A new species of *Thelotrema*, a new combination, *Leucodecton isidioides*, and a key to thelotremoid lichens of Macaronesia (lichenised *Ascomycota: Graphidaceae*)

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Abstract: The lichen *Thelotrema laurisilvae* is described as new from bark in the laurel forest of Madeira. It is characterized by a thick, white, coarsely verrucose thallus, prominent apothecia, and multiseptate ascospores becoming pale grey-brown with age.

Zusammenfassung: *Thelotrema laurisilvae*, eine corticole Flechte aus dem Lorbeerwald Madeiras, wird neu beschrieben. Sie ist durch einen dicken, grobwarzigen, weißlichen Thallus, vorgewölbte Apothecien und vielfach querseptierte, im Alter gebräunte Ascosporen gekennzeichnet.

Generic concepts in the former *Thelotremataceae*, now included in *Graphidaceae*, have changed considerably within the last decade (FRISCH & al. 2006; RIVAS PLATA & al. 2010, 2012). About 30 genera are currently accepted compared to only three to four distinguished by HALE (1974, 1978, 1980, 1981). The genus *Thelotrema* ACH. in its modern circumscription is characterized by immersed-erumpent to sessile, non-carbonised, ecolumellate, perithecioid to apothecioid ascomata with a double margin caused by a free proper exciple, and lateral periphysoids (FRISCH & al. 2006, MANGOLD & al. 2009). It comprises c. 85 species, most of which are tropical to subtropical in distribution, mostly on bark. From insular Macaronesia, eight species have been reported under the name *Thelotrema*: *T. antoninii* PURVIS & P. JAMES, *T. harmandii* PIT., *T. isidioides* (BORRER) R. SANT., *T. lepadinum* (ACH.) ACH., *T. macrosporum* P. M. JØRG. & P. JAMES, *T. perforatum* var. *pauciseptatum* PURVIS & P. JAMES, *T. petractoides* P. M. JØRG. & BRODO, *T. rockii* (ZAHLBR.) HALE, and *T. subtile* TUCK. (PITARD & HARMAND 1911, PURVIS & al. 1995, HAFELLNER 1995, ETAYO & BERGER 2004). Five of these species do not belong in *Thelotrema* (GILENSTAM 1969, APTROOT 2010, PARNMEN & al. 2012, RIVAS PLATA & al. 2012): *T. antoninii* is now *Clandestinotrema antoninii* (PURVIS & P. JAMES) RIVAS PLATA, LÜCKING & LUMBSCH,

T. harmandii PIT. is *Conotrema harmandii* (PIT.) GILENSTAM, *T. isidioides* is a species of *Leucodecton* (recombined below), *T. perforatum* var. *pauciseptatum* belongs to *Ocellularia* as *O. pauciseptatum* (PURVIS & P. JAMES) APTROOT, and *T. petractoides* is now in a new, monospecific genus, as *Crutarndina petractoides* (P. M. JØRG. & BRODO) PARNMEN, LÜCKING & LUMBSCH. The report of *Thelotrema subtile* by SCHUMM (2008) actually represents *T. suecicum* or a related, new species (see below), and earlier reports of *T. subtile* from Madeira (KALB & HAFELLNER 1992, HAFELLNER 1995) represent *Crutarndina petractoides*. Also, records of *T. rockii* belong to *T. lacteum* KREMP. (see below). This leaves four genuine *Thelotrema* species currently known from Macaronesia: *T. lacteum*, *T. lepadinum*, *T. macrosporum*, and *T.* aff. *suecicum*.

During fieldwork on the Atlantic island of Madeira (BREUSS 2012), the second author collected a specimen of *Thelotrema* that did not match any of the species included in the world-key by RIVAS PLATA & al. (2010). It is described below as new to science.

***Thelotrema laurisilvae* LÜCKING & BREUSS, spec. nova** (Figs. 1, 2)

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Diagnosis: Differing from *Thelotrema sitianum* VAIN. in the thick, verrucose, epiperidermal thallus, the prominent to sessile apothecia, and the smaller, pale grey-brown ascospores.

Holotype: Portugal: Macaronesia, Madeira, eastern mountain range, surroundings of Balcões lookout near Ribeiro Frio; 860 m s. m.; Laurel forest (laurisilva); on tree bark; 9 July 2011, leg. O. BREUSS 31091 (LI, holotype; F, isotype).

Characters:

Thallus: corticolous, epiperidermal, white, coarsely verrucose to almost pustulate (verrucae 0.3–1.0 mm in diam.); in section 200-300 µm thick, lacking a cortex or in part with thin, 3-5 µm thick, corticiform layer, irregular, 20-40 µm thick photobiont layer, and massive, 150-250 µm thick medulla; photobiont layer and medulla heavily incrusted with large clusters of calcium oxalate crystals and small, grey crystals, not dissolving in KOH.

Apothecia: prominent to sessile, rounded, 1.0-1.8 mm in diam.; disc partially covered by 0.5-0.8 mm wide pore, dark brown, white-pruinose; proper margin fissured-denticulate, incurved, white; thalline margin entire, rather thick (0.3-0.4 mm) and bulging, with split towards proper margin (double margin). Columella absent.

Excipulum: paraplectenchymatous, 25-40 µm wide, colourless; periphysoids present, distinct, 30-50 µm long and 2.0-3.0 µm wide, slightly widened towards their apices.

Paraphyses: unbranched, straight, 1.5-2.0 µm wide.

Ascospores: 8 per ascus, 15-23-septate, 70-90 × 9-12 µm, oblong to narrowly fusiform, with thick septa and lens-shaped lumina and thickened outer wall, when mature slightly constricted at the septa, for a long time remaining colourless but eventually becoming (pale) grey-brown, I+ violet-blue (amyloid), postmature ascospores collapsing and becoming dark brown.

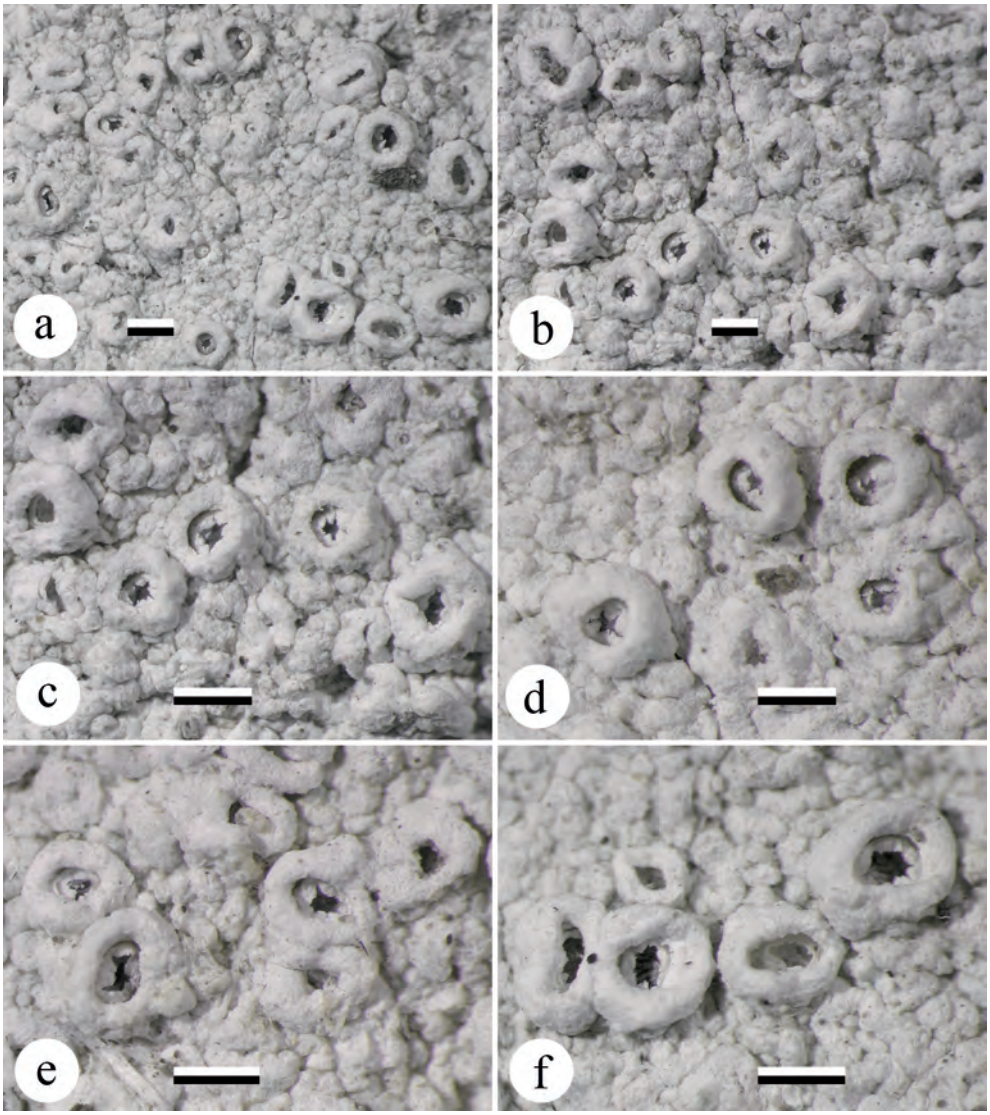

Fig. 1. *Thelotrema laurisilvae*. *a-f* Habitus and apothecia enlarged. Note the verrucose thallus and the apothecia with double margins. – Bars: 1 mm.

Secondary chemistry: no substances detected by TLC.

Remarks: This new species resembles the species of the *Thelotrema monosporum* NYL. group in having a white, ecorticate thallus and ascospores becoming (grey-) brown (RIVAS PLATA & al. 2010). Most similar within this group is *T. pachysporum* NYL., which agrees with *T. laurisilvae* in the transversely septate ascospores. However, the ascospores of that species become much darker brown and are shorter (35-75 µm long). Also, all species of the *T. monosporum* group, including *T. pachysporum*, have smaller, erumpent to prominent, crateriform apothecia with much thinner thallus margin and also a thinner thallus which is never verrucose. *Thelotrema lacteum* KREMP. agrees with *T. laurisilvae* in the thick thalline margin of the apothecia, but its thinner thallus is smooth and loosely corticate and its apothecia are smaller and have an undulating, not fissured-denticulate, proper margin. Most similar appears to be *T. sitianum* VAIN., described from Brazil; this species agrees with *T. laurisilvae* in apothecial morphology, but has a thin, endoperidermal thallus, and its ascospores are much larger (70-140 × 12-16 µm) and dark brown. *Thelotrema diplotrema* NYL. and *T. nureliyum* HALE are superficially similar to the new species but have smaller apothecia with thinner margins, a non-verrucose thallus, and colourless ascospores. While agreeing in apothecial size and emergence, *Thelotrema laurisilvae* is easily distinguished from the more common *T. lepadinum* (ACH.) ACH., which has a yellowish, loosely corticate thallus and muriform, conspicuously thick-walled, colourless ascospores. *Thelotrema rockii* from Hawaii is very similar to the new species but produces stictic acid. *Thelotrema laurisilvae* possibly represents a Macaronesian endemic.

The *Thelotrema* species reported from the Atlantic islands as *Thelotrema subtile* TUCK. by SCHUMM (2008) is another species. It has prominent, large apothecia (immersed and small in *T. subtile*; RIVAS PLATA & al. 2010) with a clearly visible, fissured inner excipulum, and a yellowish, loosely corticate thallus, and belongs in the *T. lepadinum* complex. Species in that complex with transversely septate spores are *T. suecicum* (MAGN.) P. JAMES and *T. diplotrema* NYL. Both differ from the material reported by SCHUMM (2008) in ascospore size: 20-40 µm long in *T. suecicum* and 50-100 µm long in *T. diplotrema*. If the measurements of the Madeiran material of 30-54 µm long can be confirmed, it might represent a new species closely related to *T. suecicum*; on the other hand, the illustrated ascospores (unfortunately without scale) have 15-19 septa, whereas they are given as 7-12-septate in the description, so they could actually be longer than 30-54 µm and then would fit rather well in *T. diplotrema*. Also, revision of the material reported as *Thelotrema rockii* (ETAYO & BERGER 2004) revealed that it lacks substances and has very long ascospores (100-150 µm), which fits *T. lacteum* instead and is new for Macaronesia.

***Leucodecton isidioides* (BORRER) LÜCKING & BREUSS, comb. nova**

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Basionym: *Verrucaria isidioides* BORRER in HOOKER & SOWERBY, Engl. Bot., Suppl. 1: tab. 2622, fig. 1. 1831; *Thelotrema isidioides* (BORRER) R. SANT. in HAWKSWORTH & al., Lichenologist 12: 108. 1980 (for further homotypic synonyms see PURVIS & al. 1995).

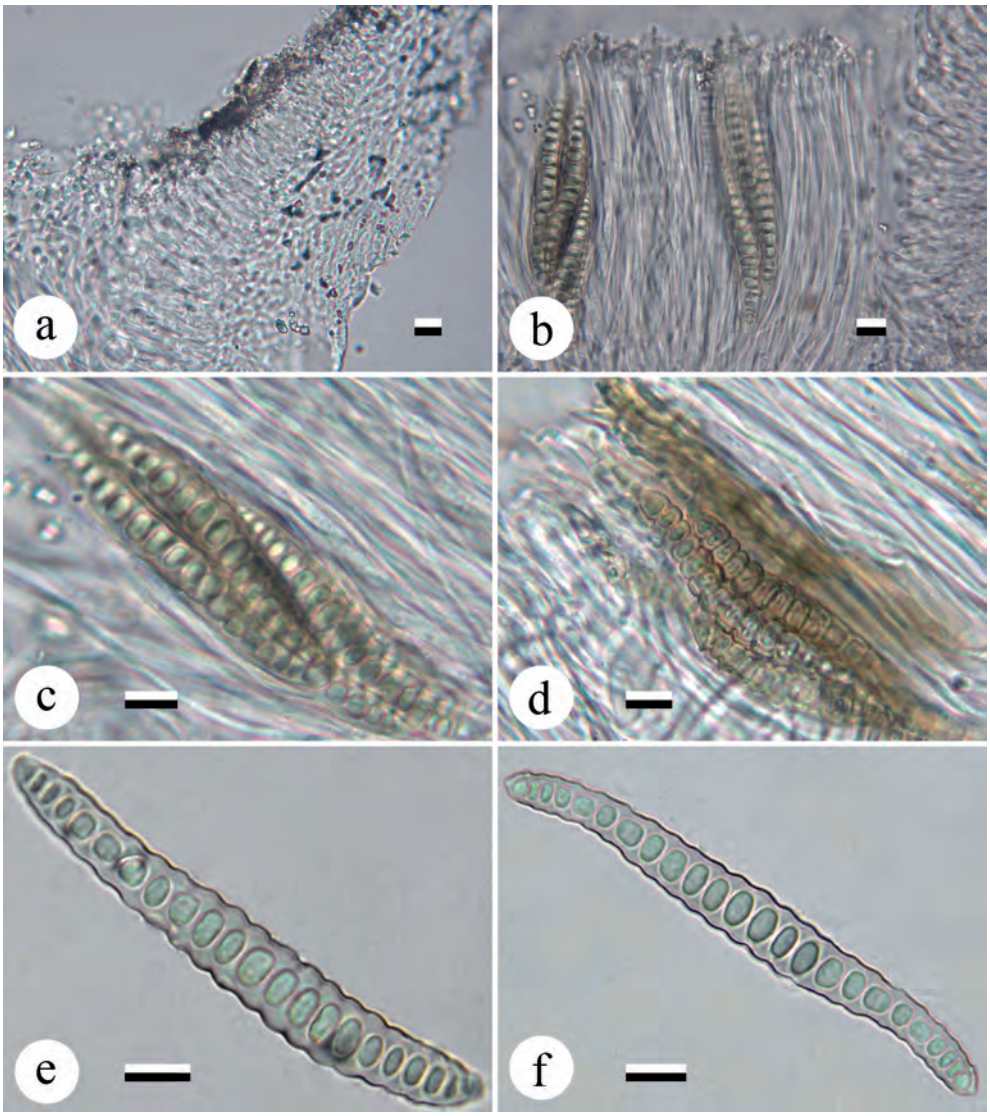

Fig. 2. *Thelotrema laurisilvae*. *a* Excipulum, *b* hymenium with ascus and ascospores, *c* ascus with mature spores, *d* postmature spores with brown tinge and constrictions at septa, *e-f* mature ascospores. – Bars: 10 µm.

Lectotype (selected by PURVIS & al. 1995)**: Ireland:** Glengariff, Miss HUTCHINS, ex hb. CAROLL (BM!).

Remarks: The systematic position of this species was unresolved from its first description, having been assigned to no less than seven genera nowadays representing two classes, three orders, and five families (*Verrucaria*, *Pertusaria*, *Porina*, *Endocarpon*, *Dermatocarpon*, *Microglaena* = *Thelenella*, and *Thelotrema*). Revision of the type material from Ireland suggests that the species is best placed in *Leucodecton*, although the latter is a genus usually found in tropical wet to dry lowland forest. The closed, porinoid ascomata with brownish, paraplectenchymatous excipulum, the brown, muriform ascospores, and the stictic acid chemistry all agree well with *Leucodecton* species (FRISCH & al. 2006, RIVAS PLATA & al. 2010). *Leucodecton isidioides* appears to be closest to *L. fissurinum* (HALE) FRISCH, which agrees in all important details except that the ostiole area is flat and not protruding as in *L. isidioides*, a character already pointed out by PURVIS & al. (1995).

Key to thelotremoid lichens of Macaronesia

1	Ascospores transversely septate	2
1’	Ascospores muriform	6
2	Ascospores with 15-25 septa	3
2’	Ascospores with 3-11 septa	5
3	Ascospores (60-)90-150 × 8-12 µm, brown to dark brown ***Thelotrema lacteum***	
3’	Ascospores 30-90 × 9-12 µm, hyaline to grey-brown	4
4	Ascospores 70-90 × 9-12 µm, with 15-23 septa, becoming grey-brown; thallus and apothecia white ***Thelotrema laurisilvae***	
4’	Ascospores 30-54 × 9-12 µm, with 15-19 septa, remaining hyaline; thallus and apothecia yellowish ***Thelotrema*** aff. ***suecicum***	
5	Ascospores 35-50 × 7-10 µm, with 8-11 septa; apothecia with double margin and striate, fissured, uncarbonized or apically carbonized excipulum; columella absent; hymenium clear ***Crutarndina petractoides***	
5’	Ascospores 18-25 × 7-9 µm, with 3-5 septa; apothecia with fused, entire, carbonized excipulum; columella usually present; hymenium inspersed ***Ocellularia pauciseptata***	
6	Ascospores large, 60-140 × 15-40 µm; no lichen substances; apothecia with double margin	7
6’	Ascospores small, 20-45 × 10-15 µm; stictic acid present; apothecia with fused excipulum	8

7 Asci 1(-2)-spored; ascospores 90-140 × 25-40 µm, dark brown; apothecia erumpent to prominent ***Thelotrema macrosporum***

7' Asci (1-)2-4(-8)-spored; ascospores 60-120 × 15-25 µm; apothecia prominent to sessile, urceolate ***Thelotrema lepadinum***

8 Ascospores light brown; apothecia porinoid, with indistinct pore; excipulum brown ***Leucodecton isidioides***

8' Ascospores hyaline; apothecia ocellularioid, with distinct pore; excipulum carbonized ***Clandestinotrema antoninii***

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