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New Laboulbeniales from China (Ascomycota)

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New Laboulbeniales from China (Ascomycota)

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ABSTRACT

The following six new species of Laboulbeniales from China are described: *Laboulbenia assingii*, sp. nov., parasitic on *Mimogonus*, sp. (Coleoptera, Staphylinidae); *L. rugosa*, sp. nov., parasitic on *Amerizus* (*Tiruka*), spp. (Coleoptera, Carabidae); *Rhachomyces latellae*, sp. nov., parasitic on an unidentified cavernicolous Carabidae; *R. spiralis*, sp. nov., parasitic on *Guizhaphaenops*, sp. (Coleoptera, Carabidae); *R. toledanoi*, sp. nov., parasitic on *Amerizus* (*Tiruka*) *perraulti* Deuve (Coleoptera, Carabidae); *Stigmatomyces ferrugineus*, sp. nov., parasitic on *Desmometopa*, sp. (Diptera, Milichiidae).

RÉSUMÉ

Nouvelles Laboulbeniales de Chine (Ascomycota).

Six nouvelles espèces de Laboulbeniales de Chine sont décrites : *Laboulbenia assingii*, sp. nov., parasite de *Mimogonus*, sp. (Coleoptera, Staphylinidae) ; *L. rugosa*, sp. nov., parasite de *Amerizus* (*Tiruka*), spp. (Coleoptera, Carabidae) ; *Rhachomyces latellae*, sp. nov., parasite d'un Carabidae cavernicole non-identifié ; *R. spiralis*, sp. nov., parasite de *Guizhaphaenops*, sp. (Coleoptera, Carabidae) ; *R. toledanoi*, sp. nov., parasite de *Amerizus* (*Tiruka*) *perraulti* Deuve (Coleoptera, Carabidae) ; *Stigmatomyces ferrugineus*, sp. nov., parasite de *Desmometopa*, sp. (Diptera, Milichiidae).

KEY WORDS

China,
Carabidae,
Diptera,
Staphylinidae,
new species.

MOTS CLÉS

Chine,
Carabidae,
Diptera,
Staphylinidae,
espèces nouvelles.

INTRODUCTION

The Chinese Laboulbeniales were the object of a recent monographic work, in which 182 species from continental China and from Taiwan are reported (Shen & Ye 2006). The Laboulbeniales recorded from continental China after the publication of this monograph are very few. These are *Laboulbenia bledii* Thaxt. and *L. rigida* Thaxt. (Shen *et al.* 2009a); *Ceratomyces hyalinus* Y.H.Shen (Shen *et al.* 2009b); *Hesperomyces virescens* Thaxt. (Haelewaters *et al.* 2014); *Asaphomyces cholevae* Thaxt., *Laboulbenia oodiphila* Huldén, *Monoicomyces homalotae* Thaxt., and *Symplectromyces vulgaris* Thaxt. (Rossi *et al.* 2018). For completeness, two more species recorded from continental China before 2006, but not reported by Shen and Ye in their monograph, must be mentioned: *Laboulbenia podontiae* Thaxt. described from Hong Kong (Thaxter 1914) and *Rhachomyces bordonii* W.Rossi & Santam. described from continental China and from Taiwan (Rossi & Santamaría 2000).

In the present paper six new species of Laboulbeniales from continental China are described. All the material utilized for the descriptions was found on insects preserved in institutional or private entomological collections.

MATERIAL AND METHODS

All the host insects of the new species were supplied to us by the entomologists listed in the acknowledgements and are preserved in their collections. The parasitic fungi were removed from the hosts by means of an entomological pin (#3); permanent slides were prepared following the method described by Rossi & Santamaría (2015). Holotypes are deposited in the Botanical Museum of Florence (FI).

Photomicrographs were made with a Jenoptik ProgRes 10 Plus digital camera on a Leica DMR microscope equipped with differential interference contrast optics (DIC).

RESULTS

Family LABOULBENIACEAE G.Winter
Genus *Laboulbenia* Mont. & C.P.Robin

Laboulbenia assingii
W.Rossi & M.Leonardi, sp. nov.
(Fig. 1A)

Thallus compact, with very short receptacle and cell V not reaching cell III; inner appendage minute, bearing a single, terminal antheridium; outer appendage unbranched and unusually stout, its basal cell as broad as cell III.

ETYMOLOGY. — Named after the German entomologist Volker Assing, distinguished student of the Staphylinidae and collector of the new species.

MATERIAL EXAMINED. — **China.** S Gansu, S Longnan, Min Shan, 1500 m, 33°05'24"N, 104°45'13"E, on the dorsal side of the

abdomen of *Mimogonus*, sp. (Coleoptera, Staphylinidae, Osoriinae), 06.VIII.2012, leg. V. Assing (holo-, FI[FI WR3766]).

MYCOBANK. — MB 831065.

DESCRIPTION

Thallus short and compact, colored dirty yellow with somewhat darker perithecium. Receptacle very short, broadly triangular, with cell I slightly longer than maximum width and cell II about as long, but much broader than the former, separated from cell III by a short, horizontal septum and from cell VI by a much longer, oblique and sometimes concave septum. Cell III quadrangular, slightly longer than broad. Cell IV similar to cell III, with a small and triangular cell V in its upper, inner angle. Insertion cell dark brown, relatively thin. Outer appendage simple and unusually stout, its basal cell as broad as cell III. Inner appendage consisting of a very small basal cell bearing a single flask-shaped antheridium. Perithecium ovoid, almost one half free from the receptacle, with a short, broad and blackened tip ending in an obliquely truncate and almost flattened apex distinctly directed outwards. Length from foot to perithecial tip 123–150 µm; perithecium 76–81 × 39–41 µm.

REMARKS

The very stocky habitus paired with the stout outer appendage makes this new species distinguishable at first sight. *Laboulbenia assingii*, sp. nov., is likely allied to *L. kenyensis* W.Rossi & Santam. parasitic on *Mimogonus rossii* Bordoni from Kenya, which also has a simple outer appendage and a single antheridium, but the latter species has a more slender appendage, elongate perithecium, much longer basal and suprabasal cells forming a geniculate receptacle, as well as other minor differences (Rossi & Santamaría 2000).

Laboulbenia rugosa

W.Rossi & M.Leonardi, sp. nov.
(Fig. 1B–D)

Thallus slender and elongate, with unbranched and elongate outer appendage; receptacle with wrinkled surface, bearing dark spots on cells III, IV and V; perithecial tip not strongly tapered.

ETYMOLOGY. — From Latin *rugosus* which means wrinkled, because of the wrinkled surface of the receptacle.

MATERIAL EXAMINED. — **China.** NW Sichuan, Maierma, 40 km SE of Aba, alt. 3250 m, on the elytra of *Amerizus (Tiruka) shatanicus* Deuve (Coleoptera, Carabidae, Bembidiini), 9–29.VI.2004, leg. R. Fabbri, (holo-, FI[FI WR3374]; para-, FI[FI WR3380]); N Yunnan, Diquing Tibet Aut. Prov., Zhongdian Co., Xue Shan 25 km S Zhongdian, alt. 3675–3725, 27°28.3'N, 99°41.5'E, on the elytra of a paratype of *A. (T.) davidales* Sciaky & Toledano, 2.VI.2005, leg. A. Smetana (para-, FI[FI WR3506]); Sichuan, Ganzi pref., Daxue Shan, 5 km E Kangding, river valley, c. 3000 m, on the elytra of *A. (T.) perraulti* Deuve, 20–23.V.1997, leg. A. Pütz (para-, FI[FI WR3507]).

MYCOBANK. — MB 831066.



FIG. 1. — **A**, *Laboulbenia assingii*, sp. nov.; **B**, *Laboulbenia rugosa*, sp. nov., immature thallus showing nuclei; **C**, *Laboulbenia rugosa*, sp. nov., mature thallus from the type slide; **D**, Cells III, IV and V of *Laboulbenia rugosa*, sp. nov., showing wrinkled surface. Scale bars: 50 µm.

DESCRIPTION

Thallus elongate, colored yellowish gray except for the perithecium, which is much darker and colored grayish brown; the surface of the receptacle is wrinkled, sometimes distinctly so especially in the upper portion. Cell I about three times longer than maximum width, slightly tapering and frequently curving towards the base. Cell II very elongate, twice or more longer than cell I, with almost parallel margins. Cell III slightly longer than broad and gradually enlarging from below upwards. Cell IV quadrangular, slightly shorter than cell III, with the cuneate cell V in the upper, inner angle, the surface of both these cells and, to a lesser extent of cell III, covered with irregular dark spots. Insertion cell blackish and thick. Outer appendage simple, slender and elongate, always broken in mature thalli. Inner appendage short, consisting of two superposed cells bearing two antheridia, one of which

at the top, the other somewhat lower. Perithecium free from $\frac{2}{3}$ to $\frac{3}{5}$ of its length, relatively small, about twice longer than maximum width, asymmetrical, with the slightly convex ventral side tapering regularly to the tip, while the dorsal side is more convex and is distinguished from the tip by a constriction; the tip relatively short and broad, blackened on the dorsal side and much paler on the ventral, ending in large hyaline lips forming an almost flattened apex. Length from foot to perithecial tip (360)425–650 µm; perithecium 110–145 × 55–70 µm; longest appendage 270 µm.

REMARKS

Because of the simple outer appendage and cell V not in contact with cell III, *Laboulbenia rugosa*, sp. nov., is likely related to *L. vulgaris* Peyr., which is common on other genera of the Bembidiini.

Genus *Rhachomyces* Thaxt.

Rhachomyces latellae

W. Rossi & M. Leonardi, sp. nov.
(Fig. 2A)

Differs from *Rhachomyces girardii* Lepesme & G. Temp. ex Santam. by the shape of antheridia and antheridial appendages, the difference between lower and upper appendages, and the lower number of cells forming the main axis of the receptacle.

ETYMOLOGY. — Named after the Italian entomologist Leonardo Latella, who collected one of the host insects of the new species.

MATERIAL EXAMINED. — **China**. Guizhou, Quianxi County, Honglin Town, cave Oa Tian Guizhou, on an unidentified Carabid beetle, 21.XI.2003, leg. A. Bileddo, (holo-, FI[FI WR3033]); Quianxi County, Honglin Town, Shu Jia Yan Dong (Shu's House Cave), GZ/Qx/21, alt. 1409 m, on an unidentified Carabid beetle, 17.XI.2001, leg. L. Latella (para-, FI[FI WR3032]).

MYCOBANK. — MB 831067.

DESCRIPTION

Axis of the receptacle from almost straight to variably curved, consisting of 11–18 brownish cells gradually increasing in size and becoming paler from below upwards. The sterile appendages are relatively few: the ones born on the lower portion of the axis are long and slender, consisting of dark brown elongate cells, becoming gradually shorter, paler and more robust in the upper portion of the axis; the appendages surrounding the base of the perithecium are distinctly shorter, usually consisting of five cells about twice longer than broad, except for the uppermost cell which is longer and has a tapering hyaline tip. Antheridial appendages very numerous, each consisting of two brownish cells and a terminal antheridium; the lower of the two cells is short and truncate-conical, the upper about three times longer than broad, the antheridium is straight, broadly bottle-shaped, slightly asymmetrical, with a paler neck. Perithecium sessile, pale brownish yellow, with the two transverse septa between the three lower tiers of the wall-cells highlighted by slight elevations, the tip truncate-conical, the apex flattened. Length from foot to perithecial apex 425–525 µm; perithecium 88–142 × 25–44 µm; longest appendage 240 µm. Thalli growing on the hind femurs are much shorter: 270–310 µm from foot to perithecial apex.

REMARKS

Rhachomyces latellae, sp. nov., bears a superficial resemblance in the general habitus with *R. girardii*, which is parasitic on *Aphaenops*, spp. (Carabidae, Trechini), from the Pyrenees (Europe). The latter fungus, however, has a longer receptacle consisting of up to 29 cells, longer and darker antheridial appendages, curved antheridial necks, shorter sterile appendages with an enlarged hyaline terminal portion, appendages surrounding the base of the perithecium not differing from the others (Santamaría & Faille 2007).

Rhachomyces spiralis

W. Rossi & M. Leonardi, sp. nov.
(Fig. 2B, C)

Differs from *Rhachomyces longissimus* Thaxt. for the very long lower appendages, for the very numerous and differently shaped upper appendages, and for the spiral twist of the thalli growing on the dorsal surface of the host.

ETYMOLOGY. — From Latin *spiralis* which means spiral, because of the thalli spirally twisted when growing on the dorsal surface of the host.

MATERIAL EXAMINED. — **China**. Guizhou, Quianxi County, Honglin Town, Luo Sai Dong, GZ/Qx/29, alt. 1445 m, on *Guizhaphaenops*, sp. (Coleoptera, Carabidae), 19.XI.2003, leg. L. Latella, S. Meggiorini & A. Bileddo (holo-, FI[FI WR3035]; para-, FI[FI WR3034]).

MYCOBANK. — MB 831068.

DESCRIPTION

Axis of the receptacle distinctly spiral in thalli growing on the elytra and pronotum of the host insect, consisting of 19–38 cells; from slightly to distinctly curved and consisting of 12–31 cells when growing on other parts of the body. These cells are brown, usually much darker on the anterior side and along the septa, gradually enlarging from the foot to the base of the perithecium. The appendages originating from the lower cells of the axis are long, dark and stiff; those in the upper portion of the thallus are more numerous, much shorter and paler, with more slender and almost hyaline tips. Antheridial appendages very numerous, consisting of two brown cells terminated by an elongate, grayish antheridium bearing a slender and curved neck. Perithecium sessile, oblong, very slightly inflated below, light brown colored, regularly tapering to the darker, subconical tip and hyaline, blunt apex. Length of the receptacle in unstretched spiral thalli growing on elytra and pronotum: up to 790 µm; length of receptacles of thalli growing on other parts of the host 255–675 µm; perithecium 130–150 × 40–42 µm; antheridial appendages 45–50 µm.

REMARKS

The spiralized habitus of thalli growing on the hosts' dorsal surface is unique among the species in the genus *Rhachomyces* and resemble tiny corkscrews emerging from (or screwed upon) the insects (Fig. 2B). Because of the shape of the perithecium and the length of the receptacle, *R. spiralis*, sp. nov., bears a superficial resemblance with *R. longissimus*, parasitic on Carabidae Anchomenini in Central and South America (Proaño Castro & Rossi 2008; fig. 7). However, the sterile appendages and the antheridial appendages of the two species are very different.

Rhachomyces toledanoi

W. Rossi & M. Leonardi, sp. nov.
(Fig. 2D, E)

Differs from *Rhachomyces canariensis* Thaxt. (Thaxter 1908; Plate XLIV, figs 1, 2) for the fewer, shorter, and much paler appendages, and for the very different shape of the antheridial appendages and antheridia.



FIG. 2. — **A**, *Rhachomyces latellae*, sp. nov.; **B**, *Rhachomyces spiralis*, sp. nov., immature thallus from the elytra; **C**, *Rhachomyces spiralis*, sp. nov., mature thallus from the legs; **D**, **E**, *Rhachomyces toledanoi*, sp. nov.; **F**, *Stigmatomyces ferrugineus*, sp. nov. Scale bars: 50 µm.

ETYMOLOGY. — Named after the Italian entomologist Luca Toledano, who supplied us with the insects bearing the new species.

MATERIAL EXAMINED. — **China.** C-Sichuan, Jintang, Jiajin Shan, 2300 m, on *Amerizus (Tiruka) perraulti* Deuve (Coleoptera, Carabidae), 15.VII.2004, leg. M. Janata (holo-, FI[FI WR3508]; para-, FI[FI WR3509]).

MYCOBANK. — MB 831069.

DESCRIPTION

Axis of the receptacle, consisting of 9-13 cells tinged with very pale brown, the basal cell longer than broad and slightly tapering towards the foot, the suprabasal one much shorter and irregularly pentagonal, the others gradually increasing in length from below upwards. Sterile appendages and antheridial appendages arising in pairs from relatively large appendiculate cells. Appendages short and straight, more numerous in the upper portion of the thallus, consisting of three brownish cells unequal in length separated by thick, dark septa: the lower is the longest, the distal one is the shortest and bears a hyaline tapering tip, which is often disorganized. Antheridial appendages consisting of an elongate brownish cell, supporting the antheridium, the latter slender and strongly tapering in a long and slightly curved neck. Perithecium sessile, pale grayish brown, its outline marked by slight elevations at the height of the transverse septa between the three lower tiers of wall cells; the tip short, broadly conical, abruptly tapered. Length from foot to perithecial apex (240)340-490 µm; longest appendages 125 µm; perithecium 115-140 × 45-50 µm; antheridia 20-25 µm.

REMARKS

The perithecium of *R. toledanoi*, sp. nov., is similar to the perithecium of *R. canariensis* and of *R. maublancii* Lepesme ex W.Rossi (Rossi 1979; figs. 8-12). However, both the latter species bear very different appendages and antheridia.

Genus *Stigmatomyces* H.Karsten

Stigmatomyces ferrugineus

W.Rossi & M.Leonardi, sp. nov.
(Fig. 2F)

Thallus with a predominant rusty color, with an almost rounded perithecial venter, the axis of free appendage consisting of three slender and elongate cells bearing two antheridia each.

ETYMOLOGY. — From Latin *ferrugineus* which means rusty, because of the predominant color of the fungus.

MATERIAL EXAMINED. — **China.** Prov. Guizhou, Tongren, Fanjing Mt., 27°56'31"N, 108°36'55"E, 874 m, evergreen broad-leaf forests, on a *Ceropegia dolichophylla* Schltr. flower, attracted by dead bee, on head and mouthparts of *Desmometopa*, sp. (Diptera, Milichiidae), 16.IX.2013, leg. A. Heiduk (holo-, FI[FI WR3821]).

MYCOBANK. — MB 831082.

DESCRIPTION

Receptacle, distal portion of the free appendage and perithecial apex pale yellow; the rest of the fungus is rusty red. Receptacle long and slender, basal cell tapering gradually towards the foot, suprabasal cell slightly longer and almost rectangular. Stalk-cell of the appendage prominent, abruptly bulging out from below the insertion cell of the appendage, its outer margin distinctly concave. Free appendage slender and curving outwards, its sigmoid axis consisting of three elongate cells, each of the two lower giving rise from their upper, inner angle to a smaller cell bearing apically two large, paired and diverging antheridia, while the third, uppermost and more slender cell of the axis bears distally two superimposed antheridia, which appear non functional even in very early stages of the fungus. Stalk cell of the perithecium triangular in outline, much broader than tall; secondary stalk cell obliquely separated and about of the same size than the former; basal cells relatively small: the whole region compact. Perithecial venter large, with symmetrically rounded outline, the surface indistinctly granular, rather abruptly and almost symmetrically inflated, slightly prominent distally below the spreading base of the slender and erect neck, which is about as long as the venter, somewhat swollen at its junction with the tip; the latter ending in four lobes, three of which are small, flattened and slightly divergent, the fourth larger, rounded and more prominent. Total length 230-380 µm; perithecium 120-230 × 80-85 µm; appendage 25-45 µm; ascospores about 35 µm.

REMARKS

Stouter specimens of *Stigmatomyces ferrugineus*, sp. nov., bear a superficial resemblance with *S. carles-tolrae* Santam. & W.Rossi, which is also parasitic on a member of the Milichiidae family (i.e. *Madiza glabra* Fallén); however, the latter fungus has a very different appendage with the axis composed of four cells, and much shorter receptacle and perithecial neck (Santamaria & Rossi 1998). The third species associated with Milichiidae, i.e., *S. deemingii* W.Rossi & A.Weir, has a more slender perithecial venter, with the surface also coarsely granular, and a long appendage (Rossi & Weir 2011).

Only one species of *Stigmatomyces* was reported from China thus far: *S. ephydrae* L.Mercier & R.Poisson (Shen & Ye 2006).

DISCUSSION

In spite of the very many species reported to date, the list of the Chinese Laboulbeniales is far from complete. Representatives from important host groups, such as mites and millipedes, but also semi-aquatic Hemiptera (families Veliidae, Hebridae, Hydrometridae) still need to be found. Laboulbeniales from Diptera represent about 10% of all described Laboulbeniales. With only two dipterophilous species recorded from China, one of which is described here, we expect many more taxa are to be found on Chinese Diptera.

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