

First records of Laboulbeniales (Ascomycota) on ants (Hymenoptera: Formicidae) in Bulgaria

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Abstract. The myrmecophilous fungi *Rickia wasmannii* Cavara, 1899 and *Laboulbenia camponoti* S. W. T. Batra, 1963 (Ascomycota: Laboulbeniales) are reported for the first time from Bulgaria. *Rickia wasmannii* was found on *Myrmica scabrinodis* Nylander, 1846 ant workers (Hymenoptera: Formicidae) in South-eastern Bulgaria near to the Black Sea coast. This is the easternmost record of *Rickia wasmannii* in Europe. *Laboulbenia camponoti* was found in six different localities in Bulgaria on the carpenter ants *Camponotus aethiops* (Latreille, 1798), *C. universitatis* Forel, 1890 and *C. pilicornis* (Roger, 1859). *Camponotus aethiops* and *C. universitatis* are new hosts for the fungus. For both fungi species the known distribution and host ranges summarized. This is the first record of the ant species *Camponotus pilicornis* for the Bulgarian fauna.

Key words: ants, ant-associated fungi, Bulgaria, Laboulbeniales, *Laboulbenia*, *Rickia*.

Introduction

The ascomycetous order Laboulbeniales is a large group comprising about 2 000 species of obligatory ectoparasites whose basic body (thallus) develops on the integument of living arthropods (Santamaria 2001). Among the hosts of these fungi are mites (Acarina), millipedes (Diplopoda) and species of 10 different insect orders, 80% of which are terrestrial beetles (Coleoptera) of various families, 10% are flies, and the rest belong to other groups such as mole crickets (Orthoptera), termites (Isopoda), and ants (Formicidae) (Weir 1998, Santamaria 2001, Henk *et al.* 2003). The fungi form a rather inconspicuous haustorium under the host integument, through which they receive nutrients without seriously harming the insects. They spread via direct contact of individual hosts with mature thalli or through parasitic mites. Among the hymenopterans only ants are known as hosts of these fungi. Three species associated with ants belonging to order Laboulbeniales have been reported in Europe – *Rickia wasmannii* Cavara, 1899, *Laboulbenia formicarum* Thaxter, 1902 and *Laboulbenia camponoti* S.W.T. Batra, 1963 (Espadaler & Santamaria 2003, Herraiz & Espadaler 2007).

The genus *Rickia* comprises more than 145 species, distinguished by a multiseriate thallus in one layer (Weir 1998). *Rickia wasmannii* is a specialised ectoparasite related to ant species of the genus *Myrmica* Latreille: *M. rubra* (Linnaeus, 1758), *M. scabrinodis* Nylander, 1846, *M. sabuleti* Meinert, 1861, *M. specioides* Bondroit, 1918, *M. slovacica* Sadil,

1952 and *M. vandeli* Bondroit, 1920 (Thaxter 1926; Espadaler & Suñer 1989; Tartally *et al.* 2007). The species was described by Cavares (1899) based on specimens collected in Lenz (Germany) on *Myrmica laevinodis* Nylander, 1846 (= *M. rubra* (Linnaeus, 1758)). Up to date, it has been reported mainly from Western and Central European countries, such as Austria, France, Germany, Italy, Spain, Switzerland, United Kingdom, Yugoslavia, Hungary and Romania (Santamaria *et al.* 1991, Tartally *et al.* 2007).

The genus *Laboulbenia* is the richest in species (near 600) of all Laboulbeniales. *Laboulbenia formicarum* infests different ant genera in North America and ant species of the genus *Lasius* (*L. neglectus* Van Loon, Boomsma & Andrásflvy, 1990 and *L. grandis* Forel, 1909) in Europe (Espadaler & Santamaria 2003, Herraiz & Espadaler 2007). The other species associated with ants *Laboulbenia camponoti* is known from three countries in the world: India (Batra 1963) where the type locality is (on *Camponotus* sp.), Spain (Balazuc *et al.* 1982; Espadaler & Blasco 1990) and Turkey (Espadaler & Lodos 1983). All identified ant hosts of *Laboulbenia camponoti* in Europe are carpenter ants from subgenus *Tanaemyrmex* – *Camponotus sylvaticus* (Olivier, 1792) and *C. pilicornis* (Roger, 1859) in Spain and *C. baldaccii* Emery, 1908 in Turkey.

Material and methods

The material of *Rickia wasmannii* was collected in the Strandzha Mountain (South-eastern Bulgaria). On 26.09.2009 and 19.04.2010 workers from one and the same nest found under a stone were collected manually, while on 19.04.2010 infested ants were additionally collected by a modified suction sampler (Partner GBV 325) in the investigated area. *Laboulbenia camponoti* was found in 5 localities in Southern Bulgaria where the Mediterranean climatic influence is enhanced and in 1 locality on the Northern Black Sea coast. The infested ants were preserved in 75% ethanol and a part of them were dry stuffed. A fine entomological needle was used to isolate fungal thalli which were later included in glycerol and observed under a microscope.

Results

***Rickia wasmannii* Cavares, 1899: Malpighia 13: 182 (1899)**

Material examined. Bulgaria: Strandzha Mountain, near Bliznak Village. (42°10'19"N, 27°18'34"E, 300 m), 26.09.2009, 19.04.2010, leg. A. Lapeva-Gjonova, host *Myrmica scabrinodis* (127 infested workers).



Fig. 1. Heavy infested worker of *Myrmica scabrinodis*.

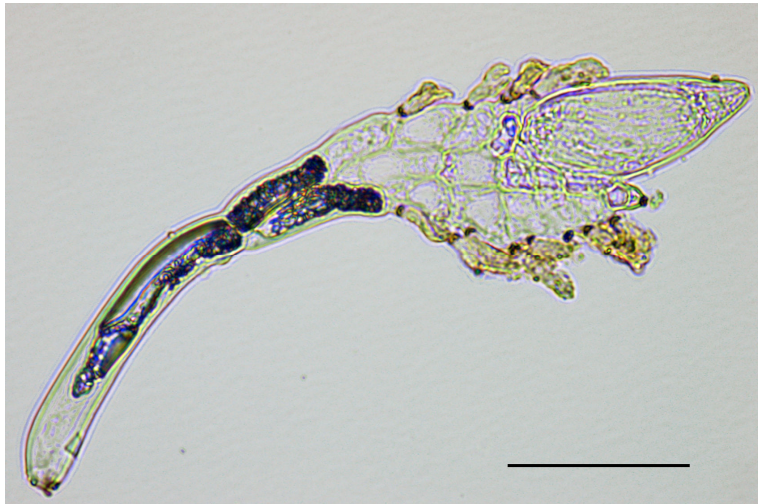


Fig. 2. A mature thallus of *Rickia wasmannii*. Scale bar: 0.025 mm.

***Laboulbenia camponoti* S. W. T. Batra, 1963:** Amer. Jour. Bot. 50(10): 991 (1963).

Material examined. Bulgaria: Northern Black Sea coast, cape Kaliakra (43°22'2"N, 28°27'57"E, 25 m), 22.06.2008, leg. A. Lapeva-Gjonova, host *Camponotus aethiops* (Latreille, 1798) (4 infested workers); East Rhodopes Mountain, Avren Village (41°19'39"N, 25°43'6"E, 570 m), 22.07.2009, leg. A. Lapeva-Gjonova, host *Camponotus pilicornis* (5 workers); Ograzhden Mountain, near Gjurgevo Village. (41°28'58" N, 23° 8'59"E, 580 m), 6.04.2010, leg. A. Lapeva-Gjonova, host *Camponotus aethiops* (7 infested workers); Struma valley, Mikrevo Village (41°38'31"N, 23°9'51"E, 292 m), 12.02.2011, leg. A. Lapeva-Gjonova, host *Camponotus aethiops* (6 workers); Strandzha Mountain, Malko Tarnovo district, Propada locality (41°58'54" N, 27°29'32"E, 385 m), 27.04.2011, leg. A. Lapeva-Gjonova, hosts: *Camponotus aethiops* (2 infested workers) and *Camponotus universitatis* Forel (3 infested workers); Sakar Mountain, Svilengrad district, Matochina Village (41°51'6.67"N, 26°32'48.21"E, 167 m), 30.04.2011, leg. A. Lapeva-Gjonova, host: *Camponotus aethiops* (1 infested worker).



Fig. 3. Mature pairs of *Laboulbenia camponoti* on the head and pronotum of *Camponotus universitatis*.



Fig. 4. A mature pair of *Laboulbenia camponoti* on an abdominal seta of *Camponotus aethiops*. Scale bar: 0.025 mm.

Discussion

In a study of the myrmecofauna of Strandzha Mountain the parasitic fungus *Rickia wasmannii* was found on *Myrmica scabrinodis* workers in the Bulgarian part of the mountain. This is the first such report for Bulgaria and the easternmost point in Europe where *Rickia wasmannii* is distributed. It is possible that the fungus is also found in the Turkish part of the mountain where the ant host having Transpalearctic distribution is also spread. The habitat has the traits of areas typically inhabited by the host – in close proximity to marshy terrain with hygrophilous vegetation, which corroborates the other observations (Santamaria 2001) on the preferences of this group of parasitic fungi. Ants were heavily infested on the head, thorax and legs and less so on the abdomen (Figs 1 and 2). Not all collected workers were infested with fungi. The fungus was absent on lightly pigmented workers which were probably recent imaged. Other ant species were also collected in the area, but *Rickia wasmannii* was found only on *Myrmica scabrinodis* workers. No impact of the fungus on the state of the nest has been observed over a period of nearly 7 months. It is expected that the fungus will be found on other ant species in Bulgaria as well, since all of its known hosts are present in the country.

The ectoparasitic fungus *Laboulbenia camponoti* S.W.T. Batra is reported for the first time in Bulgaria. It has been previously known only from Spain in Europe. All six findings of *Laboulbenia camponoti* on ants in the country are from regions where the Mediterranean climatic influence is strongly expressed – Southern Bulgaria and the Black Sea coast. The nests of the hosts *Camponotus aethiops* and *C. pilicornis* were under stones in areas with xerophytous vegetation. The third established host for *Laboulbenia camponoti* in Bulgaria is a social parasitic ant *Camponotus universitatis* from a nest of *C. aethiops*. Strandzha Mountain (Propada) is an only known locality for this rare and threatened ant species (included in IUCN Red list; status: VU D2) in Bulgaria (Lapeva-Gjonova & Kiran, unpublished). Only workers were found infested with the ectoparasitic fungus and the thalli were located on all parts of the ant bodies (Figs 3 and 4). In comparison with *Rickia wasmannii* the thalli were not so abundant. *Camponotus aethiops* and *Camponotus universitatis* are new hosts of *Laboulbenia camponoti*.

Camponotus pilicornis is a new record for the ant fauna in Bulgaria and its locality in the Rhodopes is the easternmost point of its distribution in Europe. It has been previously reported from Southern European countries – Spain, Portugal, France, Italy,

Macedonia (Radchenko 2007, Karaman 2009, Casevitz-Weulersse & Galkowski 2009). The studied material includes 1 gyne and 6 workers. Thus, there are already a total of 17 species of the genus *Camponotus* recorded for the territory of Bulgaria (Lapeva-Gjonova *et. al.* 2010, Lapeva-Gjonova 2011, Lapeva-Gjonova & Kiran, unpublished).

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