

Contribution to the study of hypogeous fungi of Castellón, Spain. III

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Abstract. Fourteen species of hypogeous fungi have been collected and studied in the province of Castellón in Spain. Significant diagnostic characters are given for some of them. Several species that belong to the *Basidiomycota* are of special interest: *Alpova microsporus*, *Hymenogaster bulliardii*, *H. hessei*, *H. luteus*, *H. lycoperdineus*, *H. muticus*, *H. niveus* and *Protoglossum aromaticum* (= *Hymenogaster remyi*).

Key words: *Ascomycota*, *Basidiomycota*, hypogeous fungi, Spain

Introduction

As a continuation of this series (Torrejón 2001, 2006), and still studying the hypogeous fungi in the province of Castellón in Spain, the south of this area has been assayed during the years 2006, 2007 and 2008, as a result of the 13 forays the author collected 14 species of hypogeous fungi associated with the genera *Pinus* and *Quercus*.

In this work the author has used the same methods that were used in Torrejón (2001). The exsiccated fungi are still in the author's herbarium (MTH). The species have been systematically arranged according to Kirk *et al.* (2008).

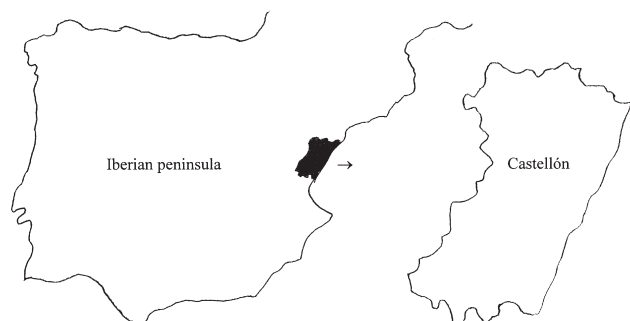


Fig. 1. Map of the prospected area

Results

Ascomycota

Order *Pezizales*

Sarcosphaera coronaria (Jacq.) J. Schröt.

Altura, Puntal de Navarrete, 820 m, 30SYK0111. Semihypogeous, beneath *Pinus halepensis*, on calcareous subsoil, 24 Apr 2006, MTH 928.

Ascocarps subglobose, 35–37 × 72–89 mm, smooth, elastic, fragile, hollow, white to cream whitish and living under litter, splitting at the top like a crown with 6–14 triangular arms, 10–46 × 9–42 mm, showing its lilac hymenium at maturity. **Asci** 300–370 × 12–13 µm, cylindrical, octosporate, amyloid at the apex and photosensitive, liberating and spreading spores when exposed under the sun light. **Spores** 13–18 × 7–8 µm, ellipsoid, smooth and bigutulate.

It is a very common species in Castellón.

There is further information about this species in Trappe *et al.* (2007).

Tuber malençonii Donadini, Rioussset, G. Rioussset & G. Chev.

Sacañet, Solana de la Bellida, 1280 m, 30TXK9313. Hypogeous between pebbles, 60 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 31 Dec

2007, MTH 906. Sacañet, Solana de la Bellida, 1270 m, 30TXK9313. Hypogeous, 120 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 31 Dec 2007, MTH 907. Sacañet, Barranco del Navajo, 1120 m, 30TXK9314. Hypogeous, 90 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 29 Dec 2007, MTH 908. Sacañet, Solana de la Bellida, 1290 m, 30TXK9313. Hypogeous, 40 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 31 Dec 2007, MTH 909. Pina de Montalgrao, Las Casillas, 1060 m, 30SYK0330. Hypogeous, 40 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 15 Dic 2006, MTH 912.

The measurements of the different collections are as follows: MTH 906, 14–33 × 14–26 mm; MTH 907, 36 × 38 mm; MTH 908, 20–22 × 30–32 mm; MTH 909, 0.9 × 12 mm; and MTH 912, 25–27 × 17–10 mm.

All the present collections were immature but we have collected this species before in Castellón (Torrejón 2006) and in the spring when it was completely mature, suggesting a long period of ripening process for this species.

There is further information about this species in Montecchi & Sarasini (2000), Rioussset *et al.* (2001), and Ceruti *et al.* (2003).

Tuber puberulum Berk. & Broome

Barracas, El Barruezo, 970 m, 30TXK9634. Hypogeous, 150 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 2 May 2008, MTH 905.

Ascocarps subglobose and gibbose, 23–26 × 37–49 mm, compact, with an intense scent. Its flesh's taste is sweet and pleasant. Peridium slightly tomentose, cream, cream brownish at maturity, 0.2–0.3 mm thick. Gleba labyrinthiform, cream greyish, brown with dark brick spots at maturity. **Asci** globose, 69–76 × 73–80 µm, 1–4 (–5) spored. **Spores** subspherical, 29–33 × 31–33 µm, with irregular foveolate ornamentation, 4–5 µm high.

Despite the depth of the fruitbodies the soil surface showed a cracked appearance.

There is further information about this species in Montecchi & Sarasini (2000), Rioussset *et al.* (2001), and Ceruti *et al.* (2003).

Tuber rufum Pico

Sacañet, Barranco del Navajo, 1100 m, 30TXK9314. Hypogeous, 40 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 29 Dec 2007, MTH 910. Sacañet, Solana de la Bellida, 1280 m, 30TXK9313. Hypogeous, 30 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 31 Dec 2007, MTH 911. Pina de Montalgrao, Rajola, 1076 m, 30TXK9830. Hypogeous, 60 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 24 Apr 2007, MTH 927. The measurements of the different collections are as follows: MTH 910, 10–11 × 19–20 mm; MTH 911, 10–13 mm; and MTH 927, 27–29 × 32–34 mm. The last one still immature.

Ascocarps globose, 10–29 × 13–34 mm, cream brownish, hard. Peridium 0.4 mm thick, smooth. Gleba cream

greyish, cream brownish at maturity with traslucid white veins.

This species produces small burned areas on the soil and is often found associated with trees where *Tuber nigrum* has recently stopped producing ascocarps. We suppose there is a long period of ripening process for this species.

On the other hand, this is not the first time that we have collected this species in Castellón (Torrejón 2001). It must be common and was described for the first time in Spain by Calonge *et al.* (1977).

There is further information about this species in Astier (1998), Montecchi & Sarasini (2000), Rioussset *et al.* (2001), and Ceruti *et al.* (2003).

Basidiomycota

Order Agaricales

Hymenogaster bulliardii Vittad.

Pina de Montalgrao, El Regajo, 1060 m, 30SYK0032. Hypogeous, 30 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 15 Dec 2006, MTH 914.

Basidiocarp 12 × 16 mm, compact, irregularly globose and gibbose with a small pseudostipe. Peridium smooth and blackish, 0.2–0.3 mm thick. Gleba rusty tawny. **Spores** 20–24 × 11–13 µm, citriform, some of them prismatic, subfusiform, rhomboid or square, with rest of sterigmata up to 6 µm length, papillate 1–2 µm length, smooth, greenish yellow, thick cell wall 1–2 µm, with two parallel layers.

There is further information about this species in Villa (2001) and Montecchi & Sarasini (2000).

Hymenogaster hessei Soehner

Pina de Montalgrao, Corral del Romeral, 1020 m, 30SYK9929. Hypogeous, 35 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 13 Dec 2006, MTH 914. Pina de Montalgrao, El Regajo, 1060 m, 30SYK0032. Hypogeous, 40 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 28 Dec 2006, MTH 921.

The measurements of the different collections are as follows: MTH 914, 12 × 16 mm; and MTH 921, 21–32 × 19–22 mm.

There is further information about this species in Torrejón (2006).

Hymenogaster luteus Vittad.

Pina de Montalgrao, El Regajo, 1060 m, 30SYK0032. Hypogeous, 35 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 28 Dec 2006, MTH 920.

Basidiocarps 21–25 × 16–17 mm, irregularly subglobose. Peridium smooth and whitish, brown on brushed or rubbed areas, 0.1–0.2 mm thick. Gleba labyrinthian, irregularly pored 2–4 by 1 mm, cream greyish with walls 0.1–1 mm width, and covering inside by a band 0.05–0.1 mm width, lemon yellow. Its taste is sweet with a characteristic smell not too pleasant. There are different opinions about its smell in Montecchi & Sarasini (2000) (Odour definite and pleasant, sweetish, not really of strawberry as reported by

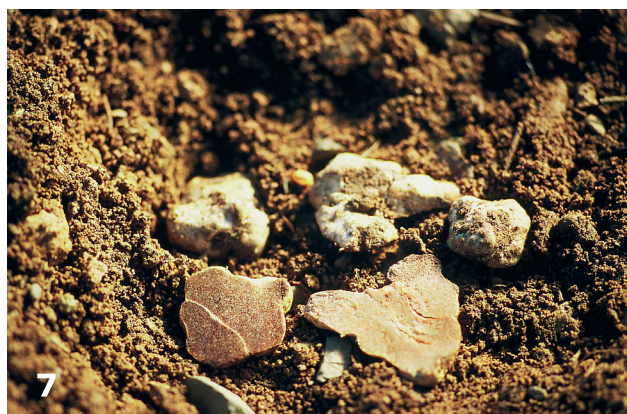
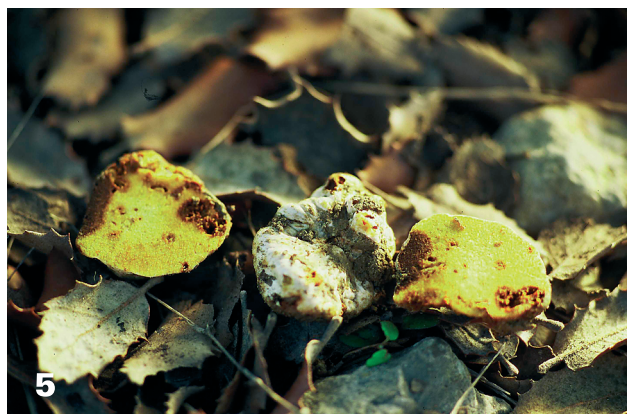
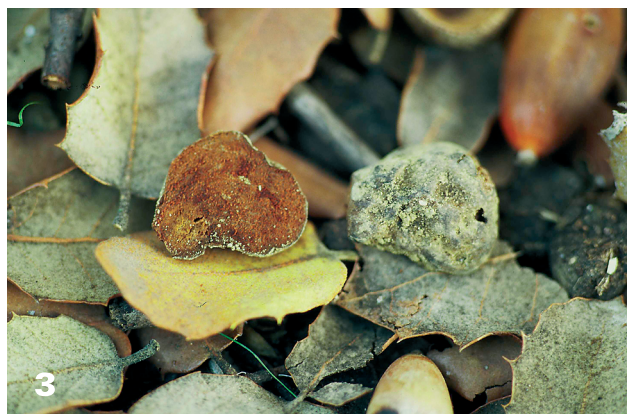


Fig. 2. *Alpova microsporus*. Fig. 3. *Hymenogaster bulliardii*. Fig. 4. *Hymenogaster hessei*. Fig. 5. *Hymenogaster luteus*. Fig. 6. *Hymenogaster lycoperdineus*. Fig. 7. *Hymenogaster muticus*. Fig. 8. *Hymenogaster niveus*. Fig. 9. *Protoglossum aromaticum*

Vittadini, but of fig-tree leaves, of lavender, well-scented by trained dogs). This is a clear example of the human's senses diversity. **Spores** 18–20 × 9–10 µm, fusiform, sulphur yellow, with rest of sterigmata up to 3 µm, cell wall with two parallel layers and with a big drop inside. Some of them are irregular, triangular or polygonal.

There is further information about this species in Montecchi & Sarasini (2000) and Villa (2001).

***Hymenogaster lycoperdineus* Vittad.**

Pina de Montalgrao, Las Casillas, 1060 m, 30SYK0330. Hypogeous, 30 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 15 Dec 2006, MTH 913. Pina de Montalgrao, La Rochuela, 1125 m, 30TYK0232. Hypogeous, 10 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 15 Dec 2006, MTH 915. Pina de Montalgrao, La Rochuela, 1125 m, 30TYK0232. Hypogeous, 20 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 15 Dec 2006, MTH 916. Pina de Montalgrao, La Rochuela, 1125 m, 30TYK0232. Hypogeous, 20 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 15 Dec 2006, MTH 917. Pina de Montalgrao, Mairana, 1025 m, 30TXK9930. Hypogeous, 15 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 13 Dec 2006, MTH 918.

The measurements of the different collections are as follows: MTH 913, 7 × 11 mm; MTH 915, 14–19 × 16–27 mm; MTH 916, 7 × 12 mm; MTH 917, 7 × 10 mm; and MTH 918, 15 × 17 mm.

This species must be the most common *Hymenogaster* in Castellón.

There is further information about this species in Torrejón (2006).

***Hymenogaster muticus* Berk. & Broome**

Barracas, La Serratilla, 1040 m, 30TXK9832. Hypogeous, 30–50 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 28 Dec 2006, MTH 923.

There is further information about this species in Torrejón (2006).

***Hymenogaster niveus* Vittad.**

Pina de Montalgrao, El Regajo, 1060 m, 30SYK0032. Semihypogeous under the litter, 20 mm depth, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 28 Dec 2006, MTH 922.

Basidiocarp 10 × 0.9 mm, subglobose and lobed. Peridium smooth and whitish, 0.3–0.4 mm thick. Gleba labyrinthiform, irregularly pored, clay pink. **Spores** 13–17 × 10–12 µm, ellipsoid, ovoid or citriform, with small papilla 1–2.5 µm, and with rest of sterigmata up to 3 µm, brown yellowish.

There is further information about this species in Montecchi & Sarasini (2000) and Villa (2001).

***Protoglossum aromaticum* (Velen.) J.M. Vidal (= *Hymenogaster remyi* Zeller & C.W. Dodge)**

El Toro, Magaña, 1490 m, 30TXK8622. Semihypogeous, beneath *Pinus sylvestris*, on calcareous subsoil, 25 Apr 2006, MTH 924.

Basidiocarps 6–52 × 8–56 mm, irregularly subglobose, flexible, and with rest of rhizomorphs, white. Peridium 0.2–0.3 mm thick, white lilac, whitish at the basal area and sienna fulvous at the top half at maturity, widened at the basal area, where we can see its cream colour at maturity between two white layers. Gleba labyrinthiform, irregularly pored, white greyish, cinnamon sienna at maturity. **Spores** 10–12 × 6–8 µm, ovoid, verrucose with rest of sterigmata up to 2 µm, brown yellowish.

There is further information about this species in Montecchi & Sarasini (2000, as *Hymenogaster aromaticus*) and Vidal (2002).

Order Boletales

***Alpova microsporus* (Velen.) Trappe**

Cabanes, Agulles de Santa Águeda, 400 m, 31TBE4941. Semihypogeous, beneath *Quercus suber*, on siliceous subsoil, 22 Nov 2006, MTH 926. Pina de Montalgrao, Las Casillas, 1060 m, 30SYK0330. Hypogeous, 20 mm depth, beneath *Q. ilex* subsp. *ballota*, on calcareous subsoil, 24 Dec 2005, MTH 930.

The measurements of the different collections are as follows: MTH 926, 36–37 × 24–25 mm; and MTH 930, 10 × 9 mm.

Measures from MTH 926 collection: **Basidiocarp** 36–37 × 24–25 mm, subglobose, with rhizomorphs cigar brown covering all fruitbody, denser at the basal area. Peridium 1–1.2 mm, thick, fulvous, cigar brown on brushed or rubbed areas. Gleba flexible, like chewing gum, with two kinds of irregular areas, sienna and snuff brown, labyrinthiform, with cream greyish veins. **Spores** 5.5–7.5 × 2–3 µm, ellipsoid, smooth, with two layers, bigutulate forming like a pseudoseptum, yellowish green. Peridium hyphae without fibulae.

There is further information about this species in Montecchi & Sarasini (2000).

***Melanogaster broomeianus* Berk.**

Pina de Montalgrao, Rajola, 1076 m, 30TXK9830. Semihypogeous, beneath *Quercus ilex* subsp. *ballota*, on calcareous subsoil, 25 Nov 2006, MTH 925.

Basidiocarps 31–46 × 16–31 mm, from globose to reniform with brown rhizomorphs at the basal area. Peridium 0.4–0.5 mm thick, smooth, slightly tomentose, fulvous sienna, snuff brown on brushed or rubbed areas. Gleba irregularly pored like *Xerocomus*, fuscous black with white veins. **Spores** 8–10 × 4–5 µm, from subcylindrical to ellipsoid, with rest of sterigmata up to 2 µm, truncate at the basal area, fulvous.

There is further information about this species in Montecchi & Sarasini (2000).

***Rhizopogon occidentalis* Zeller & Dodge**

Altura, Gaetano, 880 m, 30SYK0310. Semihypogeous, beneath *Pinus pinaster*, on calcareous subsoil, 2 Nov 2006, MTH 929.

Basidiocarps 22–28 × 24–32 mm, subglobose, flexible, and with rest of rhizomorphs buff tawnyish. Peridium 0.3–

0.4 mm thick, luteous with olivaceous areas on the external side and pinkish on the internal one; it is easy to move it away from the gleba at maturity. Gleba labyrinthiform, olivaceous. **Spores** $5.5\text{--}7 \times 2.5\text{--}3.5 \mu\text{m}$, ellipsoid, smooth, most of them bigutulate, sulphur yellow, rounded at the basal area without rest of sterigmata.

There is further information about this species in Martín (1996) and Montecchi & Sarasini (2000).

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