

NOTA II

**THE LARVAE AND PUPAE OF ANTS (HYMENOPTERA: FORMICIDAE)
ARE ALSO INFESTED BY
MYRMICINOSPORIDIUM DURUM HÖLLDOBLER, 1933 (FUNGI)**

[Las larvas y pupas de hormigas (Hymenoptera: Formicidae)
son también infestadas por
Myrmicinosporidium durum Hölldobler, 1933 (Fungi)]

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Myrmicinosporidium durum Hölldobler, 1933 is an intriguing internal parasitic fungus infesting a wide range of ant taxa and widely distributed geographically, with known localities across Europe, North America, Asia, and the Galápagos Islands (e.g. Sánchez-Peña *et al.*, 1993; Espadaler, 1997; Csösz *et al.*, 2012; Hosoiishi *et al.*, 2020). The infestation is manifested by the presence inside the insect of characteristic dark spores with a size of 25-50 microns and a bowl-like shape caused by the alcohol fixation (Espadaler, 1982). The big amount of spores is visible through the cuticle in clear colored ants, filling and darkening the gaster hemocoel and extending also through the entire body to the appendixes and the head (García & Espadaler, 2010).

All three adult castes of ants are known to be affected, being the sexuates capable of participating in the nuptial flights (Buschinger *et al.*, 2004; García & Espadaler, 2010). The infested workers apparently have no behavioral changes (Buschinger *et al.*, 2004), and affected foragers are captured in pitfall traps (e.g. Sánchez-Peña *et al.*, 1993; Gonçalves *et al.*, 2012). The infection seems to be more frequent in late summer and fall, and the affected ants die after hibernation (Buschinger *et al.*, 2004).

Most of the papers about this parasite

deal with new affected species and geographical distribution, while the biology of the fungus, infestation mechanism or its taxonomic placement is unknown. However, a relationship with Chytridiomycetes has been suggested (Sánchez-Peña *et al.* 1993).

A new population of *M. durum* has been found in the urban mountain of Montjuïc (Barcelona, NE Iberia). Four nests of *Tetramorium semilaeve* André, 1883 and three of *Pheidole pallidula* (Nylander, 1849) beginning the nuptial flights, were affected by the fungus (30-V-2020; 6-VI-2020). Two workers, four queens and three males of *T. semilaeve* presented the spores, representing the 1,12%, 9,30% and 18,75% of the total specimens observed for each caste respectively. For *P. pallidula* the number of infested specimens were one worker (1,25%), one queen (10%) and three males (11,11%).

Additionally, a colony of *Aphaenogaster senilis* Mayr, 1853 was found to be parasitized. Nine workers, 24 larvae and 13 pupae were preserved in alcohol, of which one worker, one larva and one pupa showed the spores visible through the cuticle (Figs. 1 and 2). This is the first infestation report for the ant brood phases.

Some apparently spore-free larvae (namely, looking completely white) from the same

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Figure 1: *Aphaenogaster senilis* larva with *Myrmicinosporidium* spores.

Figura 1: Larva de *Aphaenogaster senilis* con esporas de *Myrmicinosporidium*.



Figure 2: *Aphaenogaster senilis* pupa with *Myrmicinosporidium* spores.

Figura 2: Pupa de *Aphaenogaster senilis* con esporas de *Myrmicinosporidium*.

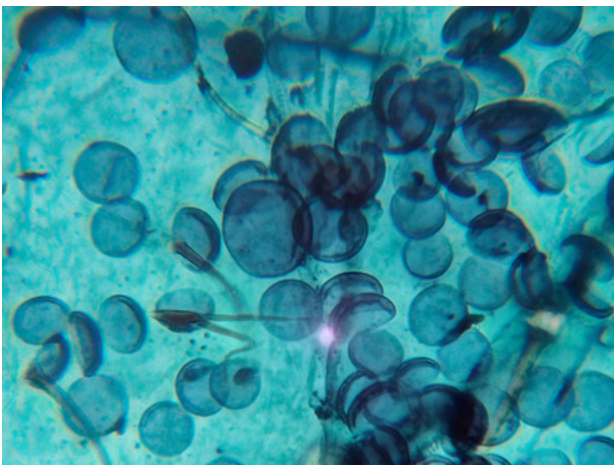


Figure 3: Stained *Myrmicinosporidium* spores inside an *Aphaenogaster senilis* larva.

Figura 3: Esporas de *Myrmicinosporidium* teñidas en una larva de *Aphaenogaster senilis*.

A. senilis colony were prepared for a microscopic study, and two of them showed the presence of the fungus. In one larvae, the spores were stained by the chlorazol black

used (Fig. 3) but not in the other. The *M. durum* spores have been described as thick-walled (Sánchez-Peña et al., 1993), and the fact that uncolored and immature spores have survived the potassium hydroxide processing of the samples shows that this assertion is certainly correct.

Since the ants eat liquid or semiliquid food, and spores are bigger than the maximum ingestible size, *Myrmicinosporidium* is not considered to be transmitted orally (Sánchez-Peña et al., 1993). However, larvae can be fed with discarded infrabuccal pellets, and this has been suggested as a way of maintenance of the infection in the colonies (Sánchez-Peña et al., 1993). It has to be determined if the presence of the fungus prevents the development of the parasitized brood.

Spore-infested larvae and pupae may have remained undetected because most of the

Myrmicinosporidium records have been published from ants collected outside the nests. Future nests inspection when facing other *M. durum* findings could allow knowing if the fungal infestation is also widespread among the ants brood.

The three ant species from Montjuïc are already known hosts for the fungus in the Iberian Peninsula (Espadaler, 1982; García & Espadaler, 2010; Gonçalves et al., 2012).

The specimens are deposited in the author's collection.

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Bibliography

- BUSCHINGER, A.; BEIBL, J.; D'ETTORRE, P.; Ehrhardt, W. 2004. Recent records of *Myrmicinosporidium durum* Hölldobler, 1933, a fungal parasite of ants, with first record north of the Alps after 70 years. *Myrmecologische Nachrichten*, 6: 9-12.
- CSÖSZ, S.; LAPEVA-GJONOVA, A.; MARKÓ, B. 2012. New data on the geographical distribution and host utilization of the entomopathogenic fungus *Myrmicinosporidium durum*. *Journal of Insect Science*, 12: Article 129.
- ESPADALER X. 1982. *Myrmicinosporidium* sp., parasite interne des fourmis. Etude au MEB de la structure externe. In: La Communication chez les Sociétés d'Insectes (De Haro A. and Espadaler, X., Eds). Colloque Internationale de l'Union Internationale pour l'Etude des Insectes Sociaux, Section Française. Universitat Autònoma de Barcelona: 239-241.
- 1997. *Pheidole williamsi* (Hymenoptera: Formicidae) parasitized by *Myrmicinosporidium durum* (Fungi) on San Salvador Island (Galápagos Islands). *Sociobiology*, 30: 99-101.
- GARCÍA, F.; ESPADALER, X. 2010. Nuevos casos y hospedadores de *Myrmicinosporidium durum* Hölldobler, 1933 (Fungi). *Iberomyrmex*, 2: 3-9.
- GONÇALVES, C.; PATANITA, I.; ESPADALER, X. 2012. Substantial, and significant, expansion of ant hosts range for *Myrmicinosporidium* Hölldobler, 1933 (Fungi). *Insectes Sociaux*, 59: 395-399.
- HOSOISHI, S.; RAHMAN, M.M.; OGATA, K. 2020. First Record of *Myrmicinosporidium durum* (Fungi) parasitizing *Pheidole nodus* and *P. indica* (Hymenoptera: Formicidae) from Japan. *Japanese Journal of Systematic Entomology*, 26 (1): 40-42.
- SÁNCHEZ-PEÑA, S.R.; BUSCHINGER, A.; Humber, R.A. 1993. *Myrmicinosporidium durum*, an enigmatic fungal parasite of ants. *Journal of Invertebrate Pathology*, 61: 90-96.

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