Laboulbeniales (Ascomycota) of the Canary Islands

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RESUMEN: Se presenta una lista con 23 especies y 8 géneros de Laboulbeniales (Ascomycota). Seis de ellas son primeras citas para las islas Canarias. La mayoría de las especies citadas infectan Carabidae (Coleoptera). Muchas de las especies de hospedantes (23) son endémicas, siendo sólo nueve las de hospedantes que también se encuentran fuera de la región Macaronésica. Los Carabidae, como familia más diversa de hospedantes, incluyen 21 especies endémicas y 6 de amplia distribución. Las pautas de distribución de Laboulbeniales dependen de dos factores ecológicos (humedad y biodiversidad de los hospedantes) que varían mucho entre las distintas islas. Palabras clave: Laboulbeniales, Carabidae, Staphylinidae, Anthicidae, Blattaria, Ephydridae, islas Canarias.

ABSTRACT: The list includes 23 species of Laboulbeniales (Ascomycota) in 8 genera. Six species are new for the Canary Islands. The majority of recorded species infests Carabidae (Coleoptera). Most host species (23) are endemic, only nine hosts also occur outside the Macaronesian region. There are 21 endemic and 6 widespread host species in the Carabidae as most diverse host family. The distribution pattern of Laboulbeniales corresponds with two ecological factors (moisture and host biodiversity respectively) which vary strongly between the different islands. Key words: Laboulbeniales, Carabidae, Staphylinidae, Anthicidae, Blattaria, Ephydridae, Canary Islands.
INTRODUCTION

The Canarian Archipelago has an extremely high biodiversity (Báez et al. 2001). More than 6,850 arthropods, 1,995 vascular plants and 2,928 species of fungi are known (Izquierdo et al., 2001, completed by unpublished data). The number of endemic arthropod species is 2,709 which corresponds to 39.6 % of the total species number and 0.364 species per km². This exceeds probably the ratio of the most other hotspots of biodiversity, however confirmed data are only available for plant and vertebrate species (Myers et al., 2000).

The diversity of Canarian arthropod species lets expect a high number of Laboulbeniales which are parasites of insects and other arthropod groups. However, there are described only two endemic species: *Laboulbenia machadoi* W. Rossi and *L. dicrodonti* W. Rossi, both on Carabidae (Rossi, 1991). A number of further carabid infesting species, which concern European or cosmopolitan species of Laboulbeniales, were summarized by Machado (1992). However, Canarian records of Laboulbeniales on other host families are very rare.

It is the aim of this paper to summarize all records of Laboulbeniales from the Archipelago, to indicate new parasite-host relations and to complete the actual list of terrestrial fungi, plant and animal species (Beltrán Tejera, 2001).

MATERIAL

The present list is based mainly on the collections of the authors and on data in the literature. A part of the material was gained during an ecological project in laurel forests by E. Arndt. It allows conclusions on infesting rates of the considered species. We received some of the infested carabid beetles by A. Kopetz (Erfurt, Germany) and the Natural History Museum Erfurt (M. Hartmann) which is greatfully acknowledged.

The material is deposited in following collections: BCB - Institutional Herbarium in Universitat Autònoma de Barcelona, Sergi Santamaria, Spain. EA - coll. Erik Arndt, Anhalt University, Bernburg, Germany. WR - coll. Walter Rossi, Università dell’Aquila, Coppito, L’Aquila, Italy.

We follow Machado (1992) concerning the taxonomy of Carabidae (Coleoptera).

LIST OF SPECIES

*Dioicomyces anthici* Thaxt.
Host. *Anthicus* sp. (Coleoptera, Anthicidae).
Locality. Isla de Montaña Clara (north-eastern most part of the Archipelago), 1989 [BCB].
New for the Canary Islands.
Remarks. A widespread species reported from all continents except Australia. Hosts are several genera of Anthicidae (*Anthicus s.l.*, Santamaria, 2002).

*Herpomyces tricuspidatus* Thaxt.
Host. Questionable; determined as *Epilampra excelsa* [=*Rhabdoblatta excelsa* (Navás, 1904)] (Blattaria, Epilampridae), see remarks.

Remarks. The mentioned blattarian host is doubtful because *R. excelsa* is not known outside its type locality in India. This species is also not included in the recent checklist of the Canary Islands (Oromí, 2001). *R. excelsa* is similar to *Rhyparobia maderae* (Fabricius), which is widespread on the Canarian Archipelago and known as host of *H. tricuspidatus* (Spegazzini, 1915).

**Laboulbenia atlantica** Thaxt.

Host. *Lobrathium multipunctatum* (Gravenhorst) (Coleoptera, Staphylinidae).


Remarks. *L. atlantica* was previously recorded on Madeira (Thaxter 1908), in France, and Belgium (Santamaria et al., 1991). It is one of the few known *Laboulbenia* species infesting two host families, Staphylinidae (as mentioned) and Carabidae (*Zargus schaumii* Wollaston).

**Laboulbenia basilewskyi** Balazuc

Host. *Lymnastis gaudini* Jeannel (Coleoptera, Carabidae).


**Laboulbenia cafii** Thaxt.

Host. *Cafius xantholoma* (Gravenhorst) (Coleoptera, Staphylinidae).


Remarks. The species infests *Cafius* and related genera world wide, however it was not recorded in Africa so far (Santamaria, 1998).

**Laboulbenia colasii** Lepesme

Host. *Dromius* sp. (Coleoptera, Carabidae).

Locality. **Tenerife**, without exact locality (Balazuc, 1974).

Remarks. *L. colasii* occurs in Europe and Tenerife, it infests species of the genus *Dromius* s.l. (Santamaria et al., 1991).

**Laboulbenia dicrodonti** W. Rossi

Hosts. *Dicrodontus aptinoides* (Wollaston) and *D. brunneus* (Dejean) (Coleoptera, Carabidae).


Remarks. The host species are endemic in laurel forests. The fungus seems to be more or less rare, because we did not record it during our ecological investigations.

[**Laboulbenia disenochi** Thaxt.]

Host. Unidentified Carabidae.
Locality. “Canary Islands”, without details (Colla, 1926).
Remarks. *L. disenochi* was described by Thaxter (1902, 1908) from Hawaiian carabid species. The record by Colla (1926) is very questionable.

*Laboulbenia egens* Speg.
Localities. **Gran Canaria**, Arucas, and **Tenerife** without locality, on *Tachyura haemorrhoidalis* (Huldén, 1985).
Remarks. *L. egens* is a cosmopolitan species which parasitizes hosts of the carabid group Tachyini (Bembidiinae) (Santamaria, 1998).

*Laboulbenia flagellata* Peyrit.
Hosts. Different species of the genera *Calathus* Bonelli and *Paranchus* Lindroth, as well as *Agonum marginatum* (Linné), *Eutrichops canariensis* (Brullé), and *Dicheirotrichus obsoletus* (Dejean) (Coleoptera, Carabidae).
Remarks. *L. flagellata* is one of the most widespread and polyphagous *Laboulbenia* species. According to Majewski (1994) at least 80 genera of Carabidae are hosts of this species. However, this number can vary because of different opinions on the generic state of several subgenera belonging to the large groups *Pterostichus* Bonelli (in widest sense) and *Platynus* Bonelli (in widest sense). The known host genera represent 12 different tribes including big-sized taxa like *Calosoma* Weber or *Macrocheilus* Hope which are not infested by any other Laboulbeniales species.
The distribution of *L. flagellata* in the Canarian archipelago seems to be heterogeneously. We know 24 endemic *Calathus* species, five of which were recorded as hosts. While *C. spretus* from El Hierro is frequently infested (about 30% of the beetles were parasitized), *L. flagellata* is extremely rare on the other species on La Gomera and Tenerife. We know only the thalli from 1964 though hundreds of *Calathus* specimens were examined in the last years.

*Laboulbenia machadoi* W. Rossi
Host. *Zargus crotchianus* Wollaston (Coleoptera, Carabidae).
Remarks. The host species is endemic in laurel forests on La Gomera. The parasite seems to be more or less rare, because we did not record it during our ecological investigations.

*Laboulbenia olisthopi* Speg.
Host. *Olisthopus glabratres* Brullé (Coleoptera, Carabidae). New for the Canary Islands.
Locality. **Tenerife**, Monte de la Esperanza, 1994 [EA].
Remarks. *L. olisthopi* occurs in Europe and on Madeira on carabid hosts of the genus *Olisthopus* Dejean (Santamaria, 1998).

**Laboulbenia pedicellata** Thaxt.
Locality. **Lanzarote**, Guanapay, 1986 on *Bembidion* (*Philochtus*) *vicinum* [BCB]; without exact locality, on *Tachys dimidiatus* [WR] (Machado, 1992); Machado (1992) mentions a further record without detailed locality on *B. vicinum*.
Remarks. A cosmopolitan parasite of mainly ripicolous carabids (mostly on Bembidiini, less numerous on Trechini, Clivinini, Brachinini, Platynini, see Santamaria *et al.*, 1991).

**Laboulbenia perpendicularis** Thaxt.
Host. *Ocydromus atlanticus* (Wollaston) (Coleoptera, Carabidae).
Locality. **Tenerife**, without locality (Thaxter, 1908; Machado, 1992).
Remarks. *L. perpendicularis* was described by Thaxter (1896) as parasite of *Bembidium* species from Virginia and Washington (U.S.A.). The only record outside North America is the specimen from Tenerife.

**Laboulbenia proliferans** Thaxt.
Host. *Chlaenius canariensis* Dejean (Coleoptera, Carabidae).
Remarks. *L. proliferans* infests carabid beetles from several tribes and subfamilies (e.g. Brachinini, Licinini, Callistini, Panagaeini) in Europe, Asia, Africa, and Australia. Most host species occur in riparian environments (Santamaria, 1998).

**Laboulbenia vulgaris** Peyrit.
Hosts. Different species of the genus *Bembidion* Latreille (in widest sense) (Coleoptera, Carabidae).
Localities. **Gran Canaria**, *Ocydromus schmidti* (Wollaston) (Huldén 1985 as *B. subcallosum*); **Tenerife**, Barranco de Masca, 1946 [BCB], Monte Aguirre, 1947 [BCB] on *Ocydromus fortunatus* (Wollaston); Teno, Puerto de Erjos, 1994 [EA] on *Bembidion varium* (Olivier) and *O. schmidti*; Adeje, Barranco del Infierno, 1994 [EA] on *O. atlanticus* and *O. fortunatus* also recorded from Tenerife by Huldén (1985); **La Gomera**, *O. atlanticus* (Huldén, 1985). Thaxter (1908) also mentioned material from the Canarian Islands without exact locality.
Remarks. *L. vulgaris* is a variable and extremely polyphagous cosmopolitan species. Most hosts are representatives of the carabid groups Bembidiini and Trechini (Santamaria *et al.*, 1991), the parasite occurs mainly in ripicolous habitats. The Canarian hosts include widespread as well as endemic species.

**Misgomyces dyschirii** Thaxt.
Host. *Dyschiriodes clypeatus* (Putzeys) (Coleoptera, Carabidae).
Locality. **Gran Canaria**, Maspalomas (Huldén, 1985 as *Dyschirius pusillus*).
Remarks. *M. dyschirii* is widespread in Europe, Asia, North Africa, and North America (Santamaria *et al.*, 1991). Its hosts are species of *Dyschirius* (s.l.) and the genus *Bledius* Mannerheim (Staphylinidae). *Bledius* and *Dyschirius* co-occur in the ground of ripicolous habitats or salt marshes.
**Peyritschiella furcifera** (Thaxt.) I. I. Tav.
Host. *Philonthus discoideus* (Gravenhorst) (Coleoptera, Staphylinidae).
Locality. Thaxter (1908) did not give a detailed locality. The host species occurs on all islands except El Hierro.
Remarks. *P. furcifera* is distributed worldwide. Hosts are several genera of the subfamily Staphylininae (Santamaria et al., 1991).

**Peyritschiella hybrida** (Thaxt.) I. I. Tav.
Host. *Philonthus* sp. (Coleoptera, Staphylinidae).
Locality. Thaxter (1908) did not give a detailed locality.
Remarks. *P. hybrida* is distributed in Asia, Europe, Madeira, the Canary Islands, West Indies and Eastern North America. Hosts are species of the genus *Philonthus* s.l. (Santamaria et al., 1991; Tavares, 1984).

**Prolixandromyces triandrus** Santam.
Host. *Velia lindebergi* Tamanini (Hemiptera, Veliidae).
Locality. Tenerife (Santamaria et al., 1991).
Remarks. *P. triandrus* is known from France, Portugal, Spain, and Tenerife. It infests bugs of the genus *Velia* Latreille like all *Prolixandromyces* (Santamaria et al., 1991).

**Rhachomyces canariensis** Thaxt.
Hosts. Several species of the genus *Trechus* Clairville (Coleoptera, Carabidae).
Remarks. Thaxter (1900) described *Rhachomyces canariensis* from Tenerife and indicated *Trechus flavomarginatus* as host. Because this host species is endemic on Madeira, it is unclear if the host name or the type locality was an error. However, this *Rhachomyces* species was confirmed for the Canary islands by later authors. Majewski (1994) characterized *R. canariensis* as a very variable species occuring in Europe, North Africa, Canary Islands and Madeira on many species of genus *Trechus*. Tavares (1985) suggested to investigate if these data from several hosts distributed over large areas include more than one taxon. All Canarian hosts are endemic.

**Rhachomyces lavagnei** (F. Picard) W. Rossi
Host. *Microlestes gomerensis* Lindberg (Coleoptera, Carabidae).
Remarks. *R. lavagnei* is distributed in Southern Europe and Africa infesting several *Microlestes* species (Santamaria et al., 1991). *M. gomerensis* is an endemic Canarian species.

**Rhachomyces tenenbaumii** J. Siemaszko & Siemaszko
Host. *Thalassophilus whitei* Wollaston (Coleoptera, Carabidae).
Locality. Tenerife, Adeje, Barranco del Infierno, 1994 [EA]; La Gomera, El Cedro, Las Mimbreras, Las Creces, Alto del Contadero and several other localities in the laurel forest [EA, WR] (Huldén, 1985); La Palma, Caldera (Huldén, 1985).
Remarks. *R. tenenbaumii* occurs frequently on *Thalassophilus longicornis* (Sturm) in Europe (Santamaria et al., 1991). *T. whitei* is a frequent endemic host on the Canary islands.
Stigmatomyces trianguliapicalis T. Majewski
Hosts. Species of the genus Parydra Stenhammar (Diptera, Ephydridae).
Locality. Gran Canaria, Los Lagunetas (Huldén, 1985).
Remarks. Huldén (1985) noted P. coarctata (Haliday) as Canarian host of S. trianguliapicalis. However, P. coarctata is not specified for the Canary islands. Probably P. fossarum (Haliday) is the correct host name, because it is the only known species from Gran Canaria and also the host from the type locality of S. trianguliapicalis (Majewski, 1994). S. trianguliapicalis is widespread in Europe and Africa, it occurs on species of Parydra and Pelina aenea (Fallén).

Table I. Distribution of known Laboulbeniales in the Canary Archipelago. Abbreviations: H - El Hierro, P - La Palma, G - La Gomera, T - Tenerife, C - Gran Canaria, [F - Fuerteventura], L - Lanzarote (and adjacent small islands). * - Endemic Canarian species. ? Data from literature without specification of an island.

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<th>Species</th>
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<td>Dioicomycyes anthici</td>
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<td>Herpomyces tricuspidatus</td>
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<td>Stigmatomyces trianguliapicalis</td>
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DISCUSSION

Actually 23 species of Laboulbeniales (eight genera) are known in the Canarian Archipelago (Tab. 1). Six species and two genera are new for the Canary Islands. Two species are endemic in the Archipelago (Tab. 1). The majority of recorded Laboulbeniales species (15, including both endemic) infests Carabidae, though ground beetles represent only 4.0 % of the pterygote insect species of the Canarian Islands. Most host species (23) are endemic, only nine hosts occur outside the Macaronesian region as well. There are 21 endemic and 6 widespread host species of Carabidae.

The largest number of Laboulbeniales was found on Tenerife with 12 species, six occur on Gran Canaria and La Gomera, four on Lanzarote, two on La Palma, and one on El Hierro. No record is known from Fuerteventura. This pattern corresponds with two ecological factors: moisture and host biodiversity. The eastern islands Lanzarote and Fuerteventura are extremely arid, permanent rivers or other fresh water as well as forests are lacking there. Laboulbeniales however occur most frequently on hosts in moist habitats.

The laurel forests in the westernmost islands provide with its leaf litter and small creeks suitable habitats for many potential host species. The biodiversity of insects in general and carabid species in particular decreases however from Gran Canaria, Tenerife, and La Gomera to La Palma and El Hierro (see Izquierdo et al., 2001; Machado, 1992).

In the future, a special attention should be directed to other potential host families (e.g. Staphylinidae) and to the population ecology of several parasite species. The abundances of some recorded Laboulbenia species seem to fluctuate strongly from year to year. The population ecology could explain such observations.

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