

Conservation and value of fungal diversity in the Mediterranean area: an overview of Tuscan experience

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Abstract. Alarming reports of recent loss of biodiversity have emphasized the importance of studies of the natural heritage with a view to its conservation. Basic steps for the conservation of fungi by means of the Tuscan experience are here reported.

Key words: biodiversity, protection of macromycetes, Tuscany (Italy)

Introduction

The concept of biodiversity has recently acquired widespread credibility. It has been recognized in international policy since the Convention on Biological Diversity attended by many countries during the 1992 Earth Summit in Rio de Janeiro. The first article of the Convention defines the objectives as “the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of utilization of genetic resources...” (<http://www.biodiv.org/>).

The concept of biodiversity is a global concept that can be summarized as the expression of the variety of life. Biodiversity is crucial for the survival and normal functioning of many ecosystems, and consequently for life on the planet Earth. The changes our planet is undergoing today are no longer due only to the forces of nature, as it was for billions of years, but also to increasing human impact. Biodiversity suffers as a result.

Realization that life is part of a complex interdependent system has raised concern and interest in conservation on the part of the general public and the scientific community. Many world, national, and local networks have been established to safeguard biodiversity. In the field of natural science, these are a few examples:

- IUCN (The World Conservation Union) founded in 1948 “to influence, encourage and assist societies throughout

the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable...” (<http://www.iucn.org>)

- Planta Europa, “a developing network of organisations working for plant conservation in Europe, with the ultimate aim of conserving European wild plants, both higher and lower, and their habitats...” (http://www.plantlife.org.uk/html/partnership_planta_euro.htm)

The ecological importance of macrofungi has led to their recent inclusion, with the same status as plants and animals, in many projects. Important work has been done by the European Council for the Conservation of Fungi (ECCF), established at the ninth European Congress of Mycologists in Oslo in 1985 (its original name was European Committee for the Protection of Fungi, ECPF). The task of the ECCF is to promote studies and publications on the protection of fungi.

Methods and Results

Progress in conservation depends on information and understanding of the natural world. This is particularly true in mycology, which has been explored much less than botany and zoology, especially in the Mediterranean area, where biodiversity is known to be quite high (Loidi Arregui 1998, abstr.). The world of fungi is more diverse than that of plants; e.g. in evergreen oak woods of Tuscany there are more than 300 species of macromycetes and less than 40 tracheophytes (Perini *et al.* 1989).

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Many types of research are required to gather the information necessary to protect the mycological heritage.

The first step is to establish a good basis of taxonomy and nomenclature for a common scientific language. Every year, many new species are described and reviewed among the Mediterranean mycoflora. In Tuscany, examples include *Antrodia macrospora* Bernicchia & De Dominicis (Bernicchia 1991), *Lindtneria hydnoidea* Bernicchia & Ryvarden (Bernicchia & Ryvarden 1998), *Mycena cupressina* Antonín & Maas Geest. (Antonín & Maas Geesteranus 1998), *Mycenella variispora* Robich (Robich 1998), *Rhodocollybia giselae* Neville & Antonín (Antonín & Neville 1998), and *Vararia maremmana* Bernicchia (Bernicchia 1992).

A second step is to acquire knowledge about the presence and distribution of the various species (flora, checklist, mapping), without which it is impossible to know which taxa are rare, restricted to certain environments or at the limits of their distribution. The first region of Italy to publish the results of a fungal census and distribution was Tuscany (Tofacchi & Mannini 1999). Following the instructions established on a national level by the Società Botanica Italiana (SBI), the vast territory of Tuscany (almost 23 000 km²) was surveyed and field-data was collected, which make reference to a geographical basis of ca 9 km²; special attention was given to epigeous macrofungi and the areas identified by Objective 5/b of EEC Reg. 2081/93. The study was carried out by amateur and professional mycologists of Associazione dei Gruppi Micologici Toscani (AGMT) with precious funding by the “Azienda Regionale per lo Sviluppo e l’Innovazione nel Settore Agricolo-forestale” (ARSIA). Chorological and ecological data was obtained on ca 1000 species. Most of the studies were made in the hill belt from the sea to 800-900 m, and have so far been mainly concerned with wooded areas. In fig. 1 the number of genera belonging to main taxonomical groups is reported. Fig. 2 shows the number of species records founded in each altitude belt. The status of individual species was investigated, identifying those that are rare or threatened. Six species cited in the preliminary red-list for Italian fungi (Venturella *et al.* 1997) were found in the investigated area: *Amanita eliae* QuéL., *Battarraea phalloides* (Dicks. : Pers.) Pers., *Cortinarius orellanus* (Fr. : Fr.) Fr., *Entoloma bloxamii* (Berk. & Broome) Sacc., *Leucopaxillus lepistoides* (Maire) Singer, and *Russula seperina* Dupain. The data obtained is a prerequisite for compiling Tuscan checklist and Red List, which are in turn required for the creation of Italian lists.

Ecological information is important for identifying and protecting habitats of special mycological interest. The most appropriate way of discovering relations between fungal communities and the environment in which they grow is myco-enological research. This type of study has been conducted in various forest ecosystems of Tuscany since the late 1970s (De Dominicis & Barluzzi 1983; Monti *et al.* 1985; Barluzzi *et al.* 1986, 1987, 1992; Perini *et al.* 1989, 1995; Laganà *et al.* 1999, 2001; Salerni *et al.* 2000, 2001), largely by the Department of Environmental Sciences of Siena University.

To determine temporal changes in fungal communities in specific environments, these communities need to be monitored. This involves research over long periods aimed at following the status of one or more species or the whole community. Studies of this type have been carried out in Tuscany (Laganà *et al.* 1996; Salerni *et al.* 1999) and are still underway. Citing Lizoň (1993) “... evaluation of the changes in mycoflora is based on the comparison of past and current records ...”. Many such studies have been carried out in Europe but few in the Mediterranean area. In 1997, a PhD was instituted at the Department of Environmental Sciences of Siena University to study the status of fungal communities 10-20 years after the first myco-enological studies in central-southern Tuscany (De Dominicis & Barluzzi 1983; Barluzzi *et al.* 1987, 1992; Perini *et al.* 1989, 1995). Combined study of fungal communities and ecological and local parameters of the study areas was carried out with the aim of explaining the changes observed (Laganà *et al.* 2000a, b, 2002). An interesting example regards communities in forests dominated by *Quercus ilex* L., typical of Mediterranean environments (Laganà *et al.* 2000a). The number of fungal species found in 1998 in the four study areas (two near the Grosseto coast; two in the inland hills near Siena) was 201, 98 of which had previously been reported from the same stations and 103 of which were reported for the first time. A marked decrease in the number of species (from 98 to 35), especially symbionts, was recorded in the station closest to the sea (st. 1). In fig. 3 the number of species belonging to the main genera found in st. 1 in each of the study periods is showed. According to the criteria proposed by Fellner & Soukup (1991), who found a correlation between the percentage of mycorrhizal and lignicolous species and forest decline, it seems that this evergreen oak wood, where symbionts are only 20% and lignicolous fungi 31.43% of the mycoflora, is undergoing acute disturbance of its ecotrophic stability. A certain main cause of the modifications detected was the very hot and dry summer in 1998. These conditions were more extreme along the coast than inland (st. 3 and 4), and it is well known that such climate always leads to lower carpophore productivity, in particular of symbionts. The mycoflora, however, might recover in subsequent years; a dry summer may induce only reversible fluctuations. The age and management of the woods was certainly another factor, as indicated by various authors (Dighton & Mason 1985; Mason *et al.* 1987; Hintikka 1988; Keizer & Arnolds 1994); indeed station 1 is not only the oldest forest (ca 46 years) but is the only one managed for mature trees.

The close relationship between fungi and environment means that conservation of fungal species is equivalent to environmental conservation. This is particularly true for entities that only grow in certain habitats; if their habitat is threatened, so are they. In Tuscany, an interesting example is the sandy dune area at Lake Burano, a WWF nature reserve since 1968. The reserve is 50 km from Grosseto and has an area of 300 ha, including a double line of dunes, 5-6 m high, a coastal lake and cultivated fields. Climate is Mediterranean. Research on plants, lichens and fungi in the dunes, which are

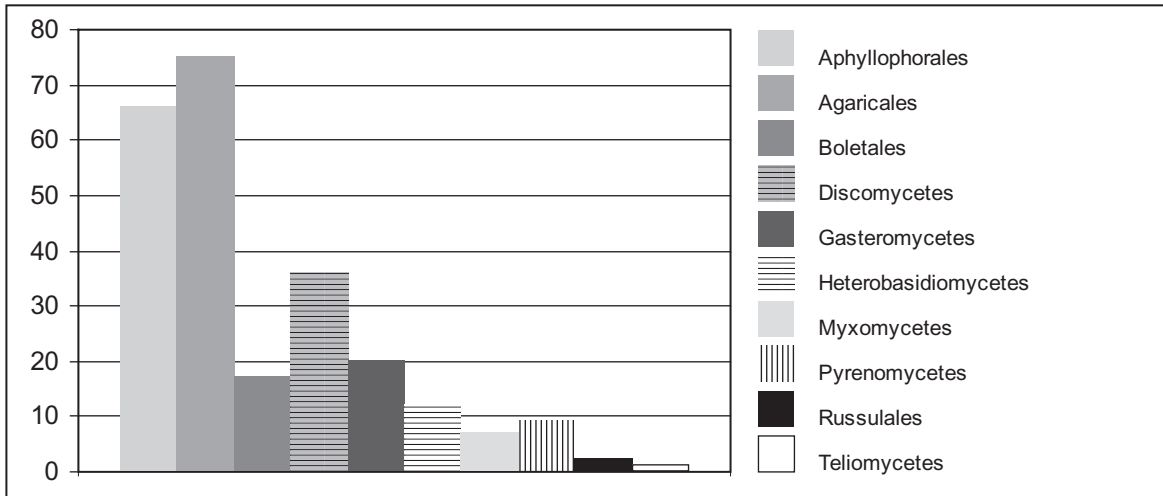


Fig. 1. Number of genera belonging to main taxonomic group (data up to 31 December 1998)

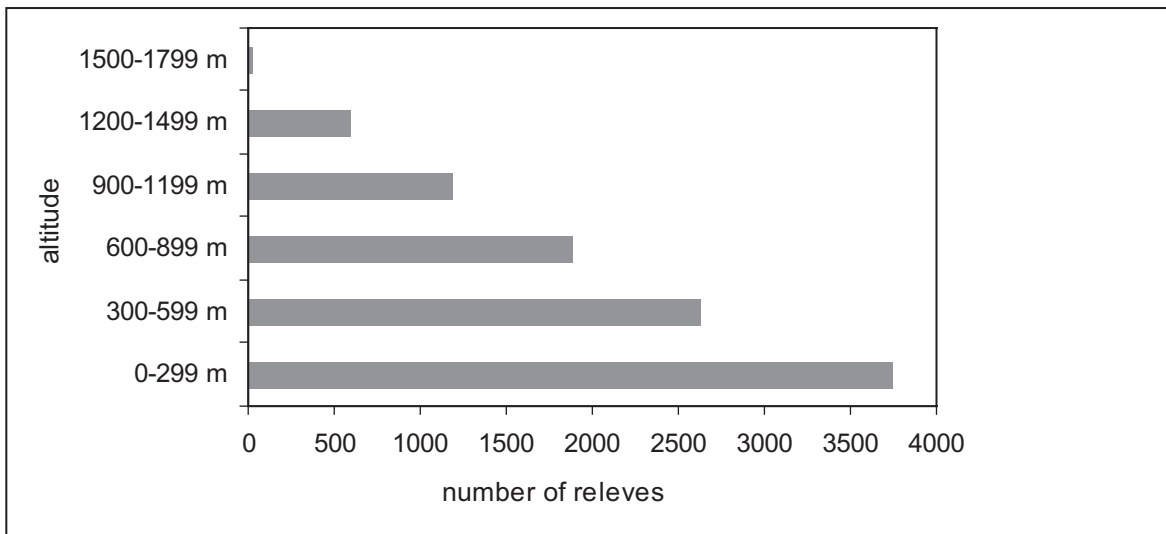


Fig. 2. Number of species records in each altitudinal belt (data up to 31 December 1998)

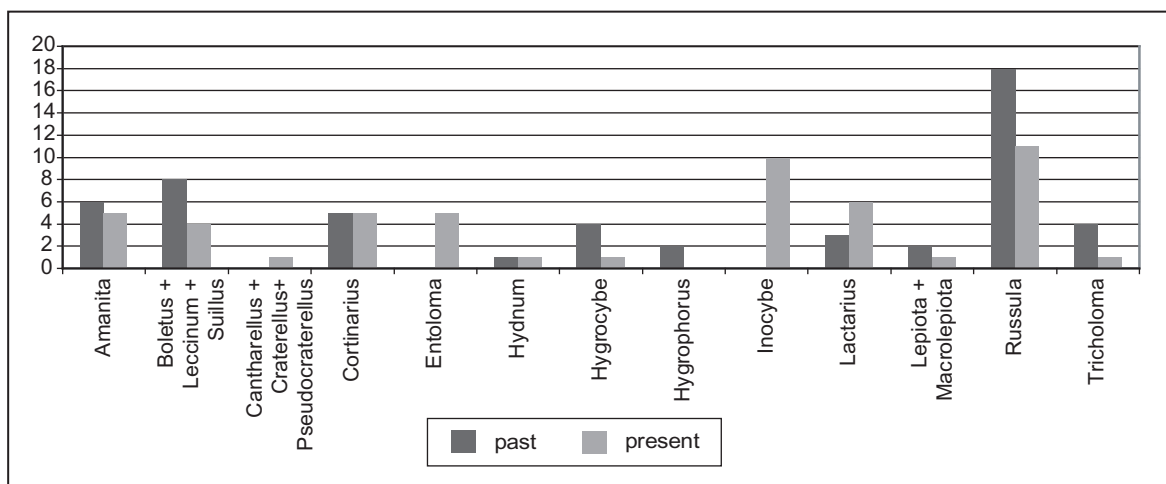


Fig. 3. Number of species belonging to the main genera found in st. 1 in the two study periods

covered in discontinuous Mediterranean maquis, show that this habitat is one of the best preserved on the Tyrrhenian coast. Fungi identified include *Gyrophragmium dunalii* (Fr.) Zeller, *Hydropus mediterraneus* Pacioni & Lalli, *Leucoagaricus menieri* (Sacc.) Singer, *Macrolepiota phaeodisca* Bellú, and *Psathyrella ammophila* (Durieu & Lév.) P.D. Orton, typical of sand dunes. Concerning the last one, Courtecuisse (1984) found a close relation between *P. ammophila* and the strongly threatened pioneer vegetation, *Ammophiletaea* (Romao 1996).

Discussion

The data obtained from all these studies could be used as a basis for the compilation of a Red List. These lists are useful for creating nature reserves and for environmental planning generally. Many European countries have drawn up national Red Lists, which vary in comprehensiveness according to the level of knowledge of their natural heritage achieved. A preliminary European Red List was published by Ing (1993), but more data is required to complete it, particularly data of Mediterranean countries. These gaps and the objective difficulties of mycological research have been the main reasons why fungi have not hitherto been considered in the various EC projects of environmental conservation. In this regard, the work of ECCF has been determinant. The network of this organisation has outlined the priorities in the field of mycological conservation towards which member countries are committed to working. ECCF also has the merit of reactivating the Species Survival Commission of Fungi of the IUCN and appointing a mycological representative in the network of Planta Europa. Finally, in 2001 ECCF drew up a list of 33 fungal species to propose for the Bern Convention. This means that also fungi, like other lifeforms, in the very next future will be regarded with respect!

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