

# The current state of knowledge of fungal diversity in Sicily

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**Abstract.** Current knowledge of fungal diversity in Sicily is reported based on historical data and recently field records. A preliminary list of rare and infrequent fungal species is also provided.

**Key words:** Mediterranean, fungal diversity, Sicily

## Introduction

Sicily and its adjacent small islands are considered to be areas of high phytogeographic interest in the Mediterranean region. The vascular and cryptogamic floras of Sicily result from convergence of different floristic elements which may co-exist in relation with the diversity of environments.

The Sicilian floristic district lies in the centre of the Mediterranean region where it covers an area of *ca* 26 000 km<sup>2</sup>, between latitudes 35° and 39° North. The district is part of the Ligurian-Tyrrhenian province and includes the Pelagie-Maltese sector and the Sicilian sector. The latter also includes the Egadi islands, the island of Ustica and the Eolian archipelago.

In Sicily, rainy days are mainly concentrated in autumn and in *ca* 70 days. The annual average rainfall is 400–1200 mm while the annual average temperature is 11 °C in the mountains and 19 °C on the coast and small islands. The minimum temperature frequently drops below 0 °C on higher mountains during the quarter December–March. On north facing slopes, fogs contribute to create oceanic conditions which are important for survival of *Fagus sylvatica* L., which is located at the southernmost border of its distribution in Europe. Sicily is characterized by different mountainous systems and by the presence of the volcano Mount Etna (*ca* 3400 m). Half of Sicily's flora has been recorded from the Madonie region. Many endemic species are present in the island, the most important of which is *Abies nebrodensis* (Lojac.) Mattei, a threatened species with only 35 remaining individuals in its population (Venturella *et al.* 1997).

The vascular flora of Sicily is well investigated and many renowned botanists such as Boccone, Gussone, Cupani, Tineo, Parlato, and others published important monographs from the 17<sup>th</sup> century onwards. The number of native species in the vascular flora amounts to *ca* 2700 taxa belonging to 137 families and 800 genera. Many authors also pointed out the correspondence between Sicilian, North African, and Middle East floras. Woody areas cover *ca* 10 % of the territory and are mainly concentrated inland and on the mountains.

The vegetation types of Sicily belong to the “Mediterranean zone”. Along the coasts two vegetation belts (“Mediterranean arid” and “Mediterranean”) predominate. They are mainly characterized by *Quercus ilex* L. and *Quercus suber* L. woodlands. A wide part of the area is covered by mixed natural woodlands with *Pinus*, *Eucalyptus*, and *Cupressus* species. The hills are characterized by mixed oak woods, chestnut woods, and hazel and ash cultivation. A particularly characteristic vegetation with *Quercus petraea* (Mattuschka) Liebl. and *Ilex aquifolium* L. is found on the Madonie mountains from 1200 to 1400 m. *Fagus sylvatica* woods are concentrated from 1200 to 2000 m in the so-called “Subatlantic belt”. On Mount Etna, forest vegetation rises to *ca* 2500 m, being characterized by *F. sylvatica* and *Pinus laricio* Poir. wet woodland and the presence of *Betula aetnensis* Rafin. The woody vegetation ends above 2000 m and is substituted by spiny shrubs of *Astragalus nebrodensis* (Guss.) Strobl.

In contrast with the interest on vascular flora and the consequent high number of related scientific papers, cryptogams in general, and fungi in particular were for a long time ignored by researchers. Until the second half of the 19<sup>th</sup>

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century, for example, *Boletus edulis* Bull. : Fr. and *Amanita caesarea* (Scop. : Fr.) Pers., two very common species in Italy, were unknown to Sicilians.

## Historical remarks

Although there are rather early accounts provided by some pre-Linnean Sicilian authors like Boccone (1674) and Cupani (1696-1697), the first real information on Sicilian fungi was provided by Rafinesque (1814) and Bivona Bernardi (1815, 1816).

In the appendix of the monograph of Father Bernardino da Ucria (1879) a few species of fungi were reported with short descriptions of some morphological characters, local names, and ethnomycological uses.

Giuseppe Inzenga (1816-1887) played a fundamental role in the beginning of modern mycology in Sicily with the publication, between 1865 and 1869, of two volumes, the so-called "Centurie", including 200 specific and infraspecific taxa. The recent findings of new, and apparently lost drawings and descriptions of Inzenga's collection (Venturella 2002), enabled many critical unsolved taxonomic cases to be resolved. The records reported in the "Centurie" mainly arose from the neighbourhood of Palermo and encompassed 169 species and 1 variety.

Many years later, an amateur mycologist Francesco Catanzaro (1962, 1963, 1968, 1971), thanks to the help of Prof. Ceruti working at the University of Turin, reported a significant number of fungi from Sicily. In particular 204 species were reported from the island of Pantelleria and 55 from the neighbourhood of the town of Mazara del Vallo (province of Trapani).

In more recent times, researchers from the University of Catania published lists of fungi from Mount Etna, the province of Catania, the Nebrodi and Caronie mountainous systems (province of Messina), and the Madonie Mountains (see literature cited in Venturella, 1991).

In parallel, the efforts of the European Council for the Conservation of Fungi (ECCF) and the activities of the Species Survival Commission (SSC) of the International Union for the Conservation of Nature (IUCN) stimulated in each European country steps to recognize fungi as important organisms to be preserved from decline.

## The Sicilian fungal census project

### *Background and methodology*

The starting point of an intense and rational exploration of Sicily to evaluate its fungal biodiversity is marked by the decision, taken in 1991, of the Working Group for Mycology of the Italian Botanical Society to stimulate research projects in each Italian region to collect data for a Check-list of Italian fungi.

The Working Group for Mycology also established the methodology for mapping macromycetes. This is based on periodical observations of the occurrence of macrofungi in the areas under study. Distributive data are referred to the 1: 50 000 grid maps (Italy's official series of maps). Each sheet was further divided into 64 subunits (3.5 × 2.5 km) to obtain a more detailed distribution of each taxon in the area under study (Padovan 1994).

In 1991, the Laboratory of Mycology of the Department of Botany of the University of Palermo, co-ordinated by Giuseppe Venturella, started a new project to investigate the mycota of Sicily and its adjacent islets.

A preliminary, but fundamental step, for the assessment of fungal biodiversity in Sicily was publication of a *Check-list of Sicilian fungi* (Venturella 1991) based on literature data and some unpublished records. The state of knowledge of fungal biodiversity in 1991 can be represented by the following statistics: 452 genera, 1457 species, and 20 varieties (601 macrofungi and 876 microfungi) belonging to 133 families.

### *Check-lists of fungi in regional Parks and natural Reserves*

In 1995 the Madonie Park Administration, funded a specific project with the aim of increasing knowledge of macrofungi in the Madonie area. 614 taxa (63 ascomycetes and 551 basidiomycetes) including 25 varieties and 8 forms, belonging to 200 genera included in 79 families were recorded, i.e. 50 % of the Sicilian mycota so far known (Venturella *et al.* 2000). The richest areas are concentrated in the central part of the Madonie territory and mainly correspond to the more important woodland areas. Five areas show high degrees of diversity numbers of taxa ranging from 154 to 375 taxa.

Another important investigated area is the Natural Reserve of Ficuzza Wood-Rocca Busambra (central Sicily). 741 taxa (72 ascomycetes and 669 basidiomycetes) including 37 varieties and 6 forms belonging to 210 genera of 80 families were recorded by Venturella *et al.* (2001).

The Nebrody territory (northern Sicily), included in a regional Park, hosts approximately 70 000 hectares of wooded areas i.e. 30 % of Sicily's woodland. In the past this area was not explored by mycologists and only 176 taxa (9 micromycetes and 167 macromycetes) were reported in the literature. Mycological investigations in the Nebrodi territory were recently carried out and the number of fungi quickly raised to 638 species from 198 genera and 75 families.

### *National projects as a basis for improving mycological knowledge in Sicily*

In 2000, the Italian Ministry of Environment funded a national project for the assessment of fungal biodiversity

in Italy. The first phase was the publication of the *Check-list of Basidiomycetes* (Onofri *et al.* 2001). More than 4000 basidiomycetes were recorded from Italy and the number of taxa reported from Sicily was 1248 (29 % of all basidiomycetes currently known from Italy).

### Sicilian fungi – the latest information

Recent additions to the list of fungi known from Sicily arise from field excursions in the provinces of Catania (145 taxa), Siracusa (111 taxa), Messina (24 taxa), and Enna (2 taxa). The wooded areas of the province of Palermo were also investigated and more than 1000 taxa were recorded. In addition, searches for hypogeous fungi resulted in collections of 35 taxa including some edible truffle species (*Tuber aestivum* Vittad., *T. borchii* Vittad., *T. brumale* Vittad., *T. mesentericum* Vittad.).

Based on the data reported in the current work, the number of fungi recorded from Sicily has reached approximately 1600 taxa. This is probably an underestimate because large areas of central and southern Sicily and its adjacent islets are still quite unexplored.

On the basis of those records, it has been possible to prepare a preliminary list of macrofungi which can be considered rare or infrequent in Sicily and to select species directly linked with certain specific ecosystems. In particular, *Helvella solitaria* (P. Karst.) P. Karst., *Lepiota cortinarius* J.E. Lange, *Macrotyphula fistulosa* (Holmsk. : Fr.) R.H. Petersen, *Entoloma atrocoeruleum* Noordel., *E. bloxamii* (Berk. & Broome) Sacc., *Gyroporus cyanescens* (Bull. : Fr.) Quél., *Albatrellus pes-caprae* (Pers. : Fr.) Pouzar, *Ossicaulis lignatilis* (Pers. : Fr.) Redhead & Ginns, and *Pleurotus nebrosensis* (Inzenga) Quél. are rare in Sicily, while *Trichoglossum hirsutum* (Pers. : Fr.) Boud., *Verpa digitaliformis* (Müller : Fr.) Swartz, *Hydnocystis piligera* Tul., *Agaricus bernardii* (Quél.) Sacc., *Amanita franchetii* (Pers. : Fr.) S.F. Gray, *A. lividopallescens* (Gilbert) Gilbert & Kühner, *Boletus fechtneri* Velen., *B. luteocupreus* Bertéa & Estadès, *Ramariopsis kunzei* (Fr. : Fr.) Corner, *Hericium erinaceum* (Bull. : Fr.) Pers., *Lactarius ilicis* Sarnari, *L. mediterraneensis* Llistos. & Bellù, *Strobilomyces strobilaceus* (Scop. : Fr.) Berk., *Lepista personata* (Fr. : Fr.) W.G. Smith, and *Melanoleuca pseudoevenosa* (Bon) ex G. Moreno & Bon are infrequent. *Leccinum corsicum* (Rolland) Singer, *Hebeloma cistophilum* Maire, *Lactarius cistophilus* Bon & Trimbach, and *L. tesquorum* Malençon are strictly linked to environments in which the vegetation type is characterized by *Cistus creticus* L., *C. salvifolius* L., and *Erica arborea* L. Among the numerous boletes, *Boletus aereus* Bull. : Fr. is the most widely distributed and recorded species. It shows high ecological plasticity in evergreen oak woodland, thermophilous broad-leaved woods and in beech woods. *Boletus impolitus* Fr., *B. queletii* Schulzer var. *queletii*, and *B. radicans* Pers.: Fr. are very common and *B. rhodoxanthus* (Krombh.) Kallenb., a declining species in Europe, is frequently recorded.

### Conclusion

The future target of fungal research in Sicily is to cover the whole territory and print an up-to-date check-list of macrofungi.

To achieve such an important objective, intense exploration of the area is in progress. The funding of several research projects by the Ministry of Universities and, at regional level, by the Agricultural and Forestry Administration has provided useful help. Some farmers' co-operatives and private concerns have furthermore funded specific research projects on biodiversity and bioprospecting of fungi in Sicily.

Screening of fungi from different forest ecosystems in the provinces of Messina and Agrigento continues.

Distribution maps have very recently become available for fungal species growing in the province of Palermo and some IPAs (Important Plant Areas) have been identified.

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