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***Inocybe obscurobadia* and *Neournula pouchetii*, infrequent macromycetes in Italy**

Abstract

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Two infrequent species from Italy, i.e. *Inocybe obscurobadia* (Basidiomycetes) and *Neournula pouchetii* (Ascomycetes) are reported for the first time from Sicily (southern Italy). The two species were collected in the Monti Sicani Park within a non-native forest in the Site of Community Interest (SCI ITA040005) - Monte Cammarata, Contrada Salaci.

Key words: Basidiomycetes, Ascomycetes, Non-native forests, Sicily.

Introduction

Although the past decade has seen an increase in fungal biodiversity studies with the discovery and identification of new taxa, the presence of infrequent species and ambiguous identification are still key topic for mycology (Olariaga & al. 2015). In Italy, several studies have been carried out on fungal diversity and on the presence in each region of rare and/or infrequent species (Venturella & al. 2011). Among these regions, Sicily represents a hot spot of mycological diversity (Venturella 1991) within which rare taxa have been recently reported in different forest ecosystems including those inside urban contexts (Venturella & al. 2012; Karadelev & al. 2017; Venturella 2017; Buccheri & al. 2020). During field researches aimed at characterizing fungal diversity two infrequent fungi from Italy were found in non-native forests of the Monti Sicani Park (Sicily) within the Site of Community Interest (SCI ITA040005) - Monte Cammarata, Contrada Salaci (Fig. 1) (Pardi & al. 2022).

Materials and Methods

Inocybe obscurobadia was photographed in habitat using a digital camera. The fresh basidiomata were dried using an hamper ventilator. The dried specimens are kept in the Herbarium SAF of the Department of Agricultural, Food and Forest Sciences (SAAF) of the University of Palermo (voucher specimen n°247). The macro-morphological characters of fresh basidiomata



Fig. 1 Investigated area in the Monte Sicani Park (Sicily).

were identified according to Stangl (1991). Microscopic structures were studied by using 3% potassium hydroxide and ammoniacal Red Congo under a Leica microscope.

Neournula pouchetii was photographed in habitat using a digital camera. The fresh ascomata were dried using a hamper ventilator. The dried specimens are kept in the Herbarium SAF of the Department of Agricultural, Food and Forest Sciences (SAAF) of the University of Palermo (voucher specimen n°248). The macro-morphological characters of fresh ascomata were identified according to Dissing & Eckblad (2000). Microscopic structures were studied under a Leica microscope by using Lugol's iodine and Melzer's reagent for the evaluation of the amyloidy of the asci. In addition, Congo red was used for staining the hymenial elements and water for a sporal measurement detection.

Plant names are referred to The Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity and fungi names to Index Fungorum.

Results

Inocybe obscurobadia (J. Favre) Grund & D.E. Stuntz

Inocybe obscurobadia (Basidiomycetes) belongs to the order *Agaricales*, class *Agaricomycetes*, subclass *Agaricomycetidae*, subdivision *Agaricomycotina*, family *Inocybaceae*.

The microscopy is very characteristic and allows a clear distinction from other species of *Inocybe*.

Basidiomata have a caespitose growth (Fig. 2). The cap, 19-25 mm, convex to campanulate, is brown to dark brown, faded when ripe, fibril-squamous to more or less glabrous in the center. General veil greyish-white at the margin of the cap. Gills adnate-smarginate, whitish with olive reflexes, then tending to ochreous. Stipe subconcolorous to the cap, cylindrical, 27-40 × 5-6 mm, slightly enlarged at the base, completely fibrillose, off-white to brownish when ripe, with visible curtain in unripe basidiomata. Flesh cream-colored, sperm smell and almost no flavor. The flesh of the stem blushes slowly when cut. Basidiospores, 8.4-10.6 × 4.8-6.1 μm, smooth, amygdaliform, with (sub)-conical apex. Cystidia metuloid on the gills, absent on the stipe. The cheilocystidia show elongated cylindrical necks and in many cases with sinuous contours and not too thick walls around 1.5 μm. Pleurocystidia cylindrical-(sub)-fusiform with elongated necks, often with a wavy profile.

Ortega & al. (2010) analyzed the mycorrhizal diversity from Mediterranean *Quercus* forest in the Iberian Peninsula (Spain and Portugal). They reported *I. obscurobadia* in *Quercus ilex* subsp. *ballota*, *Q. ilex* subsp. *ilex*, and *Q. suber* forests. Raventos & al. (2002) reported *I. obscurobadia* [sub: *Inocybe tenuicystidiata* Horak et Stangl] from Girona (Spain), in winter, under *Cistus monspeliensis* L. and *C. albidus* L. The species show a wide distribution in the Iberian thermophilous forests of *Quercus* and in *Cistus* shrublands (Esteve-Raventós & al. 2002).

Other distribution data are provided by different mycologists in various internet sites. In this regard, *I. obscurobadia* is reported by P. Tanchaud from France, under pine and spruces trees, in spring, in La Rochelle while M. Broussal for Plan du Lac in the National Park of La Vanoise (France) and A. Gerault in wetlands with alders and conifers in the Department of Finistère (France). Corriol & Hannoire (2010) found *I. obscurobadia* in a *Cistus salvifolius* L. and *C. monspeliensis* maquis.

I. obscurobadia is also reported from several localities of Aragon (N.E. Spain) and Canary islands. F. Pancorbo stated *I. obscurobadia* from La Gotera (Spain) close to *Cistus symphytifolius* Lam. in a *Pinus canariensis* C. Sm. wood.

In Italy, *I. obscurobadia* is reported by S. Tizaina from the province of Oristano (Sardinia) in a *Pinus pinaster* forest, from Emilia Romagna (F. Padovan, personal data), Lazio (Clericuzio & Fanelli 1992), Lombardia, Piemonte, Sardegna (Laganà & al 2002), Trentino Alto Adige (F. Bellù, personal data) and, Veneto (E. Bizio, personal data). M. Maletti reported *I. obscurobadia* from Calabria in a conifer wood.

A new record for southern Italy is reported here with the presence of *I. obscurobadia* in Contrada La Donna in the Monti Sicani Park (Sicily) within a reforestation of *Pinus halepensis* Mill., *Cupressus sempervirens* L., and *Cedrus atlantica* (Endl.) Carrière.



Fig. 2 Basidiomata of *Inocybe obscurobadia*.

***Neournula pouchetii* (Berthet & Rioussset) Paden**

Molecular phylogenetic and morphological studies characterized a new family, Chorioactidaceae Pfister (Ascomycota), in the order Pezizales J. Schröt. which include four genera *Chorioactis* Kupfer ex Eckblad, *Desmazierella* Lib., *Neournula* Paden & Tylutki, and *Wolfina* Seaver ex Eckblad. Chorioactidaceae symbolizes a sister clade to the *Sarcosomataceae*, to which some of these taxa were formerly referred (Pfister & al. 2008). *N. pouchetii* is distributed worldwide but is to be considered an infrequent species.

The ascoma (Fig. 3), not edible, is an apothecium of 4-5 cm in diameter, with the shape of an elongated ear, fissured and embedded in the ground with a small stem, globose with open star-shaped margins, undulated and lobed, with the edges turned outwards, a smooth outer surface, slightly floury, yellow, yellow-ochre, with pink-orange reflections, veined in the lower part and covered with fine whitish plumage on a brown or brownish background that darkens with maturation. The stem is elongated and covered by mycelium. The hymenium has a smooth surface with some protuberances, irregularly covered with a whitish pruine caused by the accumulation of spores. Flesh whitish and tenacious. Ascospores $20-26 \times 9-12\mu$, elliptical, finely warty with a thick wall; thick-walled octosporic asci; hyaline and bifurcate paraphyses of $10-12 \times 5-6\mu$, ellipsoidal, biguttulate, smooth.

The distribution of the species is restricted to western North America, southern Europe, and northern Africa. Apart from Bulgaria, where it is presumed to have been introduced,



Fig. 3 Ascomata of *Neournula pouchetii*.

the species has been found in Morocco, Spain, France, Italy, and Greece. *N. pouchetii* grows within *Cedrus atlantica* forests and in mixed forests always with the presence of cedar trees. Cavet & Martin (1988) found the species in the cedar forest of the Massif du Petit Luberon, in the Vaucluse, a department in the southeastern French region of Provence-Alpes-Côte d'Azur. Calonge & al. (2007) collected *N. pouchetii* in Fuencaliente (Spain) on litter of *Cedrus* sp. Zotti & al. (2008) reported a different habitat than that commonly indicated for *N. pouchetii* by reporting the species in spring in a *Pinus* ssp. reforestation. Maletti & Paolini (2013) reported *N. pouchetii* as infrequent and exclusive symbiont of *C. atlantica*, growing on litter of needles and on cones in spring from the Metauro Valley.

Many other distribution data do not emerge from scientific publications but rather from indications of different mycologists in various internet sites. In this regard, *N. pouchetii* is reported, in mixed forests with *C. atlantica*, between March and June, from Canada [Central Kootenay, Okanagan-Similkameen], USA [Port Orford, Quilcene, Olympia, Elwha Valley], France [Messimy, Baume-les-Dames, Massif de Cédres, Petit Luberon near Bounieux], Bulgaria [Burgas, Varna, Blagoevgrad] and, Serbia. Different types of habitats are found in the reports of S. Trudell from USA [Silver Springs Campground, Crystal Mt Blvd, Mt Baker-Snoqualmie National Forest] which collect scattered ascomata of *N. pouchetii* on mossy soil in a mixed conifer forest with *Pseudotsuga menziesii* (Mirb.) Franco, *Abies alba* Mill., *Tsuga heterophylla* (Raf.) Sarg., *Thuja plicata* D. Don, and *Alnus rubra* Bong. O. Ceska reported *N. pouchetii* from Canada in Metchosin-Victoria, Pearson

College property; the trail from the parking lot towards Galloping Goose trail in a mixed forest with *P. menziesii*, *Abies grandis* (D. Don) Lindl., and *T. plicata*. In 2009, De Ruvo, a mycological amateur expert in identification of fungi in Abruzzo, collected *N. pouchetii* in spring in Pietracamela (Teramo) in a mixed wood with *A. alba*, *Picea abies* (L.) H. Karst., *Larix decidua* Mill. and, *Cedrus* sp. V. Migliozi (Bresadola Mycological Group) gathered *N. pouchetii* in Castel di Guido (Roma) in a mixed conifer woods. T. Lezzi & M. Cittadini (AMINT mycological group, 2009) reported *N. pouchetii* in Marche region and the province of Siena.

A new record for southern Italy is reported here with the presence of *N. pouchetii* in Contrada La Donna in the Monti Sicani Park (Sicily) within a reforestation of *Pinus halepensis* Mill., *Cupressus sempervirens* L., and *Cedrus atlantica*.

Conclusions

Forest management of reforestations planted in the late 1950s requires strong attention and integrated evaluation by foresters, botanists, and mycologists. In fact, within these forest ecosystems, which should be reconverted by encouraging the growth of native species representative of the potential natural vegetation, rare fungi worthy of conservation are often observed.

In these forest ecosystems, mycorrhizal species assume a role of great importance and provide support to tree plants and increased resistance to pathogens. The presence of *Inocybe obscurobadia* and *Neournula pouchetii* in the cedar forests of Sicily confirms the hypothesis of Venturella (1995) and Venturella & Gargano (2009) that most of the symbionts of non-native trees introduced in Italy, such as cedar and eucalyptus, maintain their symbiosis also outside the habitats of origin of the trees.

Moreover, the finding in Sicily *I. obscurobadia* and *N. pouchetii* expands the distribution range of these species in Italy.

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