Fl. Medit. 26: 63-68
doi: 10.7320/FlMedit26.063
Version of Record published online on 7 November 2016

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A list of macromycetes from Calabria (southern Italy)

Abstract

Pisani, G., Gargano, M. L. & Venturella, G.: A list of macromycetes from Calabria (southern Italy). — Fl. Medit. 26: 63-68. 2016. — ISSN: 1120-4052 printed, 2240-4538 online.

On the basis of literature data and personal observation, a list of 338 species (319 *Basidiomycetes*, 18 *Ascomycetes* and 1 *Zygomycetes*) belonging to 156 genera included in 70 families is here reported for Calabria. Comparing the literature data with our records we confirmed the presence of 281 species while 57 are new for Calabria.

Key words: fungi, ecology, distribution, *Basidiomycetes*, *Ascomycetes*, *Zygomycetes*.

Introduction

Calabria is one of the Italian regions with the highest rate of forest areas (41%). On a total forest area of 612,931 hectares, 31% of the land area (amounting to 468,000 hectares) are covered by woodland (Iovino & Menguzzato 2000a). The most represented type of vegetation are characterized by the presence of *Fagus sylvatica* L. and *Abies alba* Mill. occasionally mixed with *Pinus nigra* subsp. *laricio* Maire (Ciancio & al. 1995, 2008). Mixed and pure forests of evergreen and deciduous oaks, coppice and *Castanea sativa* Mill. groves, high and low maquis, garrigues and reforestation with Mediterranean pines are also distributed in the territory (Iovino & Menguzzato 2000b).

As reported by Venturella & al. (2011) a remarkable number of macrofungi are present within the different types of vegetation of Calabria. The data reported for Calabria in the Checklist of Basidiomycetes from Italy (Onofri & al. 2005) derived from the lists of macrofungi by C. Lavorato & M. Rotella and, A. Contin (unpublished personal lists), the book of Bernicchia (1990) and the publications of Bernicchia & Padovan (1991), Lavorato & Lavorato (1985) and, Roseti & al. (1998). No other publications on macromycetes of Calabria are available at the time of writing this publication.

In this paper, based on research carried out directly in the field, we confirmed the presence of some macromycetes and provided a list of new species for Calabria.

Materials and Methods

Periodical observation in forest ecosystems in the Ferdinandea territory (Serre Calabresi), prevalently characterized by pure or mixed stand of *F. sylvatica* and *A. alba*, were carried out from 1999 until nowadays. In particular we investigated the woods of Ferdinandea (800-1400 m a.s.l.) and Archiforo (900-1080 m), the localities of Stilo, Bivongi, Brognaturo, Mongiana and, Serra San Bruno (province of Reggio Calabria and Vibo Valentia) and the forest ecosystems belonging to the municipalities of Sorianello, the wood of Prastu, Spadola, Lacina, Monte Pecoraro, Santa Maria and, Certosa di Serra San Bruno. The wood of Archiforo, extended 4913,61 ha, is a Site of Community Importance (SCI, code IT9340121) which almost entirely falls in the municipality of Serra San Bruno (province of Vibo Valentia). The wood represent ca. 26.5 % of the territory of the Regional Natural Park of the Serre.

The collections were made through samplings of each ascoma and basidioma. The surveys were limited to macromycetes that were visible to the naked eye (1 mm in size) (*sensu* Arnolds 1981).

The fungi were identified on fresh based on macro-morphological and microscopic features according to the methodology adopted by Venturella & al. (2015a, 2015b, 2016). The following keys, books and monographies were used for identification: Dennis (1978); Moser (1980); Jülich (1989); Candusso & Lanzoni (1990); Ryvarden and Gilbertson (1993–1994); Courtecuisse & Duhem (1994); Basso (1999); Bernicchia & Gorjón (2010); Breitenbach & Kränzlin (1984, 1986, 1991, 1995, 2000); Robich (2003) and Bernicchia (2005).

Finally the unpublished lists of Lavorato & Rotella and, A. Contin, the book of Bernicchia (1990) and the publications of Bernicchia & Padovan (1991), Lavorato & Rotella (1985) and, Roseti & al. (1998) have been compared with our collections.

The nomenclature of vascular plants follow The Euro+Med PlantBase - The Information Resource for Euro-Mediterranean plant diversity (http: //www.emplantbase.org/home.html) while the nomenclature of fungi is referred to Index Fungorum (http://www.indexfungorum.org/names/names.asp).

Distribution data based on The Universal Transverse Mercator (UTM) are also provided for each taxon.

The herbarium specimens were prepared in a hamper ventilator and kept in the personal Herbarium of G. Pisani and in the Herbarium SAF of the Department of Agricultural and Forest Sciences in the University of Palermo.

Species diversity and ecological notes

The literature data in addition to our research carried out in forest areas of Calabria have shown the presence of 338 species belonging to 156 genera included in 70 families. 60 families belong to the class *Basidiomycetes*, 9 to the class *Ascomycetes* and 1 to the class *Zygomycetes*. The largest number of genera (140) and species (319) belongs to the *Basidiomycetes*. 18 fungi are *Ascomycetes* included in 15 genera and 9 families. *Pilobolus kleinii* Tiegh. (*Pilobolaceae*) is the only species belonging to *Zygomycetes*. Comparing the

literature data with our records we confirmed the presence of 281 species (131 genera and 63 families) (Electronic supplementary file 1) while 57 species (25 genera and 7 families) are first record for Calabria (Electronic supplementary file 2). The presence of these species in the forests of Calabria is not ruled out even in the past but their failure to find by other researchers is certainly to be attributed to climatic factors that have limited their appearance in some years of observation.
The fungi were collected in an altitudinal range of 225-1995 m mainly within the mixed wood of *Abies alba* and *Fagus sylvatica* in the woods Ferdinandea and Archiforo. The fungi were collected mainly in autumn, but depending on the weather conditions of the year, they were also regularly collected in the summer months. Many trees of the Calabrian forests form ectomycorrhiza and this is demonstrated by the high number of species belonging to the families *Russulaceae* (40), *Boletaceae* (32), *Tricholomataceae* (24) and, *Amanitaceae* (13). The saprotrophs are also widely available on different organic residues, on the litter and the many wood residues that are found abundantly in the forests. In the forests of Calabria there are also many species that grow on living plants, on stumps, cones, roots and fallen branches of large and small size. Their appearance is favored by the presence on the Calabrian territory of old-growth forests and by the type of forest management (Ciancio & al. 2005, 2008). They are mainly represented by species of the families *Agaricaceae* (23), *Hygrophoraceae* (9), *Mycenaceae* (9), *Physalacriaceae* (9), *Omphalotaceae* (8) and, *Strophariaceae* (7).

Discussion and Conclusions

Although this study concerns a restricted part of the territory of Calabria the number of species surveyed is sizable. In fact if we compare the diversity of species reported in our survey with that of a wider area of Basilicata (Venturella & al. 2016) we can assume that an extension of field investigation in all the Calabrian territory could show a fungal diversity comparable with that of Sardinia, currently the Italian region with the highest number of fungal species (Venturella & al. 2011). The fungal diversity of Calabria is strongly influenced by plant diversity and species composition in forest ecosystems and the impact of forest management. The high number of ectomycorrhizal fungi (182 species), which corresponds to 53.8 % of the total number of surveyed fungi, is an expression of the good health of the forests of Calabria and the functioning of ecosystems (Amaranthus 1998).

Some interesting species both for their role in the ecosystem than for applicative potential were surveyed during our study. *Pilobolus kleinii*, growing on dung, is a rare species in Italy while *Rhizocybe vermicularis*, recently described by Alvarado & al. (2015), is reported from the Ferdinandea territory in a mixed wood of *Abies alba* and *Fagus sylvatica*. The presence of *Pleurotus columbinus* on dead trunk of *A. alba* in the Archiforo wood increases the number of species of the genus *Pleurotus* in Italy (Zervakis & al. 2014; Venturella & al. 2015a) and the number of oyster mushrooms which can be cultivated on various ligninocellulosic wastes (Mandeel & al. 2005) and investigated for their healing properties (Schillaci & al. 2013). *Schenella simplex*, a species which appears to be exclusively associated with conifers of diverse genera (Estrada Torres & al. 2005) is reported for the first time in a *Castanea sativa* wood. *Ramaria bataillei*, a species known from many European countries, especially from the

Alps in central and western Europe (Franchi & Marchetti 2001), is reported for the first time in Calabria and in southern Italy too. *Tylopilus porphyrosporus* is a widespread species of Europe, especially in the north, but is infrequent in Italy (Watling & Hills 2005). A very important record is that of *Phylloporus pelletieri*, short-listed for inclusion in Appendix I of the Bern Convention, by the European Council for Conservation of Fungi (ECCF), and included on the Red Lists of 12 European countries (Dahlberg & Croneborg 2003). *Sarcodon scabrosus*, a northern European species apparently mycorrhizal with pines (Hrouda 1999) was found in a *Q. ilex* wood of the Ferdinandea territory. The distribution in Italy of *Artomyces pyxidatus*, a widespread species but uncommon in Europe, is scattered (Onofri & al. 2005) as also that of *Cortinarius cyanites*, *C. claricolor*, *Entoloma cetratum*, *Phaeoclavulina abietina* and, *Ramaria largentii*. Data reported in this paper also confirmed the preference of *Alessioporus ichnusanus* for the Mediterranean environment. Finally significant reports are those of *Cystolepiota sistrata*, so far reported only for Lazio, Tuscany and, Trentino Alto Adige (Onofri & al. 2005). The presence of *Amanita spadicea*, a basidiomycetes with predominant distribution in central and northern Italy, and *Clavaria acuta*, reported by some amateur groups only twice in northern Italy and more recently in Sardinia, is noteworthy.

Acknowledgments

The authors contributed equally to this work.

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