

MYRMICA SCABRINODIS (HYMENOPTERA, FORMICIDAE), AN ACCIDENTAL HOST OF LABOULBENIA CLIVALIS (LABOULBENIALES)

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Summary

Ants of the genus *Myrmica* are so far only known to host Laboulbeniales of the genus *Rickia*. During a pitfall trapping campaign in a wet meadow at Meise Botanic Garden (Belgium), an infected population of *Clivina fossor* (Coleoptera, Carabidae) was sampled. *Clivina fossor* is the main host of *Laboulbenia clivalis* (Laboulbeniales). The traps also contained huge numbers of *Myrmica scabrinodis* (Hymenoptera, Formicidae). Screening of these ants was negative for *Rickia wasmannii*, but revealed 2 specimens carrying mature thalli of *L. clivalis*. Thalli were normally developed and perithecia contained fully developed spores. We here report a first case of host shifting of a carabidicolous *Laboulbenia* towards an ant host. Although extremely rare, these finds support the hypothesis of 'habitat specificity', i.e., that species of Laboulbeniales can shift between variously related hosts sharing the same micro-habitat. *Myrmica scabrinodis* is here considered an accidental host for *L. clivalis*.

Samenvatting

Tot nu toe was bekend dat mieren van het geslacht *Myrmica* enkel Laboulbeniales van het geslacht *Rickia* dragen. Tijdens een bodemvallen studie in een nat hooiland (Plantentuin Meise) werd een geïnfecteerde populatie van *Clivina fossor* (Coleoptera, Carabidae) gevonden. In het studiegebied is *C. fossor* de hoofdgastheer van *Laboulbenia clivalis* (Laboulbeniales). De bodemvallen bevatten ook grote aantallen mieren, vooral *Myrmica scabrinodis* (Hymenoptera, Formicidae). Screening van deze mieren was negatief voor *Rickia wasmannii*, maar leverde wel 2 exemplaren met adulte thalli van *Laboulbenia clivalis*. Dit is de eerste vondst van een loopkever geassocieerde *Laboulbenia* op een mier. De thalli waren volledig ontwikkeld en perithecia bevatten volgroeide sporen. Hoewel uiterst zeldzaam, ondersteunen deze vondsten de hypothese van habitatspecificiteit. Hierbij veronderstelt men dat een *Laboulbenia* ook minder verwante gastheren (zoals kevers en mieren) kan infecteren, op voorwaarde dat ze in hetzelfde micro-habitat leven. *Myrmica scabrinodis* wordt hier beschouwd als een toevallige gastheer voor *L. clivalis*.

Keywords: Laboulbeniomycetes, specificity, host-shifting, habitat preference

1. Introduction

Laboulbeniales (Ascomycota) are a diverse group of host-specific, ectobionts and parasites associated with Arthropoda, predominantly insects (subphylum Hexapoda). Worldwide 2459 species are known, most of them (80%) specialized in insects and occurring selectively on beetles (Coleoptera) and flies (Diptera) (Haelewaters *et al.* 2021). Laboulbeniales cannot survive without a living host. They produce thalli on the outside of the host's body and it is generally accepted that nutrition is obtained through its attachment area. Specificity and nutrition are thought to be linked (Haelewaters *et al.* 2022). All Laboulbeniales produce sticky spores and the most common way of transmission is by intraspecific contact (grooming, copulation). Each species has a host-range, composed of one or several host taxa, in which Scheloske (1969) and Majewski (1994) could recognize main, occasional, and accidental hosts. Experiments facilitating inter- and intraspecific transmission have shown that next to a living host, habitat allows thalli to develop on a wider range of hosts (De Kesel 1996). This habitat preference ('habitat specificity' in Haelewaters *et al.* 2021) explains why under natural conditions less related hosts, sharing

the same habitat, can carry the same parasite species. Host ranges with remotely related taxa are rare. A classic example is seen in *Rickia wasmannii* Cavara, commonly infecting *Myrmica* ants (main host) but also some of the immature stages of Diptera and Chelicerata living in its nests (Pfliegler *et al.* 2016).

In this paper we report the occurrence of a carabidicolous *Laboulbenia* on a *Myrmica* Latreille, 1804.

2. Materials & methods

Collecting of host insects was done using pitfall traps filled with water and 5% propane-1,2-diol (killing and conserving agent). Long-term preservation of insects was in 96% ethanol. Screening for Laboulbeniales was done under a dissecting microscope (50×). Slides of Laboulbeniales were made as described in De Kesel *et al.* (2020). Photographs of thalli were made using an Olympus BX51 light microscope with DIC optics and digital camera and analySIS® (Soft Imaging System GmbH). Photographs of hosts were made using a Keyence VHX5000 digital microscope. *Clivina fossor* was identified using Muilwijk *et*

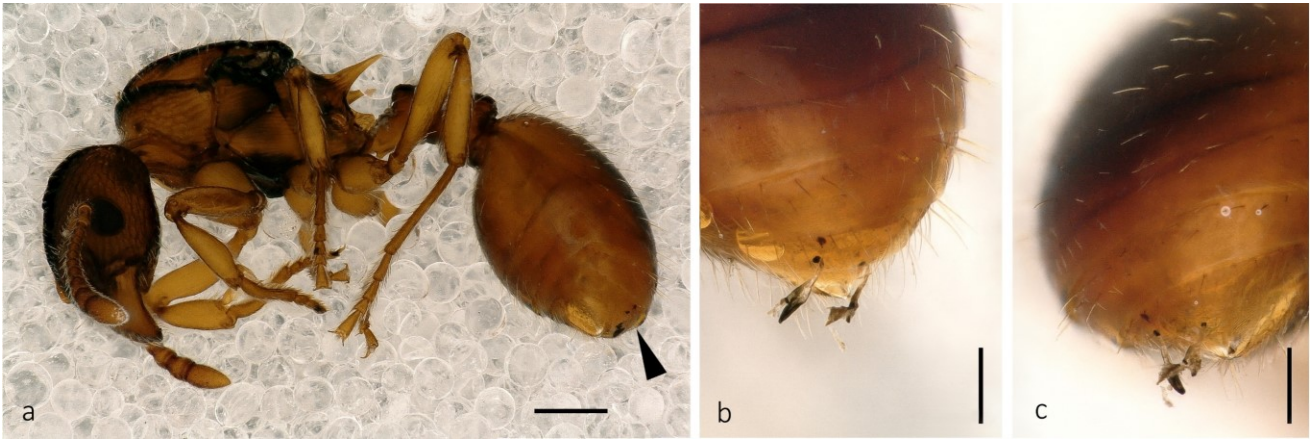


Fig. 1. *Myrmica scabrinodis* (Hymenoptera, Formicidae), CG512. **a.** lateral view of a queen with thalli on the last abdominal segment (black arrow), **b-c.** detail of mature thalli of *Laboulbenia*. Scale bars: a = 500 µm, b-c = 250 µm.

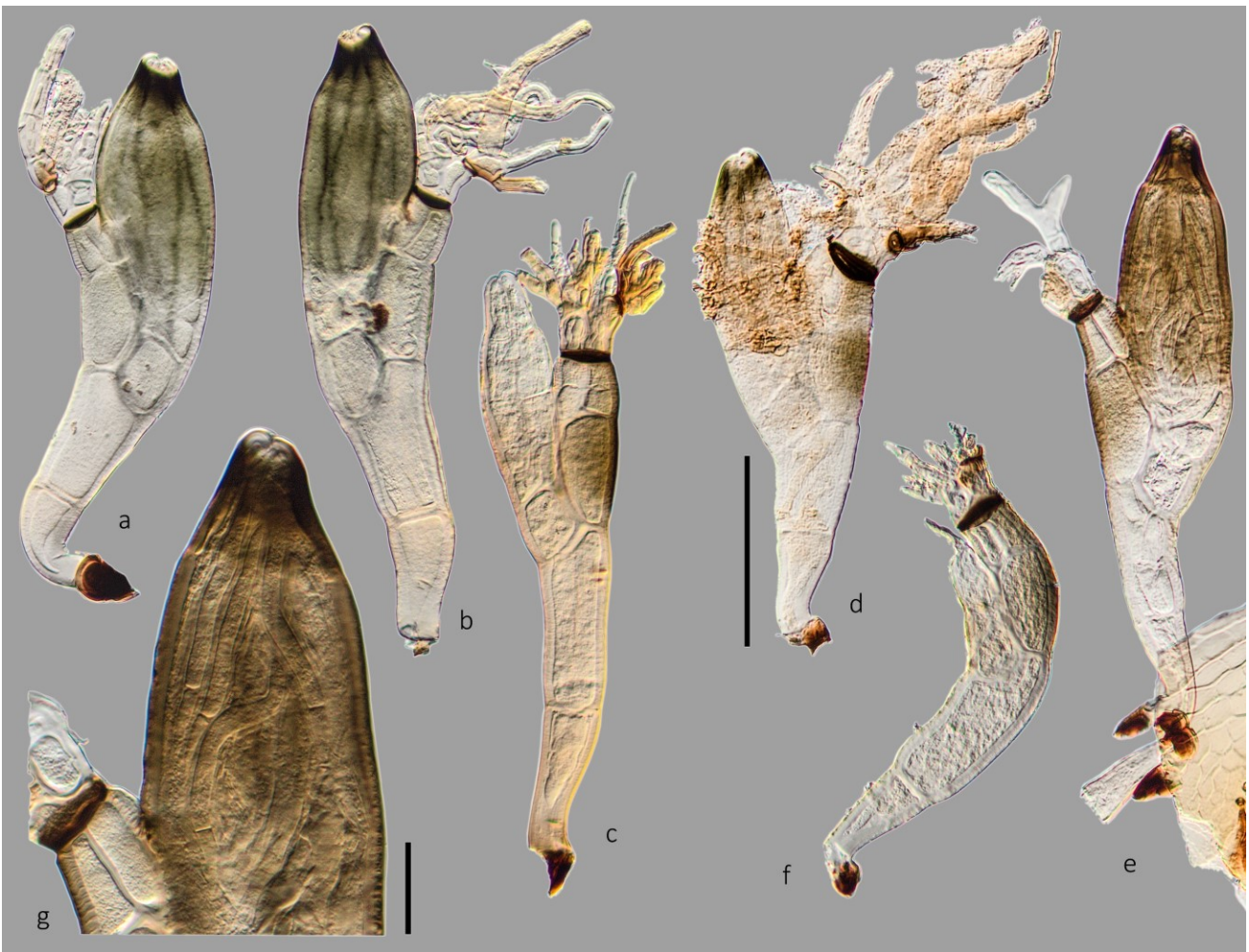


Fig. 2. *Laboulbenia clivinalis* Thaxt. **a-b.** thalli from *Clivina fossor* (Coleoptera, Carabidae; a = slide ADK6367, b = slide ADK6576), **c.** young thallus from *Clivina fossor* (slide ADK6579). **d-g.** thalli from *Myrmica scabrinodis* (Hymenoptera, Formicidae) showing morphological traits of *Laboulbenia clivinalis* with cell V connected to cell III and of similar height as cell IV; suprabasal cell of outer appendage darkened and separated from the basal cell by a, oblique, dark and constricted septum; basal cell of inner appendage half as high as basal cell of outer appendage, supporting few, short branches each with one terminal antheridium (d = slide CG512a, e = slide CG512b). **f.** juvenile thallus from abdomen of *Myrmica scabrinodis*, showing diagnostic features of appendage system of *L. clivinalis*, young perithecium with trichogyne (slide ADK6580). **g.** detail of the upper part of the thallus in Fig.2e, showing the free insertion cell, cell IV and V of similar height and perithecium with fully developed ascospores (slide CG512b). Scale bars: a-e = 100 µm, g = 25 µm.

al. (2015) and the identity of the ants (*Myrmica scabrinodis*) was confirmed by W. Dekoninck (RBINS - Royal Belgian Institute of Natural Sciences, Brussels). Hosts and microscope slides are deposited at the Herbarium of Meise Botanic Garden (BR).

3. Results

Infected *Clivina fossor* (Coleoptera, Carabidae) and *Myrmica scabrinodis* (Hymenoptera, Formicidae) were found together in pitfall traps in a wet meadow at Meise Botanic Garden (Belgium). Over a period of 3 years (2019, 2020, 2021) only 2 of +300 *Myrmica scabrinodis* showed thalli of *Laboulbenia*, not *Rickia wasmannii*. Thalli on ants were only present on the abdomen (Fig. 1a-c). Thalli from *Clivina fossor* (Fig. 2a-c) and those from *Myrmica scabrinodis* (Fig. 2d-g) were identified as *Laboulbenia clivinalis*. Material taken from ants showed thalli with young perithecia and trichogyne (Fig. 2f), and mature thalli with perithecia containing fully developed spores (Fig. 2g).

Studied material:

All from BELGIUM, prov. Vlaams Brabant, Meise, Domein van Bouchout, pitfall traps in a wet meadow (sector 45: 50.927388°N - 4.323910°E).

Laboulbenia clivinalis Thaxt.

On *Clivina fossor* (Linnaeus, 1758) [Col., Carabidae].

Sampled 21/11/2018, 2 thalli from elytra, coll. De Kesel A., slide ADK6367 (BR5060011621385); sampled 13-22/05/2019, 1 thallus from elytra, coll. De Kesel A., slide ADK6476 (BR5060011612406); sampled 24/08/2020, 5 thalli from pronotum, coll. De Kesel A., slide ADK6579 (BR5060011716555).

On *Myrmica scabrinodis* Nylander, 1846 [Hym., Formicidae]

Sampled 24/08/2020, 1 thallus last abdominal segment (worker), coll. De Kesel A., slide ADK6580 (BR5060011715527); sampled 25/05/2020, 2 thalli last abdominal segment (queen), coll. Gerstmans C., slide CG512a,b (BR5060020474484, BR5060011724505).

4. Discussion

In many European countries, including Belgium, *Myrmica* spp. commonly host *Rickia wasmannii* (Haelewaters et al. 2015, Santamaria & Pedersen 2021, De Kesel et al. 2016 & 2021). This is the first time that a *Laboulbenia* sp., in casu *L. clivinalis*, is found on a *Myrmica* ant.

Laboulbenia clivinalis is a carabidicolous species, i.e., only known from ground beetles from the genus *Clivina* Latreille, 1802. In our study plot, its main host is *Clivina fossor*, a burrowing species (De Kesel 1995, Muilwijk et al. 2015). Transmission of *L. clivinalis* between hosts is mostly through copulation (De Kesel 1995). Both infected ants were carrying thalli on their last abdominal segment. We think this is the result of contacts with the main host. Habitat preferences (De Kesel 1996) of *L. clivinalis* were probably met on *M. scabrinodis*, otherwise thalli would not have reached maturity. This observation supports the hypothesis of 'habitat specificity' (Haelewaters et al. 2021),

i.e., that species of Laboulbeniales can shift between variously related hosts as long as these share the same micro-habitat. Although the thalli, on both the queen and worker ant, were mature and with spores, it is unclear whether infections like these can further spread into the ant population. In this context we consider *Myrmica scabrinodis* an accidental host of *L. clivinalis*.

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