymnopus hariolorum* (Bull.) Antonín, Halling & Noordel.; SHL; beech wood; w; one basidioma.
109. *Mycetinis alliaceus* (Jacq.) Earle; SHL; beech forest; w; 10 basidiomata.
110. *Mycetinis scorodonius* (Fr.) A. W. Wilson & Desjardin; SHL; beech forest; w; five basidiomata.
111. *Omphalotus olearius* (DC.) Singer; WD; chestnut wood; w; five basidiomata.
112. *Rhodocollybia butyracea* (Bull.) Lennox; ECM; chestnut wood, oak wood, beech forest; w; 58 basidiomata.

ORDER AGARICALES, FAMILY PHYSALACRIACEAE

113. *Armillaria mellea* (Vahl) P. Kumm.; P(SHL); chestnut wood, oak wood; w; 86 basidiomata.
114. *Armillaria tabescens* (Scop.) Emel; P(SHL); oak wood; w; 60 basidiomata.
115. *Cylindrobasidium laeve* (Pers.) Chamuris; WD; beech forest; c; two basidiomata.
116. *Hymenopellis radicata* (Relhan) R. H. Petersen; SHL(WD); chestnut wood, beech forest; w; 30 basidiomata.
117. *Xerula pudens* (Pers.) Singer; SHL(WD); beech forest; w; one basidioma.
118. *Psathyrella spadiceogrisea* (Schaeff.) Maire; SHL; oak wood; w; three basidiomata.

ORDER AGARICALES, FAMILY PLEUROTACEAE

119. *Pleurotus ostreatoroseus* Singer; WD; chestnut wood; c; four basidiomata.

ORDER AGARICALES, FAMILY PLUTEACEAE

120. *Pluteus cervinus* (Schaeff.) P. Kumm.; WD; beech forest; c; one basidioma.
121. *Pluteus romellii* (Britzelm.) Sacc.; WD; oak wood; c; 12 basidiomata.
122. *Pluteus salicinus* (Pers.) P. Kumm.; WD; oak wood; c; one basidioma.

ORDER AGARICALES, FAMILY PSATHYRELLACEAE

123. *Coprinellus micaceus* (Bull.) Vilgalys, Hopple & Jacq. Johnson; SHL; beech forest; w; 15 basidiomata.
124. *Psathyrella candolleana* (Fr.) Maire; SHL; chestnut wood, oak wood, beech forest; w; 15 basidiomata.

ORDER AGARICALES, FAMILY SCHIZOPHYLLACEAE

125. *Schizophyllum commune* Fr.; WD; oak wood, beech forest; w; 12 basidiomata.

ORDER AGARICALES, FAMILY STROPHARIAACEAE

126. *Cyclocybe aegerita* (V. Brig.) Vizzini; WD; oak wood; c; one basidioma.
127. *Deconica crobula* (Fr.) Romagn.; SHL; beech forest; w; one basidioma.
128. *Galerina marginata* (Batsch) Kühner; WD; beech forest; w; one basidioma.
129. *Hebeloma cavipes* Huijsman; ECM; oak wood; w; eight basidiomata.
130. *Hebeloma crustuliniforme* (Bull.) Quél.; ECM; chestnut wood, oak wood, beech forest; w; 30 basidiomata.
131. *Hebeloma eburneum* Malençon; ECM; oak wood; c; 10 basidiomata.
132. *Hebeloma fragilipes* Romagn.; ECM; oak wood; c; five basidiomata.
133. *Hebeloma sinapizans* (Paulet) Gillet; ECM; oak wood, beech forest; c; 12 basidiomata.
134. *Hypholoma fasciculare* (Huds.) P. Kumm.; WD; chestnut wood, oak wood, beech forest; w; 88 basidiomata.
135. *Hypholoma lateritium* (Schaeff.) P. Kumm.; WD; chestnut wood, beech forest; w; 237 basidiomata.
136. *Leratiomyces squamosus* (Pers.) Bridge & Spooner; SHL; beech forest; w; five basidiomata.
137. *Stropharia aeruginosa* (Curtis) Quél.; SHL; beech forest; w; three basidiomata.

ORDER AGARICALES, FAMILY TRICHOLOMATACEAE

138. *Clitocybe gibba* (Pers.) P. Kumm.; SHL; chestnut wood, oak wood, beech forest; w; 10 basidiomata.
139. *Clitocybe herbarum* Romagn.; SHL; oak wood; *; 10 basidiomata.
140. *Clitocybe nebularis* (Batsch) P. Kumm.; SHL; chestnut wood, oak wood, beech forest; w; 138 basidiomata.
141. *Clitocybe odora* (Bull.) P. Kumm.; SHL; chestnut wood, beech forest; w; four basidiomata.
142. *Clitocybe phaeophthalma* (Pers.) Kuyper; SHL; chestnut wood; w; 20 basidiomata.
143. *Cuphophyllus virgineus* (Wulfen) Kovalenko; ECM; oak wood; w; nine basidiomata.
144. *Hygrocybe conica* (Schaeff.) P. Kumm.; SHL; oak wood; w; 10 basidiomata.
145. *Lepista flaccida* (Sowerby) Pat.; SHL; beech forest; w; one basidioma.
146. *Lepista nuda* (Bull.) Cooke; SHL; chestnut wood, oak wood; w; five basidiomata.
147. *Pogonoloma macrocephalum* (Huijsman) Sánchez-García; SHL; oak wood; c; one basidioma.
148. *Resupinatus trichotis* (Pers.) Singer; WD; beech forest; w; four basidiomata.
149. *Tricholoma acerbum* (Bull.) Quél.; ECM; oak wood; w; five basidiomata.
150. *Tricholoma album* (Schaeff.) P. Kumm.; ECM; oak wood; w; 26 basidiomata.
151. *Tricholoma atosquamosum* Sacc.; ECM; chestnut wood, oak wood, beech forest; w; 17 basidiomata.
152. *Tricholoma bresadolanium* Cléménçon; ECM; oak wood; w; 45 basidiomata.
153. *Tricholoma columbetta* (Fr.) P. Kumm.; ECM; chestnut wood, oak wood, beech forest; c; 11 basidiomata.
154. *Tricholoma portentosum* (Fr.) Quél.; ECM; chestnut wood, oak wood; w; three basidiomata.
155. *Tricholoma quercetorum* Contu; ECM; oak wood; w; 30 basidiomata.
156. *Tricholoma saponaceum* (Fr.) P. Kumm.; ECM; chestnut wood, oak wood; w; 24 basidiomata.
157. *Tricholoma saponaceum* var. *squamosum* (Cooke); ECM; oak wood; w; 20 basidiomata.
158. *Tricholoma scalpturatum* (Fr.) Quél.; ECM; beech forest; w; six basidiomata.
159. *Tricholoma sejunctum* (Sowerby) Quél.; ECM; oak wood; w; 47 basidiomata.
160. *Tricholoma sulphureum* (Bull.) P. Kumm.; ECM; chestnut wood; w; two basidiomata.
161. *Tricholoma ustale* (Fr.) P. Kumm.; ECM; beech forest; w; four basidiomata.
162. *Tricholoma ustaloides* Romagn.; ECM; chestnut wood, oak wood, beech forest; w; 72 basidiomata.

ORDER AGARICALES, FAMILY TUBARIAACEAE

163. *Tubaria furfuracea* (Pers.) Gillet; SHL; chestnut wood, beech forest; w; 25 basidiomata.

ORDER ATHELIALES, FAMILY ATHELIAACEAE

164. *Athelia acrospora* Jülich; WD; oak wood, beech forest; c; eight basidiomata.
165. *Athelia decipiens* (Höhn. & Litsch.) J. Erikss.; WD; beech forest; c; one basidioma.
166. *Hypochniciellum ovoideum* (Jülich) Hjortstam & Ryvarde; WD; beech forest; c; three basidiomata.
167. *Leptosporomyces raunkiaeri* (M. P. Christ.) Jülich; WD; beech forest; c; two basidiomata.

ORDER AURICULARIALES, FAMILY AURICULARIACEAE

168. *Auricularia auricula-judae* (Bull.) J. Schröt.; WD; oak wood; w; five basidiomata.

ORDER AURICULARIALES, FAMILY EXIDIACEAE

169. *Exidia glandulosa* (Bull.) Fr.; WD; oak wood, beech forest; c; 34 basidiomata.

ORDER BOLETALES, FAMILY BOLETACEAE

170. *Aureoboletus gentilis* (Quél.) Pouzar; ECM; chestnut wood, oak wood; w; four basidiomata.
171. *Boletus aereus* Bull.; ECM; oak wood; w; 47 basidiomata.
172. *Boletus aestivalis* (Paulet) Fr.; ECM; oak wood, beech forest; w; 11 basidiomata.
173. *Boletus edulis* Bull.; ECM; chestnut wood, beech forest; w; 97 basidiomata.
174. *Boletus ferrugineus* Schaeff.; ECM; beech forest; w; four basidiomata.
175. *Boletus reticulatus* (Hoffm.) Pers.; ECM; beech forest; w; two basidiomata.
176. *Boletus subtomentosus* L.; ECM; oak wood; w; one basidioma.
177. *Caloboletus calopus* (Pers.) Vizzini; ECM; chestnut wood; w; one basidioma.
178. *Chalciporus piperatus* (Bull.) Bataille; ECM; beech forest; w; one basidioma.
179. *Cyanoboletus pulverulentus* (Opat.) Gelardi, Vizzini & Simonini; ECM; chestnut wood; w; two basidiomata.
180. *Hemileccinum impolitum* (Fr.) Šutara; ECM; beech forest; w; four basidiomata.
181. *Hortiboletus rubellus* (Krombh.) Simonini, Vizzini & Gelardi; ECM; oak wood; w; one basidioma.
182. *Imleria badia* (Fr.) Vizzini; ECM; beech forest; w; two basidiomata.
183. *Imperator luteocupreus* (Bertéa & Estadès) Assyov, Bellanger, Bertéa, Courtec., G. Koller, Loizides, G. Marques, J. A. Muñoz, N. Oppicelli, D. Puddu, F. Rich. & P.-A. Moreau; ECM; chestnut wood; w; one basidioma.
184. *Imperator rhodopurpureus* (Smotl.) Assyov, Bellanger, Bertéa, Courtec., G. Koller, Loizides, G. Marques, J. A. Muñoz, N. Oppicelli, D. Puddu, F. Rich. & P.-A. Moreau; ECM; oak wood; w; 10 basidiomata.
185. *Leccinum aurantiacum* (Bull.) Gray; ECM; oak wood; w; six basidiomata.
186. *Leccinum duriusculum* (Schulzer ex Kalchbr.) Singer; ECM; oak wood; w; 13 basidiomata.
187. *Neoboletus erythropus* (Pers.) C. Hahn; ECM; chestnut wood, beech forest; w; five basidiomata.
188. *Pulchroboletus roseoalbidus* (Alessio & Littini) Gelardi, Vizzini & Simonini; ECM; oak wood; w; 10 basidiomata.
189. *Suillellus dupainii* (Boud.) Blanco-Dios; ECM; oak wood; w; eight basidiomata.
190. *Suillellus luridus* (Schaeff.) Murrill; ECM; beech forest; w; three basidiomata.
191. *Suillellus permagnificus* (Pöder) Blanco-Dios; ECM; oak wood; w; five basidiomata.
192. *Suillellus queletii* (Schulzer) Vizzini, Simonini & Gelardi; ECM; oak wood; w; 17 basidiomata.
193. *Xerocomellus pruinatus* (Fr. & Hök) Šutara; ECM; beech forest; w; two basidiomata.

ORDER BOLETALES, FAMILY CONIOPHORACEAE

194. *Coniophora puteana* (Schumach.) P. Karst.; WD; beech forest; c; one basidioma.

ORDER BOLETALES, FAMILY DIPLOCYSTACEAE

195. *Astraeus hygrometricus* (Pers.) Morgan; ECM; beech forest; c; three basidiomata.

ORDER BOLETALES, FAMILY GOMPHIDIACEAE

196. *Chroogomphus rutilus* (Schaeff.) O. K. Mill.; ECM; chestnut wood, oak wood; c; two basidiomata.

ORDER BOLETALES, FAMILY HYGROPHOROPSIDACEAE

197. *Hygrophoropsis aurantiaca* (Wulfen) Maire; WD; oak wood; c; 18 basidiomata.

ORDER BOLETALES, FAMILY PAXILLACEAE

198. *Paxillus involutus* (Batsch) Fr.; ECM; chestnut wood, oak wood; c; two basidiomata.

ORDER BOLETALES, FAMILY SCLERODERMATACEAE

199. *Scleroderma citrinum* Pers.; ECM; chestnut wood; w; one basidioma.

200. *Scleroderma verrucosum* (Bull.) Pers.; ECM; chestnut wood; w; four basidiomata.

ORDER BOLETALES, FAMILY SUILLACEAE

201. *Suillus granulatus* (L.) Roussel; ECM; oak wood; w; two basidiomata.

ORDER CANTHARELLALES, FAMILY BOTRYOBASIDIACEAE

202. *Botryobasidium laeve* (J. Erikss.) Parmasto; WD; chestnut wood, beech forest; c; four basidiomata.

ORDER CANTHARELLALES, FAMILY CANTHARELLACEAE

203. *Cantharellus cibarius* Fr.; ECM; beech forest; w; 10 basidiomata.

204. *Cantharellus subpruinosis* Eyssart. & Buyck; ECM; chestnut wood, oak wood; w; 98 basidiomata.

205. *Craterellus cornucopioides* (L.) Pers.; ECM; chestnut wood; w; 201 basidiomata.

206. *Craterellus lutescens* (Fr.) Fr.; ECM; chestnut wood; w; 13 basidiomata.

ORDER CANTHARELLALES, FAMILY CERATOBASIDIACEAE

207. *Scotomyces subviolaceus* (Peck) Jülich; WD; beech forest; c; one basidioma.

ORDER CANTHARELLALES, FAMILY CLAVULINACEAE

208. *Clavulina cinerea* (Bull.) J. Schröt.; ECM; chestnut wood, beech forest; c; nine basidiomata.

209. *Clavulina coralloides* (L.) J. Schröt.; ECM; chestnut wood; c; five basidiomata.

210. *Clavulina cristata* (Holmsk.) J. Schröt.; ECM; chestnut wood; c; five basidiomata.

ORDER CANTHARELLALES, FAMILY HYDNACEAE

211. *Hydnum repandum* L.; ECM; chestnut wood, oak wood, beech forest; w; 46 basidiomata.

212. *Hydnum rufescens* Pers.; ECM; chestnut wood, oak wood, beech forest; w; 65 basidiomata.

213. *Sistotrema porulosum* Hallenb.; WD; oak wood; c; 30 basidiomata.

ORDER CANTHARELLALES, FAMILY TULASNELLACEAE

214. *Tulasnella violacea* (Johan-Olsen) Juel; WD; chestnut wood, beech forest; nc; 17 basidiomata.

215. *Tulasnella violea* (Quél.) Bourdot & Galzin; WD; chestnut wood; nc; one basidioma.

ORDER CORTICIALES, FAMILY CORTICIACEAE

216. *Corticium confine* Bourdot & Galzin; WD; chestnut wood, beech forest; w; five basidiomata.

217. *Vuilleminia comedens* (Nees) Maire; WD; chestnut wood, oak wood, beech forest; w; 34 basidiomata.

ORDER DACRYMYCETALES, FAMILY DACRYMYCETACEAE

218. *Calocera cornea* (Batsch) Fr.; WD; beech forest; c; eight basidiomata.

219. *Calocera viscosa* (Pers.) Fr.; WD; oak wood, beech forest; c; two basidiomata.

ORDER GOMPHALES, FAMILY GOMPHACEAE

220. *Clavariadelphus flavoimmaturus* R. H. Petersen; ECM; oak wood; c; 30 basidiomata.

221. *Clavariadelphus pistillaris* (L.) Donk; ECM; oak wood; w; 51 basidiomata.

222. *Ramaria aurea* (Schaeff.) Quél.; ECM; chestnut wood; w; seven basidiomata.

223. *Ramaria flavescens* (Schaeff.) R. H. Petersen; ECM; oak wood; w; 10 basidiomata.

224. *Ramaria flavobrunnescens* (G. F. Atk.) Corner; ECM; beech forest; w; five basidiomata.
 225. *Ramaria formosa* (Pers.) Quél.; ECM; chestnut wood; w; three basidiomata.
 226. *Ramaria pallida* (Schaeff.) Ricken; ECM; chestnut wood; w; 10 basidiomata.

ORDER HYMENOGASTRIMORPHS, FAMILY TUBULICRINACEAE

227. *Hyphodontia radula* (Fr.) Langer & Vesterh.; WD; chestnut wood; c; one basidioma.

ORDER PHALLALES, FAMILY PHALLACEAE

228. *Clathrus ruber* P. Micheli ex Pers.; SHL; beech forest; w; one basidioma.

ORDER POLYPORALES, FAMILY FOMITOPSIDACEAE

229. *Daedalea quercina* (L.) Pers.; WD; beech forest; w; two basidiomata.
 230. *Postia caesia* (Schrad.) P. Karst.; WD; chestnut wood, beech forest; w; 11 basidiomata.
 231. *Postia caesioflava* (Pat.) V. Papp; WD; oak wood; w; 15 basidiomata.

ORDER POLYPORALES, FAMILY MERULIACEAE

232. *Ceriporiopsis gilvescens* (Bres.) Domanski; WD; chestnut wood; c; one basidioma.
 233. *Ceriporiopsis mucida* (Pers.) Gilb. & Ryvarden; WD; chestnut wood, beech forest; c; three basidiomata.
 234. *Ceriporiopsis resinascens* (Romell) Domański; WD; chestnut wood; c; one basidioma.
 235. *Mutatoderma mutatum* (Peck) C. E. Gómez; WD; beech forest; c; two basidiomata.

ORDER POLYPORALES, FAMILY PHANEROCHAETACEAE

236. *Byssomerulius corium* (Pers.) Parmasto; WD; beech forest; c; two basidiomata.
 237. *Irpex lacteus* (Fr.) Fr.; WD; chestnut wood, beech forest; c; two basidiomata.
 238. *Phanerochaete laevis* (Fr.) J. Erikss. & Ryvarden; WD; beech forest; c; three basidiomata.
 239. *Phanerochaete velutina* (DC.) P. Karst.; WD; chestnut wood, beech forest; c; five basidiomata.
 240. *Phlebia bispora* (Stalpers) Nakasone; WD; oak wood; c; five basidiomata.
 241. *Phlebiopsis ravenelii* (Cooke) Hjortstam; WD; chestnut wood, beech forest; c; four basidiomata.
 242. *Steccherinum bourdotii* Saliba & A. David; WD; oak wood; c; three basidiomata,
 243. *Steccherinum ochraceum* (Pers. ex J. F. Gmel.) Gray; WD; chestnut wood, oak wood; c; 11 basidiomata.

ORDER POLYPORALES, FAMILY POLYPORACEAE

244. *Cerioporus mollis* (Sommerf.) Zmitr. & Kovalenko; WD; chestnut wood, beech forest; c; five basidiomata.
 245. *Polyporus varius* (Pers.) Fr.; WD; beech forest; c; seven basidiomata.
 246. *Trametes hirsuta* (Wulfen) Lloyd; WD; chestnut wood; w; one basidioma.
 247. *Trametes versicolor* (L.) Lloyd; WD; chestnut wood, beech forest; w; two basidiomata.

ORDER RUSSULALES, FAMILY ALBATRELLACEAE

248. *Scutigera pes-caprae* (Pers.) Bondartsev & Singer; ECM; beech forest; c; three basidiomata.

ORDER RUSSULALES, FAMILY AURISCALPIACEAE

249. *Lentinellus micheneri* (Berk. & M. A. Curtis) Pegler; WD; beech forest; c; 10 basidiomata.

ORDER RUSSULALES, FAMILY PENIOPHORACEAE

250. *Peniophora cinerea* (Pers.) Cooke; WD; beech forest; c; one basidioma.
 251. *Peniophora incarnata* (Pers.) P. Karst.; WD; beech forest; c; one basidioma.
 252. *Peniophora lycii* (Pers.) Höhn. & Litsch.; WD; beech forest; c; one basidioma.
 253. *Peniophorella pubera* (Fr.) P. Karst.; WD; beech forest; c; one basidioma.

ORDER RUSSULALES, FAMILY RUSSULACEAE

254. *Lactarius acerrimus* Britzelm.; ECM; beech forest; w; five basidiomata.
 255. *Lactarius atlanticus* Bon; ECM; beech forest; w; three basidiomata.
 256. *Lactarius blennius* (Fr.) Fr.; ECM; beech forest; w; 14 basidiomata.
 257. *Lactarius chrysorrheus* Fr.; ECM; chestnut wood, oak wood, beech forest; w; 39 basidiomata.
 258. *Lactarius controversus* Pers.; ECM; oak wood; w; 55 basidiomata.
 259. *Lactarius decipiens* Quél.; ECM; beech forest; w; seven basidiomata.
 260. *Lactarius fraxineus* Romagn.; ECM; oak wood; r; two basidiomata.
 261. *Lactarius luridus* (Pers.) Gray; ECM; oak wood; nc; 10 basidiomata.
 262. *Lactarius piperatus* (L.) Pers.; ECM; oak wood; c; 17 basidiomata.
 263. *Lactarius quietus* (Fr.) Fr.; ECM; chestnut wood, beech forest; w; nine basidiomata.
 264. *Lactarius serifluus* (DC.) Fr.; ECM; chestnut wood; w; six basidiomata.
 265. *Lactarius uvidus* (Fr.) Fr.; ECM; oak wood; c; 12 basidiomata.
 266. *Lactarius vellereus* (Fr.) Fr.; ECM; oak wood, beech forest; w; 26 basidiomata.
 267. *Lactarius volemus* (Fr.) Fr.; ECM; chestnut wood, oak wood, beech forest; w; 15 basidiomata.
 268. *Lactarius zonarius* (Bull.) Fr.; ECM; oak wood; w; 19 basidiomata.
 269. *Russula acrifolia* Romagn.; ECM; chestnut wood, oak wood; w; four basidiomata.
 270. *Russula anatina* Romagn.; ECM; oak wood; w; 10 basidiomata.
 271. *Russula atropurpurea* (Krombh.) Britzelm.; ECM; chestnut wood; c; one basidioma.
 272. *Russula aurea* Pers.; ECM; oak wood; w; three basidiomata.
 273. *Russula aurora* Krombh.; ECM; beech forest; c; 11 basidiomata.
 274. *Russula chloroides* (Krombh.) Bres.; ECM; beech forest; w; one basidioma.
 275. *Russula cuprea* J. E. Lange; ECM; oak wood; c; one basidioma.
 276. *Russula cyanoxantha* (Schaeff.) Fr.; ECM; chestnut wood, oak wood, beech forest; w; 92 basidiomata.
 277. *Russula emetica* (Schaeff.) Pers.; ECM; oak wood; c; three basidiomata.
 278. *Russula foetens* Pers.; ECM; chestnut wood, oak wood, beech forest; w; 12 basidiomata.
 279. *Russula fragilis* Fr.; ECM; chestnut wood, oak wood; w; four basidiomata.
 280. *Russula heterophylla* (Fr.) Fr.; ECM; oak wood, beech forest; w; 10 basidiomata.
 281. *Russula laeta* Jul. Schäff.; ECM; oak wood; r; two basidiomata.
 282. *Russula lilacea* Quél.; ECM; beech forest; nc; five basidiomata.
 283. *Russula lutensis* Romagn.; ECM; oak wood; r; three basidiomata.
 284. *Russula luteotacta* Rea; ECM; oak wood; c; seven basidiomata.
 285. *Russula maculata* Quél.; ECM; beech forest; c; one basidioma.
 286. *Russula nigricans* Fr.; ECM; chestnut wood, beech forest; w; 19 basidiomata.
 287. *Russula nobilis* Velen.; ECM; beech forest; w; 15 basidiomata.
 288. *Russula odorata* Romagn.; ECM; oak wood; c; 25 basidiomata.
 289. *Russula parazurea* Jul. Schäff.; ECM; beech forest; w; one basidioma.
 290. *Russula risigallina* (Batsch) Sacc.; ECM; chestnut wood; w; three basidiomata.
 291. *Russula romellii* Maire; ECM; oak wood; w; five basidiomata.
 292. *Russula rubroalba* (Singer) Romagn.; ECM; oak wood; w; two basidiomata.
 293. *Russula vesca* Fr.; ECM; chestnut wood, oak wood; w; eight basidiomata.
 294. *Russula zvarae* Velen.; ECM; oak wood; w; five basidiomata.

ORDER RUSSULALES, FAMILY STEREACEAE

295. *Stereum hirsutum* (Willd.) Pers.; WD; chestnut wood, oak wood, beech forest; w; 90 basidiomata.
 296. *Stereum ochraceoflavum* (Schwein.) Sacc.; WD; chestnut wood, oak wood, beech forest; w; 52 basidiomata.

ORDER THELEPHORALES, FAMILY THELEPHORACEAE

297. *Thelephora terrestris* Ehrh.; ECM; chestnut wood; c; five basidiomata.

ORDER TRECHISPORALES, FAMILY HYDNODONTACEAE

298. *Trechispora nivea* (Pers.) K. H. Larss.; WD; oak wood; c; three basidiomata.

ORDER TREMELLALES, FAMILY TREMELLACEAE

299. *Tremella foliacea* Pers.; P; beech forest; w; four basidiomata.

300. *Tremella mesenterica* Retz.; P; oak wood, beech forest; w; four basidiomata.

Composition of communities

Based on the collected species, the macrofungal communities in the three study sites were found to be composed of a total of 300 species (seven Ascomycota and 293 Basidiomycota) and 5,065 sporomata. Specifically, 124, 150, and 148 species and 1,364, 2,061, and 1,640 sporomata were collected and identified in each site. Among Ascomycota, the collected species belong to Pezizales (with three species), followed by Helotiales (two sp.), and Xylariales (two sp.) (Fig. 2). Six different families (viz. Helotiaceae, Leotiaceae, Pezizaceae, Pyrenomataceae, Diatrypaceae, and Xylariaceae; Fig. 3) and six genera (viz. *Bisporella*, *Diatrype*, *Leotia*, *Peziza*, *Tarsetta*, and *Xylaria*) were identified (Fig. 4).

Within Basidiomycota, we identified 15 different orders of which Agaricales was the most represented in number of species, followed by Russulales, Boletales, and Polyporales (Fig. 2).

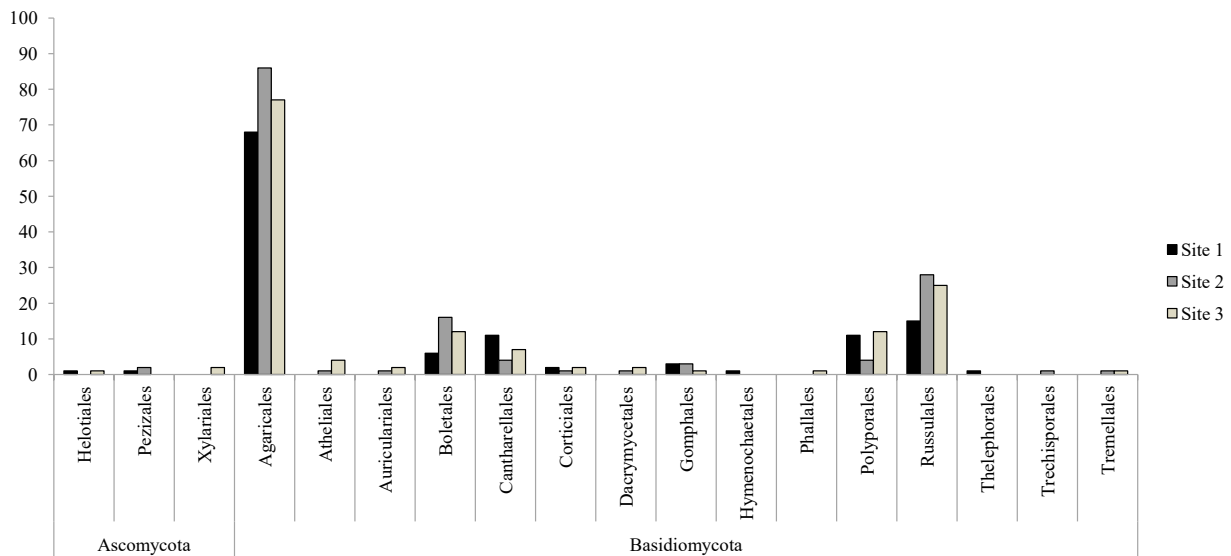


Fig. 2 Species repartition into orders for each study site.

We also recorded 53 families and 111 genera. The most frequent families (in number of species) were Russulaceae, Tricholomataceae, Boletaceae, Mycenaceae, and Cortinariaceae (Fig. 3). At the genus level, *Russula*, *Lactarius*, *Cortinarius*, *Tricholoma*, *Mycena*, and *Amanita* were the most represented (Fig. 4). With respect to sporomata collected, the most abundant species were *Hypholoma lateritium* (with 237 sporomata), *Craterellus cornucopioides* (201), *Laccaria laccata* (187), *Clitocybe nebularis* (138), *Laccaria bicolor* (119), *Boletus edulis* (97), *Cantharellus subpruinus* (98), *Amanita rubescens* (95), *Mycena pelianthina* (93), *Russula cyanoxantha* (92), *Entoloma rhodopolium* (89), *Hypholoma fasciculare* (88), *Amanita dryophila* (85), and *Crepidotus mollis* (85).

Species repartition into functional groups showed that the ectomycorrhizal fungi (ECM) had the highest number of species (173), followed by the wood decaying species (WD) (69 sp.) and the soil decaying fungi (SHL) (54 sp.). Only four parasites species were recorded (viz. *Armillaria mellea*, *A. tabescens*, *Tremella foliacea*, and *T. mesenterica*). Overall, despite the differences in the vegetation type, the three sites also showed a similar community composition and trophic ratio.

According to the available data on the geographic distribution of macrofungal species in Italy [15–17,40], we found a significant number of widespread (190) and common (83) species. However, it is worth noting that among the collected species, a relevant number are uncommon (10) or rare (10) species and seven species (viz. *Alboleptonia*

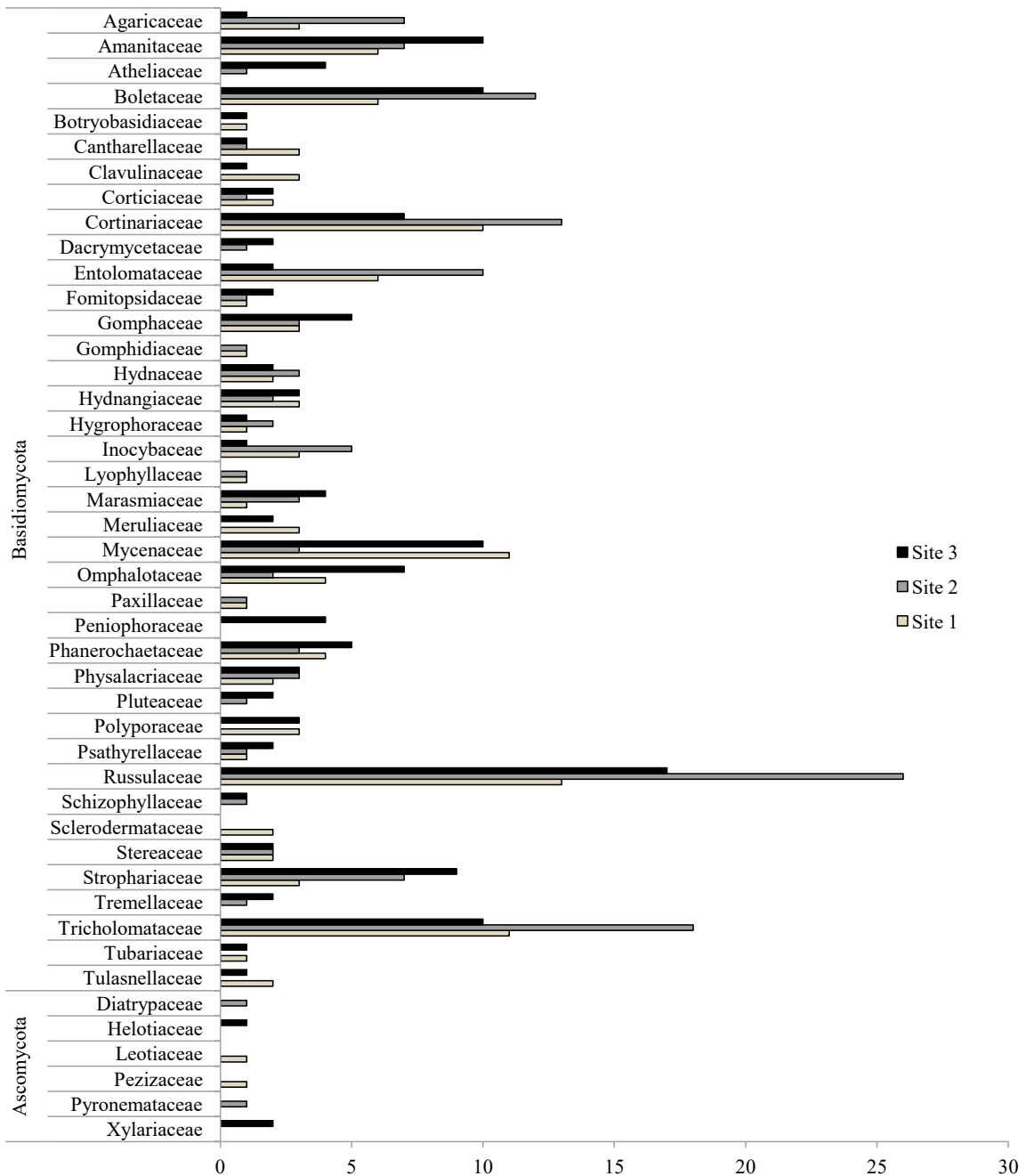


Fig. 3 Species repartition into families for each study site. Families of Basidiomycota with only one species were excluded from the graph.

sericella, *Clitocybe herbarum*, *Cortinarius caesiopallescens*, *C. helianthemorum*, *C. olidoamethysteus*, *C. ophiopus*, *Entoloma cinchonense*; see Fig. 6) were found for the first time.

Discussion

The results obtained in this study contribute to improve the knowledge on macrofungal diversity in broadleaf Mediterranean forests. The relevant number of species and abundance of sporomata recorded indicate that these types of forests are favorable habitats for a wide range of macrofungi. In accordance with previous studies [41,42], we can confirm the high macrofungal species richness of Liguria in the Italian territory [15,17,40].

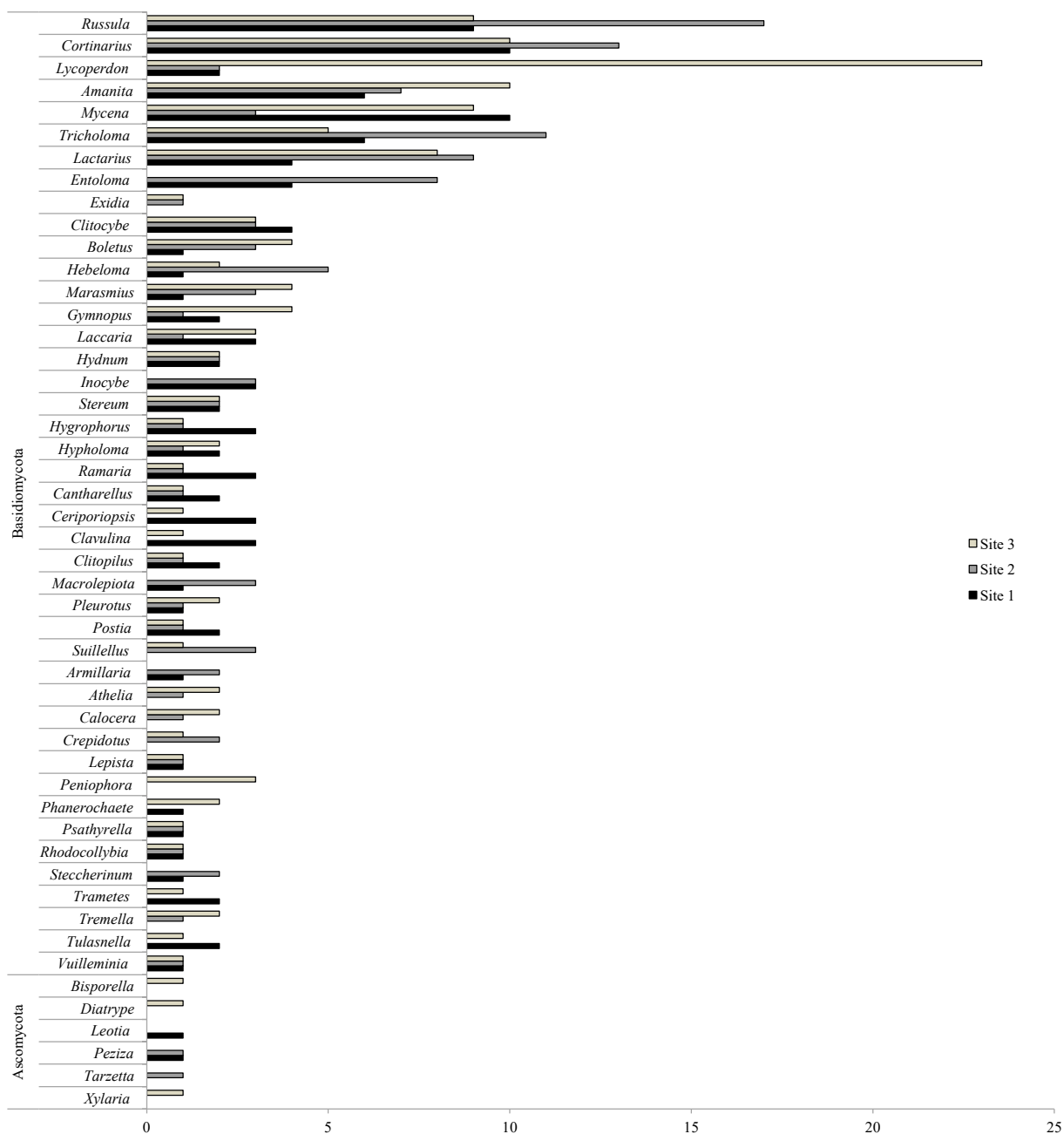


Fig. 4 Species repartition into genera for each study site. Genera of Basidiomycota with only one and two species were excluded from the graph.

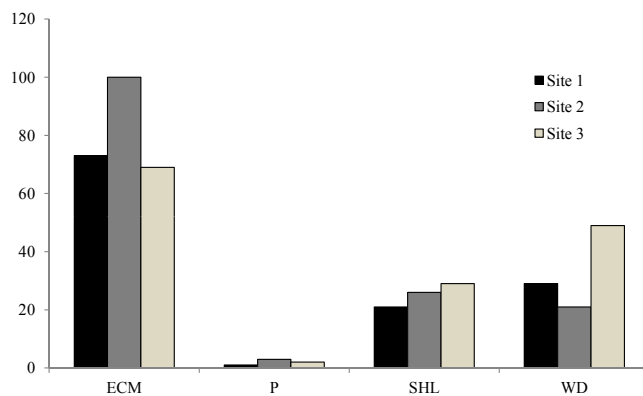


Fig. 5 Repartition into trophic group.

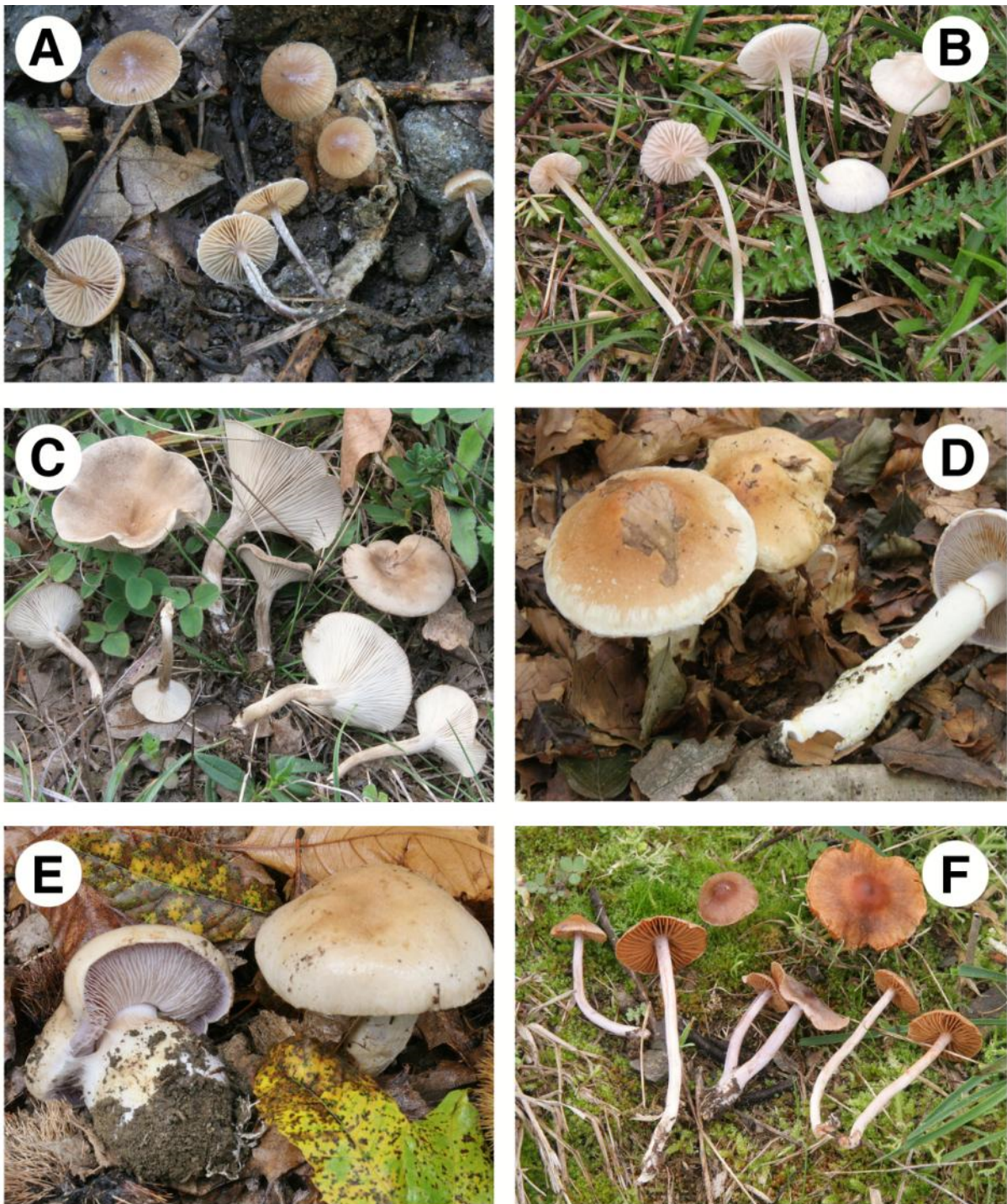


Fig. 6 Images of some recorded macrofungi by F. Boccardo. (A) *Deconica crobula*; (B) *Entoloma cinchonense*; (C) *Clitocybe herbarum*; (D) *Cortinarius ophiopus*; (E) *Cortinarius olidoamethysteus*; (F) *Cortinarius helianthemorum*.

The presence of new records and rare species add to the data on their geographic distribution. Specifically, to the best of our knowledge, the aforementioned (see “Results” section) seven species have not been listed in the available checklists of the Italian macrofungi [15,17,40,41,43]. Worldwide check-listing studies stated that *Alboleptonia sericella* has been recorded in South America (e.g., in Brazil [44] and Guyana [45]), in the USA (in California [46]), and in Europe (e.g., in Germany [47] and Poland [48]). Information available on the geographical distribution of *Clitocybe herbarum* found in Cyprus island (Mediterranean basin) is limited [49]. *Cortinarius caesiopallescens* was collected in Europe (in France) and previous studies highlight the rarity of this species [22–26,50]. Similarly, *C. helianthemorum*, *C. olidoamethysteus*, and *C. ophiopus* were collected from France [50–52]. Finally, the geographical distribution of *Entoloma*

cinchonense has been reported from Korea [53]. The few studies available confirmed the rare distribution and number of collections of these seven species, as well as the lack of published data/records from Italy.

Further investigations are needed to define an accurate Italian checklist and to enrich our knowledge on macrofungal biodiversity in the Mediterranean forests.

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