

***Wirthiotrema*: a new genus for the *Thelotrema glaucopallens* group (Ascomycota: Ostropales: thelotremoid Graphidaceae)**

Eimy RIVAS PLATA, Klaus KALB and Andreas FRISCH

Abstract: The new genus *Wirthiotrema* Rivas Plata, Kalb & Frisch. is described for the *Thelotrema glaucopallens* group, based on molecular and morphological evidence, with *W. glaucopallens* as the type species. The genus is characterized by myriotremoid thalli and apothecia, in combination with a paraplectenchymatous excipulum, 1- ascospores, and stictic acid as a secondary compound. The new combinations *W. glaucopallens* (Nyl.) Rivas Plata & Kalb comb. nov., *W. santessonii* (Hale) Rivas Plata & Frisch comb. nov., and *W. trypaneoides* (Nyl.) Rivas Plata & Lücking comb. nov., are proposed and a key to the three species is presented.

Key words: Ostropalean fungi, *Leptotrema*, *Leucodecton*, *Thelotremataceae*

Introduction

Ostropalean fungi include the *Graphidaceae* and *Thelotremataceae* (Eriksson & Hawksworth 1998; Winka *et al.* 1998; Lutzoni *et al.* 2001; Kauff & Lutzoni 2002), both important components of tropical lichen communities. The two families were recently revised (Staiger 2002; Frisch *et al.* 2006), and Mangold *et al.* (2008a) demonstrated polyphyly among them, resulting in the inclusion of *Thelotremataceae* in *Graphidaceae*. Genera in the former *Thelotremataceae* were traditionally separated by ascospore characters (Redinger 1936; Salisbury 1972a,b; Hale 1973, 1974, 1978) into *Ocellularia* (transversely septate, hyaline), *Phaeotrema* (transversely septate, brown), *Thelotrema* (muriform, hyaline) and *Leptotrema* (muriform, brown), or by excipular characters (Salisbury 1971, 1972a,b, 1978; Hale 1980, 1981) into *Thelotrema*

(uncarbonized with lateral paraphyses), *Myriotrema* (non-carbonized, lacking lateral paraphyses), and *Ocellularia* (carbonized, lacking lateral paraphyses). Kalb (2004) and Frisch *et al.* (2006) used a combination of thallus, apothecial, ascospore, and chemical characters to distinguish 21 genera, among them the reinstated *Chapsa*, *Leucodecton* and *Stegobolus* and the newly established *Acanthotrema*, *Ampliotrema*, *Fibrillithecis*, *Gyrotrema*, *Melanotrema*, *Redingeria*, and *Reimnitzia*. Further contributions added two further genera, *Melanotopelia* and *Schizotrema* (Mangold *et al.* 2008b; Mangold *et al.* 2009), but some of the distinctive species groups in the family have not yet been formally repositioned and remain in the collective genera *Myriotrema*, *Ocellularia* and *Thelotrema*, respectively.

Thelotrema traditionally comprised species with muriform, hyaline ascospores. Based on Salisbury (1971, 1972a,b, 1978), Hale (1980) changed the generic concept to include species with a non-carbonized excipulum and lateral paraphyses. Frisch *et al.* (2006) provided a narrower concept, restricting the genus to species with a non-carbonized, paraplectenchymatous excipulum, lateral paraphyses, lepadinoid apothecia with a more or less entire thalline margin and free proper excipulum (double margin), a

E. Rivas Plata: Department of Botany, The Field Museum, 1440 S Lake Shore Drive, Chicago IL 60605, USA. Email: erivasplata@fieldmuseum.org; Biological Sciences Department, University of Illinois at Chicago, 845 W. Taylor St., Chicago, IL 60607, USA.

K. Kalb: Lichenologisches Institut Neumarkt, Im Tal 12, D-92318 Neumarkt, Germany.

A. Frisch: Department of Ecology, Swedish University of Agricultural Sciences, P.O. Box 7044 SE 750 07 Uppsala, Sweden.

thallus usually with a weakly developed or without a cortex, and stictic acid and related substances as dominant secondary compounds. *Myriotrema*, on the other hand, was defined by lack of lateral paraphyses, prosoplectenchymatous, usually fused excipulum, a thallus with a usually prosoplectenchymatous and often split cortex, and frequently psoromic acid as a secondary substance. A third genus, *Leucodecton*, is intermediate between *Thelotrema* and *Myriotrema* in lacking lateral paraphyses but having a paraplectenchymatous excipulum, a weakly developed or absent thallus cortex, and stictic acid as dominant secondary substance. Frisch *et al.* (2006) identified two closely related species variously placed in either *Thelotrema* or *Myriotrema*, viz. *T. glaucopallens* and *T. santessonii*, that did not fit in any of the three genera and also in the molecular phylogenetic analysis fell outside these clades (Frisch *et al.* 2006; Mangold *et al.* 2008a). The so-called *Thelotrema glaucopallens* group was found to be most similar to *Leucodecton* but differed particularly in the *Myriotrema*-type, prosoplectenchymatous cortex with internal splitting. Molecular analysis by Mangold *et al.* (2008a) also showed *Myriotrema trypaneoides* as a sister species of *T. glaucopallens*, and examination of the morphological characters confirmed that the species shares the paraplectenchymatic excipulum, I- ascospores, and presence of stictic acid as a secondary compound with *T. glaucopallens* and *T. santessonii*. Because of the morphological differences and its isolated phylogenetic position, we describe the new genus *Wirthiotrema* for this group of species.

The new genus

Wirthiotrema Rivas Plata, Kalb, Frisch & Lumbsch gen. nov.

Mycobank no. MB 512786

Genus novum ad familiam Graphidacearum pertinens. *Leucodecto* similis sed cortice thalino prosoplectenchymatico et ascosporis hyalinis I- differt.

Type species: *Wirthiotrema glaucopallens* (Nyl.) Rivas Plata & Kalb

(Figs 1 & 2)

Thallus corticolous, yellow-green to light olive, smooth to uneven-rimose and often fissured, up to 250 µm thick. *Cortex* well-developed, prosoplectenchymatous, compact and strongly conglutinated, partially with internal splitting, 5–20 µm thick. Dactyls ('pustules') present in one species.

Apothecia myriotremoid, immersed to erumpent, round, up to 0.6 mm diam. with a pore up to 0.2 mm wide; disc immersed, hardly visible, brown-black with a thin white pruina; thallus margin concolorous with the thallus. *Excipulum* fused (to rarely partially free), paraplectenchymatous, laterally pale brown but apically darker, up to 50 µm broad; periderm layer usually distinct, up to 30 µm broad. *Lateral paraphyses* absent. *Hypothecium* pale, up to 10 µm high. *Epitecium* grey-brown, granular, K-. *Hymenium* 80–170 µm high, clear; columella and columelloid structures absent; *paraphyses* simple, straight, 1.5–2 µm thick, with slightly thickened apices. *Asci* of the *Thelotrema* type, clavate, 90–160 × 10–25 µm. *Ascospores* 8 per ascus, ellipsoid, muriform with 5–9 transverse and 1–3 longitudinal septa per segment, 20–50 × 9–15 µm, distoseptate, hyaline or brown, I-.

Pycnidia immersed to erumpent, 0.4–0.8 mm diam. with 1–4, white to brownish pores, 0.1–0.4 mm wide. *Wall* prosoplectenchymatous, hyaline to pale brown, apically dark brown, laterally 10–20 µm wide but up to 120 µm apically. *Conidiophores* of Vobis type II(–IV). *Conidiogoneous* cells bottle-shaped, 7–11 × 1.5–2 µm. *Conidia* formed acrogenously, oblong to fusiform, 2.5–3.5 × 1–1.2 µm.

Secondary chemistry. Stictic acid and satellite substances (acetylconstictic acid, constictic acid, consalazinic acid and others).

Etymology. We dedicate this new genus to Prof. Dr Volkmar Wirth for his numerous outstanding contributions to lichenology.

Distribution and ecology. Pantropical; in lowland to lower montane rainforests, on

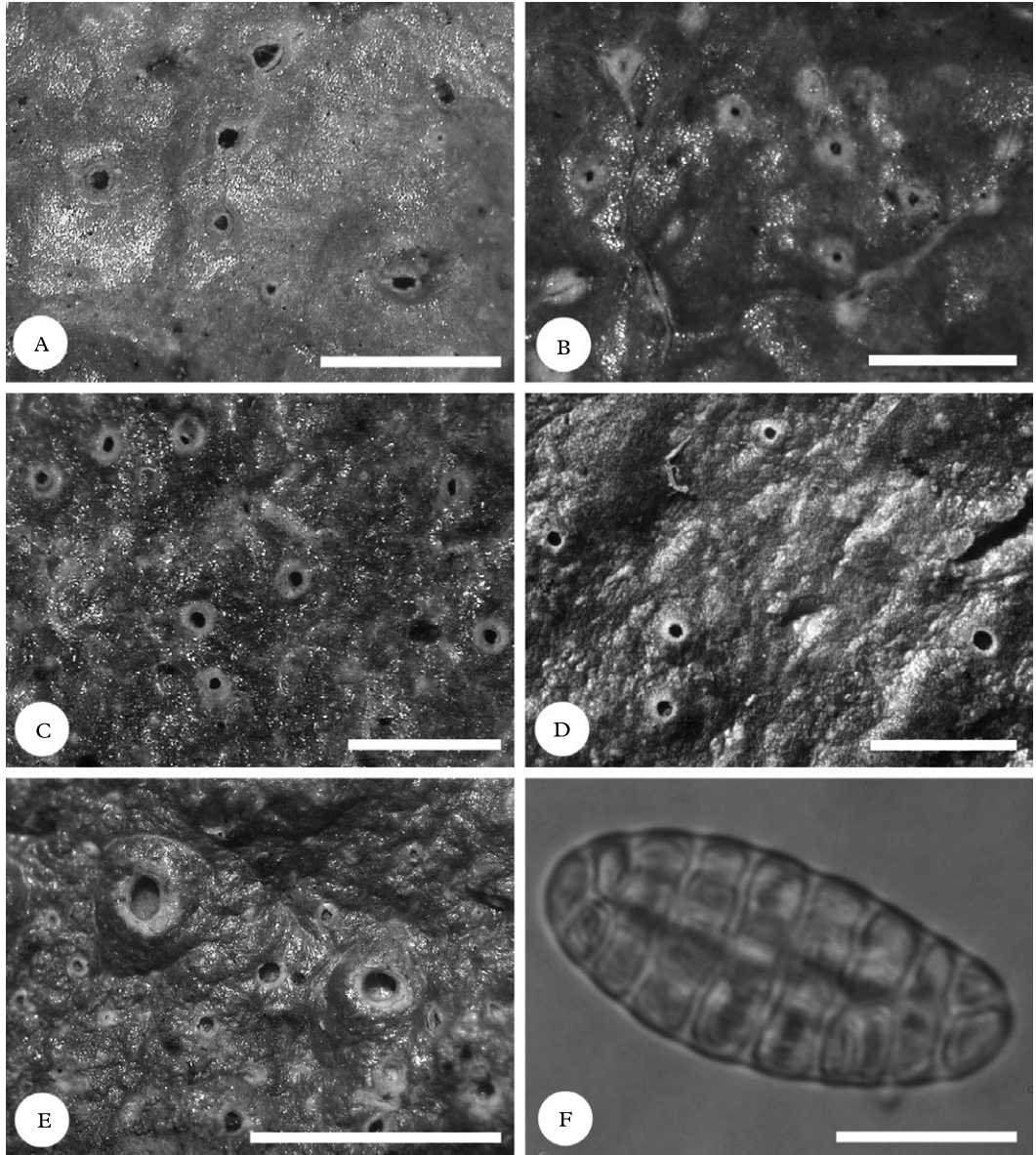


FIG. 1. *Wirthiotrema glaucopallens*. A–E, thallus with apothecia; F, ascospore. [A, holotype; B, isotype; C, Costa Rica, Lücking 17064(F); D, Costa Rica, Lücking 15620 (F); E, Costa Rica Sipman 37294 (B); F, holotype]. Scales: A–E = 1 mm, F = 10 μ m.

bark of tree trunks in shady to semi-exposed conditions.

Remarks. The genus *Wirthiotrema* is characterized by its myriotremoid thallus with a prosoplectenchymatous, partially split cor-

tex, its immersed to erumpent, myriotremoid apothecia with a more or less fused, paraplectenchymatous, brownish excipulum, its muriform, hyaline or brown, non-amyloid ascospores, and stictic acid as a major secondary substance. The genus is externally

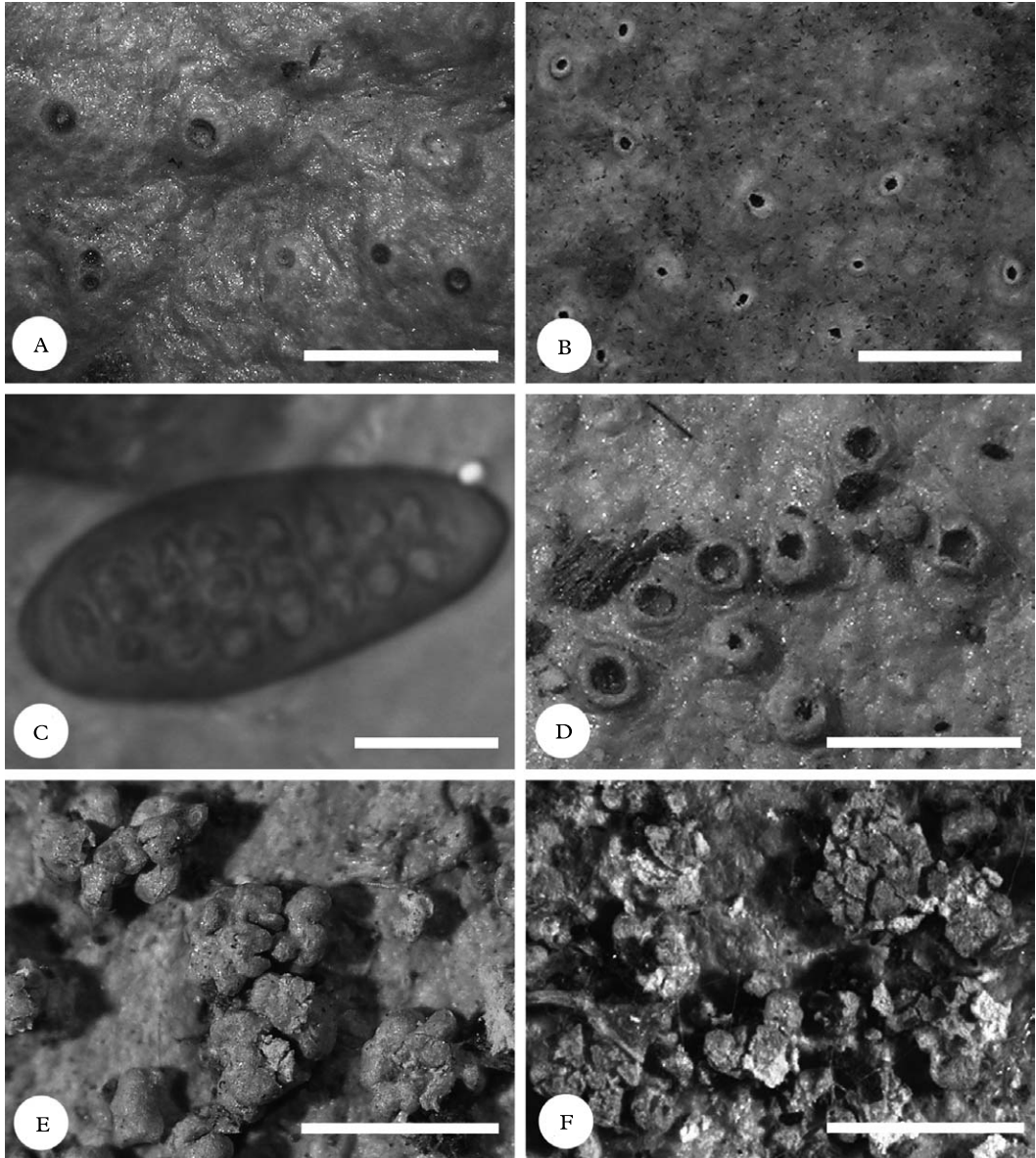


FIG. 2. *Wirthiotrema* species. A–C, *W. trypaneoides*; A & B, thallus with apothecia; C, ascospore [A, Costa Rica, Sipman 37286 (B); B, Costa Rica, Lüicking 1563 (F); C, lectotype].; D–F, *W. santessonii* (holotype); D, thallus with apothecia; E & F, dactyls. Scales: A, B, D–F = 1 mm; C = 10 μ m.

most similar to *Myriotrema* but differs in the paraplectenchymatous excipulum and the non-amyloid ascospores. These characters are reminiscent of *Thelotrema*, but that genus has a thallus with a weakly developed to absent cortex and lepadinoid apothecia with

double margin and lateral paraphyses. Apothecial structure, thallus chemistry, and the cell arrangement of the ascospores are reminiscent of *Leucodecton*, but *Wirthiotrema* differs from that genus in the prosoplectenchymatous thallus cortex with internal

splitting and the hyaline, non-amyloid ascospores lacking ornamentation. Furthermore, molecular analyses (Frisch *et al.* 2006; Mangold *et al.* 2008a) placed *Wirthiotrema* distant from *Leucodecton*.

Wirthiotrema thus far contains three species:

**Wirthiotrema glaucopallens (Nyl.)
Rivas Plata & Kalb comb. nov.**

Mycobank no. MB 512787

Thelotrema glaucopallens Nyl., *Ann. Sci. Nat., Bot., Sér. 4*, **19**: 327 (1863).

**Wirthiotrema santessonii (Hale) Rivas
Plata & Frisch comb. nov.**

Mycobank no. MB 512788

Thelotrema santessonii Hale, *Phytologia* **26**: 417 (1973).—*Myriotrema santessonii* (Hale) Hale, *Mycotaxon* **11**: 135 (1980).

**Wirthiotrema trypaneoides (Nyl.) Rivas
Plata & Lücking comb. nov.**

Mycobank no. MB 512789

Thelotrema trypaneoides Nyl., *Ann. Sci. Nat. Bot. sér. 4*, **19**: 335 (1863).—*Leptotrema trypaneoides* (Nyl.) Riddle, *Bull. Torrey Bot. Cl.* **43**: 151 (1916).—*Myriotrema trypaneoides* (Nyl.) Hale, *Mycotaxon* **11**: 135 (1980); type: Cuba, Wright 156 (FH-Tuck.—lectotype selected by Hale [1978: 54]; US!—isolectotype).

Thelotrema subterebrans Nyl., *Flora* **59**: 561 (1876) [fide Hale 1978].—*Leptotrema subterebrans* (Nyl.) Zahlbr., *Cat. Lich. Univ.* **2**: 640 (1923); type: Cuba, Wright 520 (H, hb. Nylander 22514—lectotype)

Thelotrema laevius Vain., *Journ. of Bot.* **34**: 207 (1896).—*Leptotrema laevius* (Vain.) Zahlbr., *Cat. Lich. Univ.* **2**: 635 (1923); type: St. Vincent, Elliott s. n. (TUR-Vain. 26774!—lectotype).

(Fig. 2)

Key to *Wirthiotrema* species

- | | | |
|------|---|-------------------------|
| 1 | Hymenium interspersed; ascospores brown | W. trypaneoides |
| | Hymenium clear | 2 |
| 2(1) | Dactyls present | W. santessonii |
| | Dactyls absent | W. glaucopallens |

Wirthiotrema glaucopallens and *W. santessonii* are closely related and agree in thallus and apothecial features and chemistry but differ in the presence of conspicuous dactyls in *Wirthiotrema santessonii*. They form a species pair as defined by Poelt (1970, 1972). *Wirthiotrema glaucopallens* somewhat resembles *Ocellularia clandestina* (Frisch *et al.* 2006), but the latter has a whitish thallus owing to a strong incrustation with calcium oxalate crystals, apothecia with an apically carbonized excipulum and columella, and ascospores with tryptelioid walls and septa. The dactyls ('pustules') of *W. santessonii* are unique among *Graphidaceae* and show a great variability with respect to coarseness and size. Their apex often breaks open and exposes the central cavity. Soredia are not formed, but small thallus fragments removed from the apex might function as diaspores, a phenomenon also known from

species in *Pyxine* (Kalb 1987), and similar to the schizidia of *Stegobolus* (Frisch *et al.* 2006). According to Frisch *et al.* (2006), open dactyls may also play a role in gas exchange and their enlarged surface could be advantageous for photosynthesis in the rather shady habitat in which this species is usually found.

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