

A world-wide key to the thelotremoid *Graphidaceae*, excluding the *Ocellularia-Myriotrema-Stegobolus* clade

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Abstract: In the course of an ongoing systematic and taxonomic revision of the lichen family *Graphidaceae* (including *Thelotremataceae*), we present world-wide keys to the currently accepted thelotremoid genera and species, excluding the columellate taxa and their relatives of the *Ocellularia-Myriotrema-Stegobolus* clade (*Melanotrema*, *Myriotrema*, *Ocellularia*, *Ocellularia clandestina* group, *Redingeria*, *Stegobolus*), which will be treated in a forthcoming paper. The keys include all genera and species with chroodiscoid, lepadinoid, and topeliopsidoid apothecia and other taxa featuring periphysoids or fibrils, and their relatives. Taxa keyed out to genus and species level are *Acanthotrema*, *Chapsa*, *Chroodiscus*, *Diploschistes*, *Fibrillithecis*, *Gyrotrema*, *Leptotrema*, *Leucodecton*, *Melanotopelia*, the ‘*Ocellularia*’ *cruentata* group, *Pseudoramonia*, *Reimmitzia*, *Schizotrema*, *Thelotrema*, *Topeliopsis* and *Wirthiotrema*. Over 260 species are treated, including a few yet unnamed taxa. The following taxonomic and nomenclatural novelties are introduced: *Acanthotrema frischii* Lücking sp. nov., *Chapsa aggregata* (Hale) Sipman & Lücking comb. nov., *C. albida* (Nyl.) Lücking & Sipman comb. nov.; *C. albomaculata* (Sipman) Sipman & Lücking comb. nov., *C. boninensis* (Tat. Matsumoto) Rivas Plata & Mangold comb. nov., *C. elabens* (Müll. Arg.) Rivas Plata & Mangold comb. nov., *C. imperfecta* (Hale) Rivas Plata & Lücking comb. nov., *C. laceratula* (Müll. Arg.) Rivas Plata & Lücking comb. nov., *C. magnifica* (Berk. & Broome) Rivas Plata & Lücking comb. nov., *C. meghalayensis* (Patw. & Nagarkar) Lumbsch & Divakar comb. nov., *C. meridensis* (Kalb & Frisch) Lücking, Lumbsch & Rivas Plata comb. nov., *C. mirabilis* (Zahlbr.) Lücking comb. nov., *C. neei* (Hale) Mangold & Lücking comb. nov., *C. paralbida* (Riddle) Rivas Plata & Lücking comb. nov., *C. pseudoexanthismocarpa* (Patw. & C. R. Kulk.) Rivas Plata & Lücking comb. nov., *C. pulvereoidisca* (Hale) Rivas Plata & Mangold comb. nov., *C. scabiomarginata* (Hale) Rivas Plata & Lücking comb. nov., *C. waasii* (Hale) Sipman & Lücking comb. nov., *Fibrillithecis argentea* (Müll. Arg.) Rivas Plata & Lücking comb. nov., *F. carneodisca* (Hale) Rivas Plata & Lücking comb. nov., *F. confusa* Lücking, Kalb & Rivas Plata spec. nov., *F. diminuta* (Hale) Rivas Plata & Lücking comb. nov., *F. eximia* (R. C. Harris) Rivas Plata & Lücking comb. nov., *F. fissurata* (Nagarkar & Hale) Rivas Plata & Lücking comb. nov., *F. gibbosa* (H. Magn.) Rivas Plata & Lücking comb. nov., *Leucodecton desquamescens* (Vain.) Lücking comb. nov., *L. oxysporum* (Redinger) Lücking comb. nov., *Schizotrema cryptotrema* (Nyl.) Rivas Plata & Mangold comb. nov., *Thelotrema patwardhanii* (Hale) Rivas Plata & Mangold comb. nov., *Topeliopsis guaiquinimae* (Sipman) Rivas Plata & Mangold comb. nov., and *T. tuberculifera* (Vain.) Rivas Plata & Mangold comb. nov. Using the examples of *Fibrillithecis halei* s. lat., *Leucodecton compunctellum* s. lat., and *Thelotrema monosporum* s. lat., we show how difficult species complexes can be flexibly treated in a key, allowing for either a broad concept or the distinction of several individual taxa.

Key words: *Thelotremataceae*, new species, new combinations

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Introduction

The recently merged *Graphidaceae* and *Thelotremataceae* (Ascomycota: Lecanoromycetes: *Ostropales*) is the largest family of crustose lichens, with about 1200 species world-wide. While emending the revised generic classifications presented by Staiger (2002) and Frisch *et al.* (2006), we compiled a large dataset with characters of most of the species described in the two families, focusing on the genus *Graphis* and the thelotremoid *Graphidaceae*. Based on this dataset, we prepared a world key to species of *Graphis* (Lücking *et al.* 2009) and present here a world-key to the species of most genera of thelotremoid *Graphidaceae*, excluding the bulk of the *Ocellularia-Myriotrema-Stegobolus* clade (Mangold *et al.* 2008) for which no final generic concept is yet available and which will be treated in a forthcoming paper.

The majority of the thelotremoid *Graphidaceae* were traditionally classified into four ascospore genera (*Ocellularia*, *Phaeotrema*, *Thelotrema*, *Leptotrema*) by Müller Argoviensis (1887) and later into three excipular genera (*Ocellularia*, *Myriotrema*, *Thelotrema*) by Salisbury (1971, 1978) and Hale (1980, 1981). Frisch *et al.* (2006) used a combination of thallus, apothecial, ascospore, and chemical features to distinguish 21 genera. This system was subsequently emended by various authors (Mangold *et al.* 2009; Rivas Plata *et al.* 2010, this volume).

Molecular studies have improved our understanding of phylogenetic relationships and generic delimitation within the thelotremoid *Graphidaceae*, although the position and delimitation of several genera are unknown. The two main emerging clades are the *Ocellularia-Myriotrema-Stegobolus* clade and the *Chapsa-Leucodecton-Thelotrema* clade (Mangold *et al.* 2008; Papong *et al.* 2009). The position of other genera and clades within the *Graphidaceae* is not yet resolved. The following genera have been shown to be monophyletic and more or less well-supported in molecular phylogenetic studies: *Chroodiscus*, *Leucodecton*, *Melanotopelia*, *Schizotrema*, *Thelotrema*, *Topeliopsis* and *Wirthiotrema*. Two further genera have only

had one species analysed, but do represent separate lineages not nested within other genera, i.e. *Acanthotrema* and *Leptotrema*. Other genera, such as *Chapsa*, are not yet well-understood and generic limits in the *Ocellularia-Myriotrema-Stegobolus* clade are not clear.

To illustrate the progress in our studies of the thelotremoid *Graphidaceae*, we present a world-key to the genera and species with chroodiscoid or lepadinoid apothecia and all their relatives and similar taxa, which includes all genera of the *Chapsa-Leucodecton-Thelotrema* clade, as well as the genera *Diploschistes*, *Fibrillithecis*, *Gyrotrema*, *Melanotopelia*, the 'Ocellularia' *cruentata* group, *Reimnitzia*, *Schizotrema*, *Topeliopsis* and *Wirthiotrema*. In the course of this study, we revised nearly one thousand type specimens and assigned the epithets to the corresponding genera if not done previously. However, a small fraction of the taxa in the family have yet to be studied, including some described from India, and their taxonomic status remains uncertain at this point. Therefore, it is likely that further type studies will reveal previously unrecognized species in the genera treated here. Also, additional fine-tuning in the generic concepts is to be expected as result of our ongoing molecular studies.

Delimitation of the subject

The following keys to species include all thelotremoid genera of *Graphidaceae* with chroodiscoid (erect to recurved lobulate margins) or lepadinoid (double margin) apothecia or feature periphysoids, as well as similar and related genera. Essentially this covers all thelotremoid *Graphidaceae* except the bulk of the *Ocellularia-Myriotrema-Stegobolus* clade (Mangold *et al.* 2008), which will be treated in a forthcoming paper. Except for the *Acanthotrema-Chapsa-Chroodiscus-Leucodecton-Thelotrema* clade (Papong *et al.* 2009), the genera treated here do not form a monophyletic group. For chroodiscoid species of *Melanotrema*, the *Ocellularia clandestina* group, and *Stegobolus*,

the reader is referred to the keys presented by Frisch *et al.* (2006).

Following the key to genera, keys are presented to the species of each genus, in alphabetical order. Nomenclature of the species follows Frisch *et al.* (2006), Mangold *et al.* (2008, 2009), Lumbsch *et al.* (2009; this volume), Messuti *et al.* (2009; this volume), Papong *et al.* (2010; this volume) and Rivas Plata *et al.* (2010; this volume). New species and new combinations are indicated by an asterisk and are treated at the end of this paper. Taxonomic synonyms, if applicable, are listed under the corresponding species entries in the keys (basionyms only).

In a few instances, the generic placement of species or species delimitations are preliminary and may deviate from those provided in the recently completed monograph on Australian thelotremoid *Graphidaceae* (Mangold *et al.* 2009). Some species provide transitional forms between different genera and molecular data are needed to confirm their systematic placement. Delimitation between *Chapsa* and *Thelotrema* on one hand and *Topeliopsis* on the other is particularly difficult: all three agree in core features but *Topeliopsis* falls consistently outside the *Chapsa*-*Thelotrema* clade (Mangold *et al.* 2008; Papong *et al.* 2009). We have used the combination of free excipulum plus lepadinoid or urceolarioid apothecia to characterize *Thelotrema* (all species confirmed to belong to this genus by molecular data have this character combination), but there are at least two species included in the genus that have a fused excipulum. *Chapsa platycarpa* and *C. neei* have *Thelotrema*-like apothecia, but the first has been confirmed as belonging in *Chapsa* by molecular data (Frisch *et al.* 2006). The apothecia are not strictly lepadinoid in these two species as they feature a widely exposed disc.

Although molecular studies indicate that *Chapsa* and *Topeliopsis* are not closely related, they include some difficult species that make a clearcut separation of both genera difficult. In *Chapsa*, the apothecia are usually erumpent with erect to recurved marginal lobules and more or less widely exposed discs. In *Topeliopsis*, the apothecia are typi-

cally sessile with incurved marginal, exfoliating teeth (more numerous and more regular than the lobules in *Chapsa*) and the disc is hidden or barely visible. *Chapsa* is more frequently tropical and occurs on bark, whereas *Topeliopsis* is typically tropical-montane to temperate and occurs on bryophytes. Intermediate forms which cause difficulties include *Chapsa meridensis*, a species that clusters with *Chapsa* in molecular studies, but on account of its ecology and its (at least young) topeliopsidoid apothecia would key out under *Topeliopsis*. *Chapsa asteliae*, *C. lamellifera* and *C. minor* are all southern hemisphere temperate species that resemble *Topeliopsis*, and a similar species, *Topeliopsis novae-zelandiae*, is currently retained in *Topeliopsis* although it closely resembles *Chapsa astelia* and *C. lamellifera*. Then there is the *Chapsa scabiomarginata* group, with tropical species producing a waxy thallus and immersed-erumpent apothecia with layered margins; the species of this group are provisionally placed in *Chapsa* but their systematic affinity is unclear. All doubtful species are keyed out under both *Chapsa* and *Topeliopsis*.

In order to facilitate the identification to genus and species levels apothecial morphology as an important character complex, we have defined several different apothecial morphotypes (Figs 1–7). This list is by no means exhaustive but provides a good starting point to characterize and classify the vast diversity of apothecial types in the thelotremoid *Graphidaceae*:

Aulaxinoid (Fig. 1A): apothecia are immersed-erumpent with black, carbonized thalline margin that opens by irregular cracks; only known example: “*Thelotrema*” *dislaceratum* (systematic affinity unknown).

Chroodiscoid (Fig. 2A–C): apothecia are immersed-erumpent and open by regularly triangular marginal lobules that become recurved to form geaster-like mature apothecia; examples: *Chroodiscus*, *Chapsa astroidea*, *C. stellata*.

Fissurinoid (Fig. 1B–F): similar to chroodiscoid but apothecia open by irregular cracks in thallus (“exfoliating”

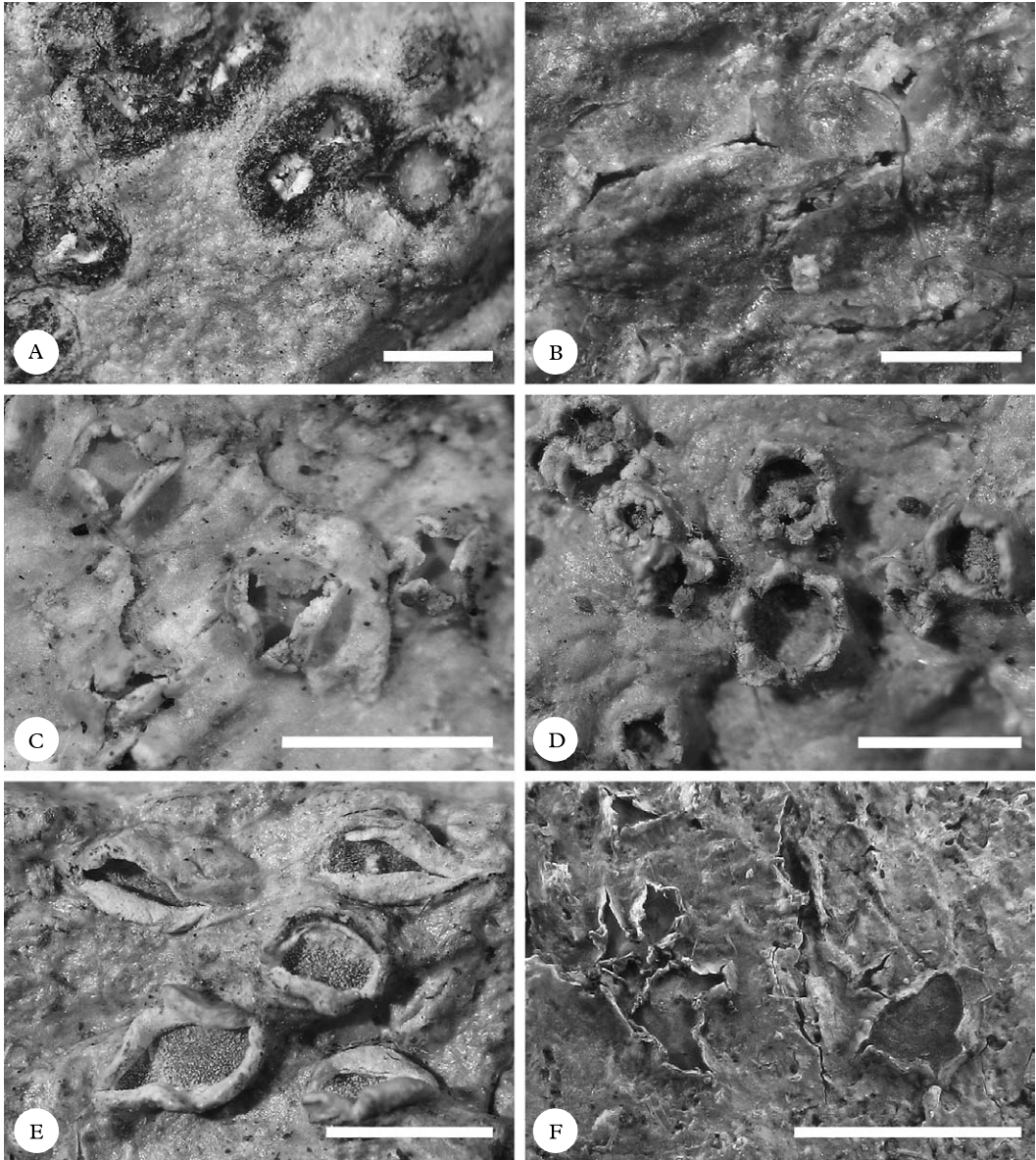


FIG. 1. Thelotremaoid *Graphidaceae*, apothecial types. A, aulaxinoid (*Thelotrema dislaceratum*); B, fissurinoid (*Chapsa perdissuta*); C–F, fissurinoid-chroodiscoid; C, *Chapsa dissuta*; D, *C. calathiformis*; E, *C. zahlbruckneri*; F, *Acanthotrema brasilianum*. Scales A – F = 1 mm.

thallus) eventually resembling chroodiscoid apothecia; they often have an irregularly elongate shape when mature; examples: *Acanthotrema brasilianum*, *Chapsa calathiformis*, *C. dissuta*, *C. perdis-*

suta, *C. lassae*, *C. sublilacina*, *C. zahlbruckneri*, *Reimnitzia santensis*.

Leprocarpoid (Fig. 2D): apothecia are immersed-erumpent and open by irregular marginal lobes that remain more or less

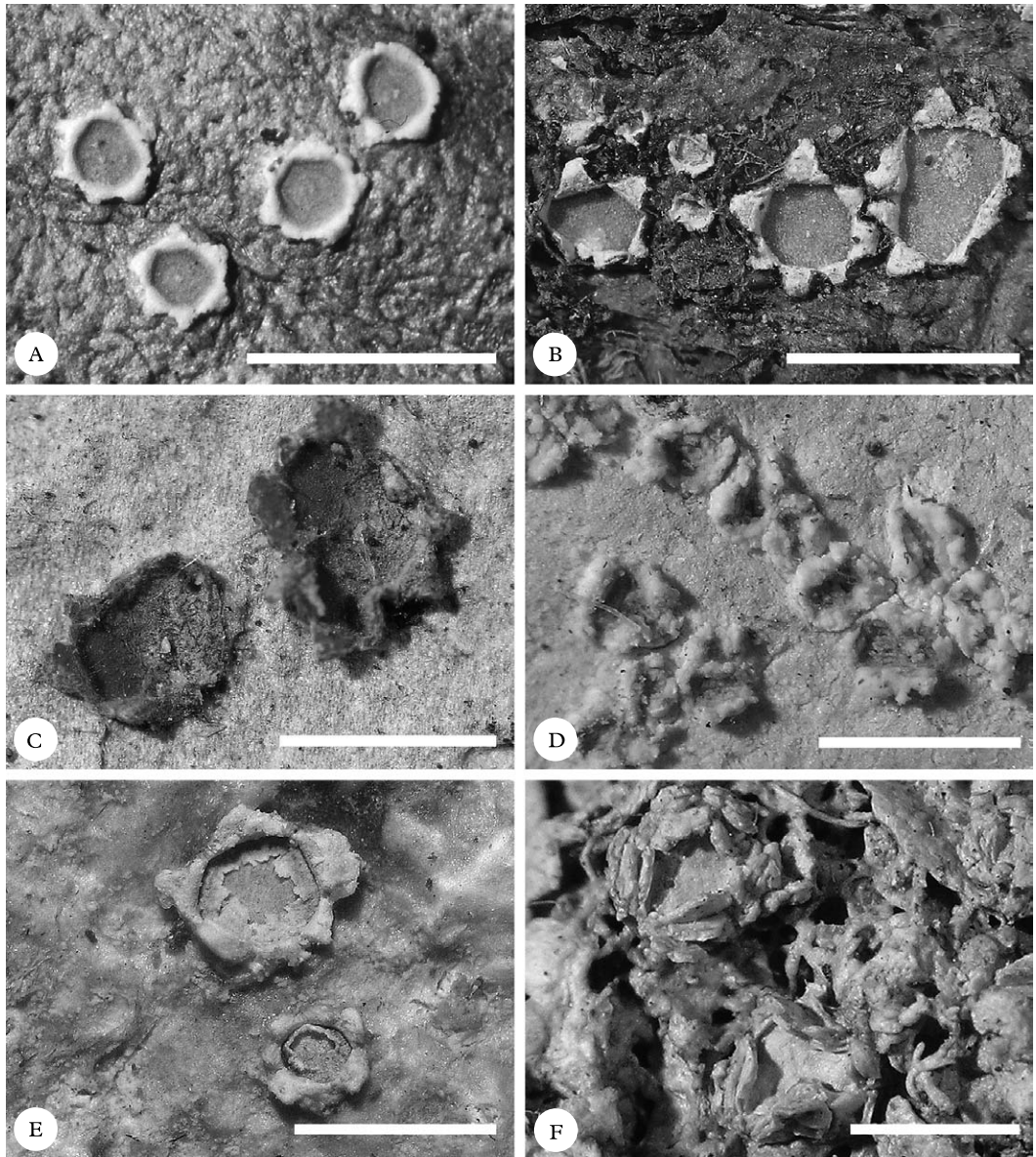


FIG. 2. Thelotremoid *Graphidaceae*, apothecial types. A & B, chroodiscoid; A, *Chroodiscus defectus*; B, *Chapsa astroidea*; C, chroodiscoid-leprocarpoid pigmented (*Chapsa waasii*); D, leprocarpoid (*C. velata*); E, platycarpoid (*C. platycarpa*); F, lamelloid (*C. lamellifera*). Scales: A – F = 1 mm.

erect but often crumble or break apart; examples: *Chapsa indica*, *C. leprocarpa*, *C. phlyctidioides*, *C. velata*.

Platycarpoid (Fig. 2E): similar to chroodiscoid or leprocarpoid but with a free excipulum and forming a distinct

double margin; example: *Chapsa platycarpa*, *C. neei*.

Lamelloid (Fig. 2F): apothecia are erumpent to prominent and form several distinct, concentric rows of lobulate excipula; example: *Chapsa lamellifera*.

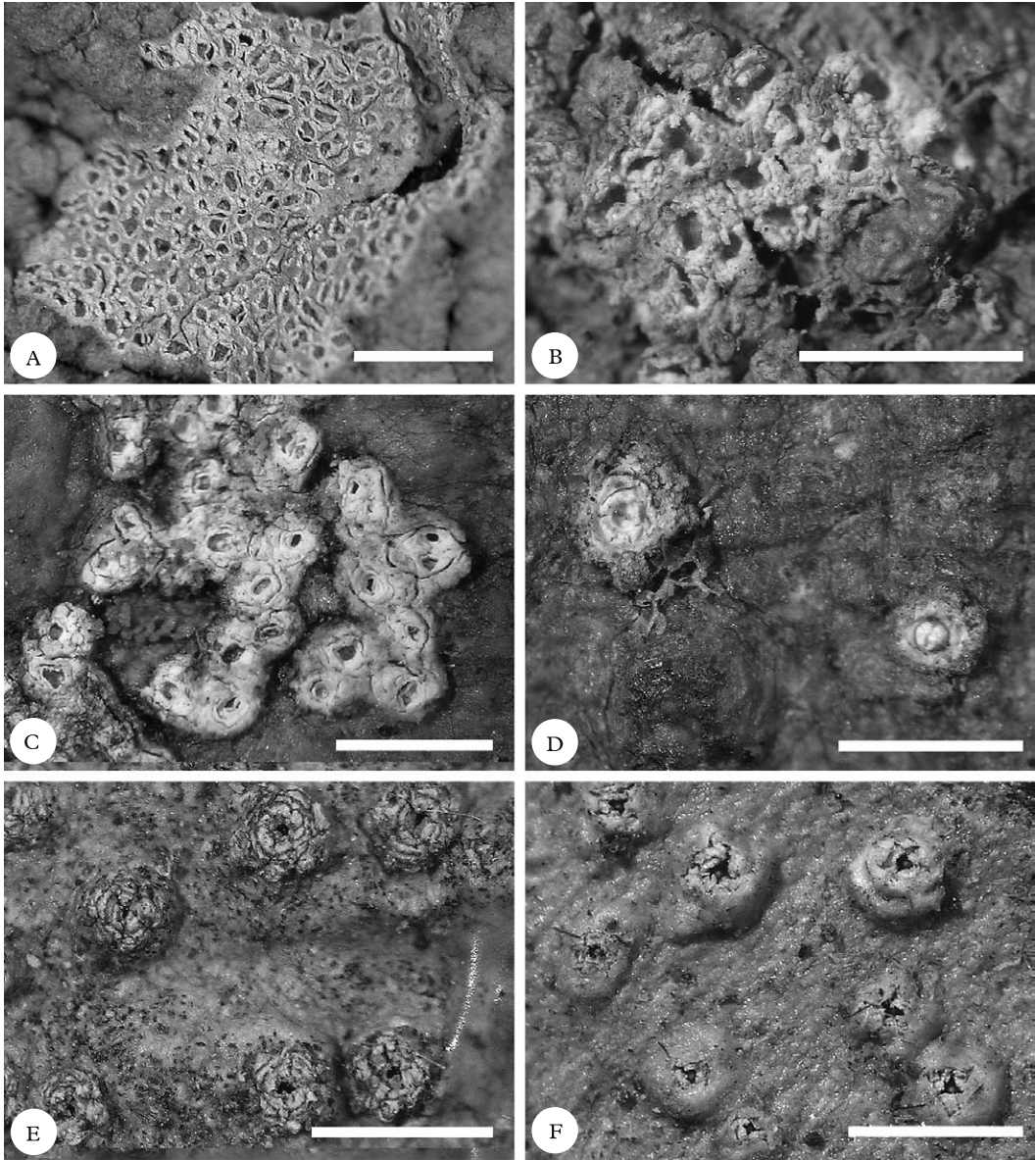


FIG. 3. Thelotremoid *Graphidaceae*, apothecial types. A, glaucescentoid (*Leucodecton glaucescens*); B & C, scabioid; B, *Chapsa aggregata*; C, *C. albomaculata*; D – F, schizotremoid; D, *Schizotrema scabiomarginatum*; E, *S. schizolumum*; F, *S. decoloratum*. Scales: A – F = 1 mm.

Glaucescentsoid (Fig. 3A & B): similar to leprocarpoid but tend to have a free ex-cipulum and irregular split between ex-cipulum and thalline margin; example: *Leucodecton glaucescens*.

Scabioid (Fig. 3B–D): similar to leprocarpoid but with regenerating hymenia that produce concentrically layered ex-cipula which eventually cover the disc; examples: *Chapsa aggregata*, *C. albomaculata*.

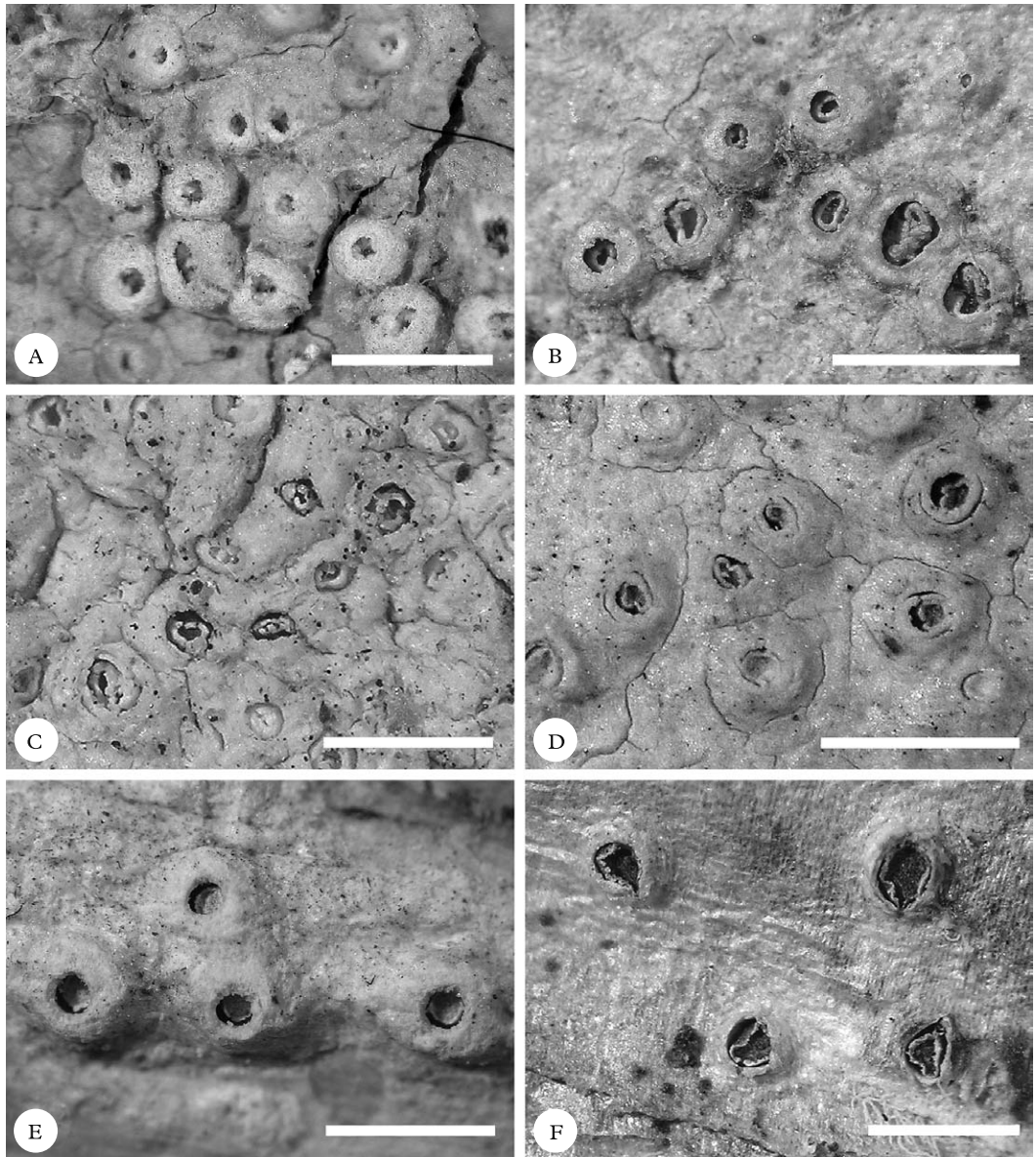


FIG. 4. Thelotremoid *Graphidaceae*, apothecial types. A–F, lepadinoid; A, *Fibrillithecis halei*; B, *Thelotrema hians*; C, *T. defossum*; D, *Leucodecton occultum*; E, *Thelotrema rockii*; F, *Chapsa neei*. Scales: A – F = 1 mm.

Schizotremoid (Fig. 3E & F): similar to scabioid but the apothecia have a narrow pore from the beginning and the excipula are more or less carbonized; the new hymenia are formed from below the previous hymenium; examples: *Schizotrema*.

Lepadinoïd (Fig. 4A–F): apothecia are immersed-erumpent to more typically prominent and feature a free excipulum and a distinct double margin, with the thalline margin bulging and entire and the excipulum prominent and

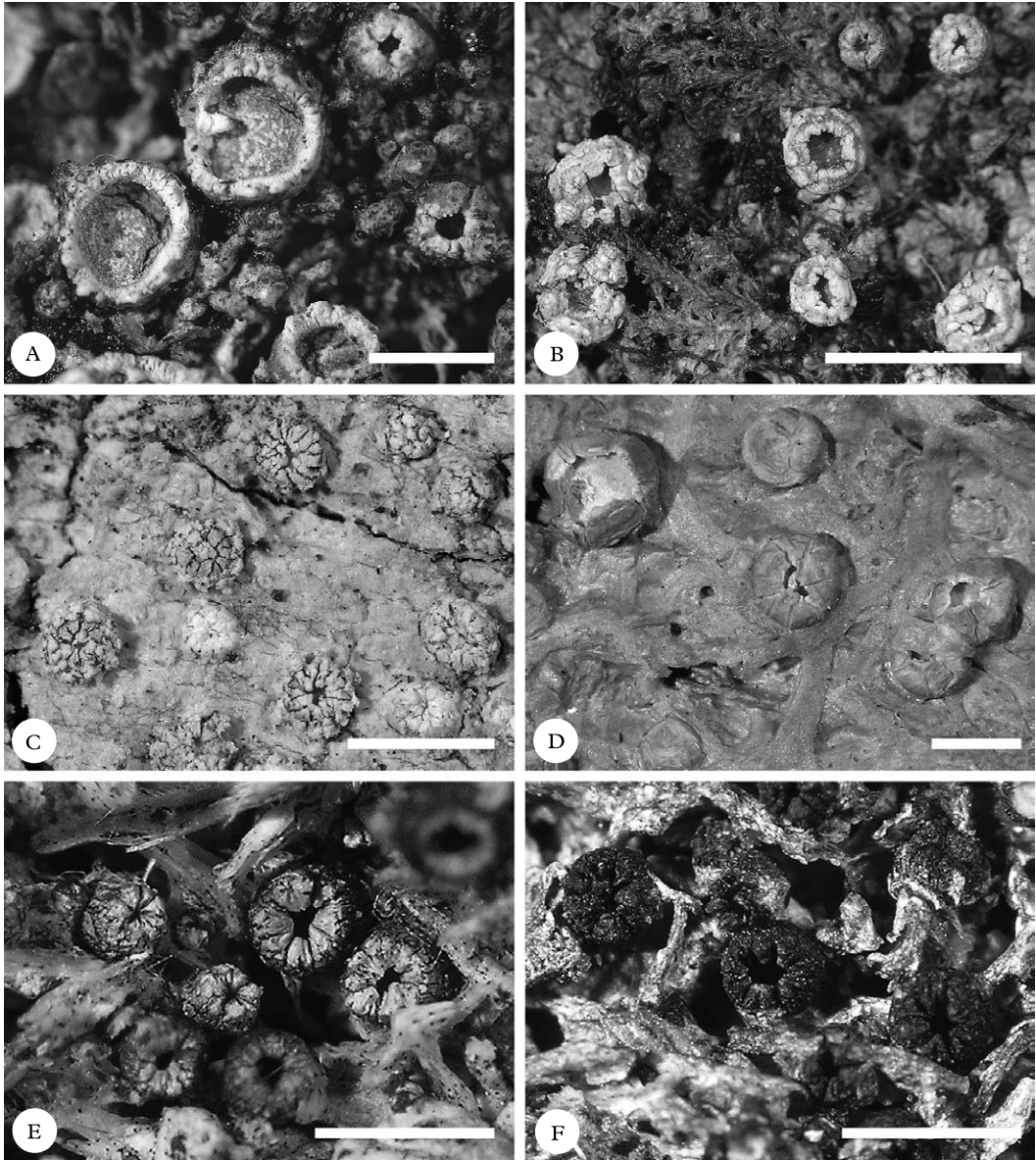


FIG. 5. Thelotrema-like *Graphidaceae*, apothecial types. A–D, topeliopsidoid; A, *Chapsa meridensis*; B, *Topeliopsis macrocarpa*; C, *T. lomatae*; D, *T. novae-zelandiae*; E & F, melanotopelioid; E, *Melanotopelia blepharostoma*; F, *M. rugosa*). Scales: A–F = 1 mm.

undulate-lobulate; examples: *Fibrillithecia halei*, *Leucodecton occultum*, *Myriotrema costaricense*, *Thelotrema*.

Topeliopsidoid (Fig. 5A–D): apothecia are prominent to sessile (but often hidden between substratum) and open with nu-

merous, more or less regular teeth that remain more or less incurved over the barely visible disc; the margins often exfoliate, i.e. the covering thallus cortex breaks away from the underlying marginal thallus tissue but no distinct, clean split between thallus

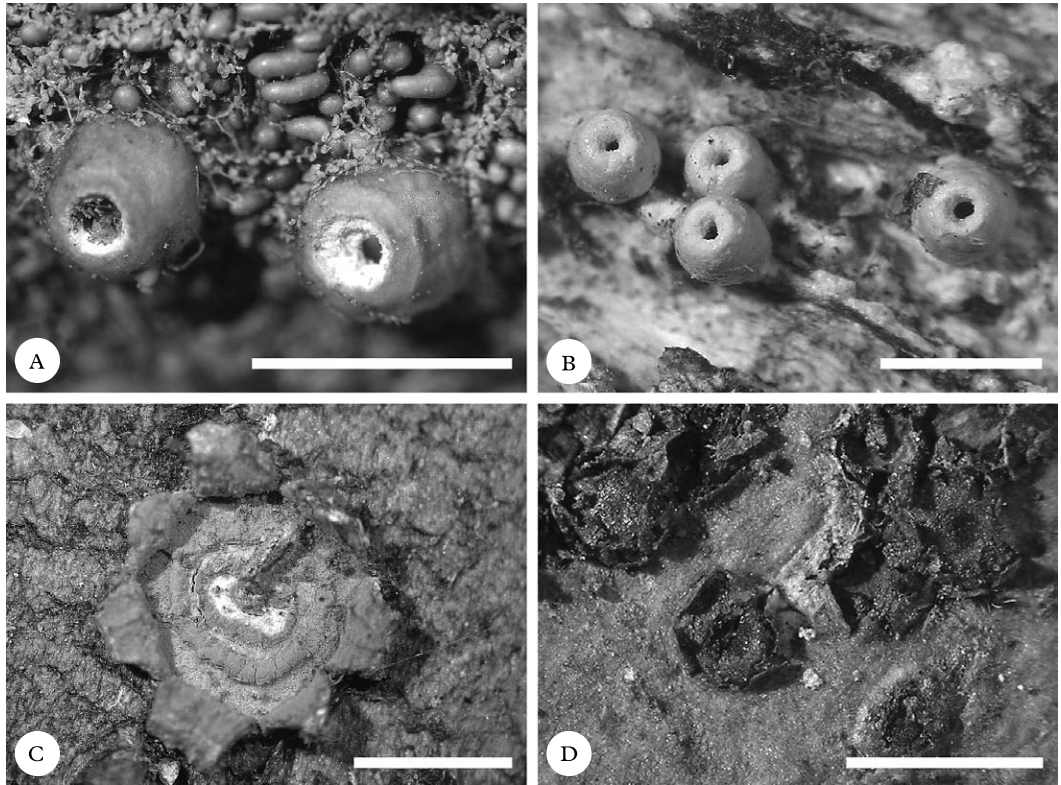


FIG. 6. Thelotremoid *Graphidaceae*, apothecial types. A & B, urceolarioid; A, *Thelotrema isidiophorum*; B, *T. weberi*; C, gyrotremoid (*Gyrotrema wirthii*); D, cruentodiscoid (*Ocellularia cruentana*). Scales: A–D = 1 mm.

margin and excipulum is formed; examples: *Chapsa meridensis*, *Topeliopsis*.

Melanotopelioid (Fig. 5E & F): similar to topeliopsidoid but the thallus margin is reduced and the teeth are (at least externally) black and carbonized.

Pseudoramonioid (not shown): similar to topeliopsidoid or melanotopelioid but with distinct stipe.

Urceolarioid (Fig. 6A & B): apothecia are prominent to sessile and have a narrow pore with entire margin through which the disc and excipulum are not visible; examples: *Thelotrema isidiophorum*, *T. subweberi*, *T. weberi*.

Gyrotremoid (Fig. 6C): similar to chroodiscoid but with regeneration of new hymenia in centrifugal direction, leaving concentric, shallow rings of old excipula; the excipula are partially carbonized (not

to be confused with complex columellae!) and the disc is pigmented; example: *Gyrotrema*.

Cruentodiscoid (Fig. 6D): apothecia are erumpent but are covered by thalline tissue for a long time before eventually rupturing the upper cortex and exposing the inner, often pigmented medulla; apothecia appear chroodiscoid but the disc is actually hidden under the inner thalline layers and then the carbonized excipulum and is not visible; example: “*Ocellularia*” *cruentata* (systematic affinity unknown).

Ocellularioid (Fig. 7A): apothecia are erumpent to prominent with a thick thalline margin and narrow, entire pore; example: *Fibrillithecis argentea*, *Thelotrema monosporum*.

Glaucophaenoid (Fig. 7B–D): similar to ocellularioid but the thalline margin is

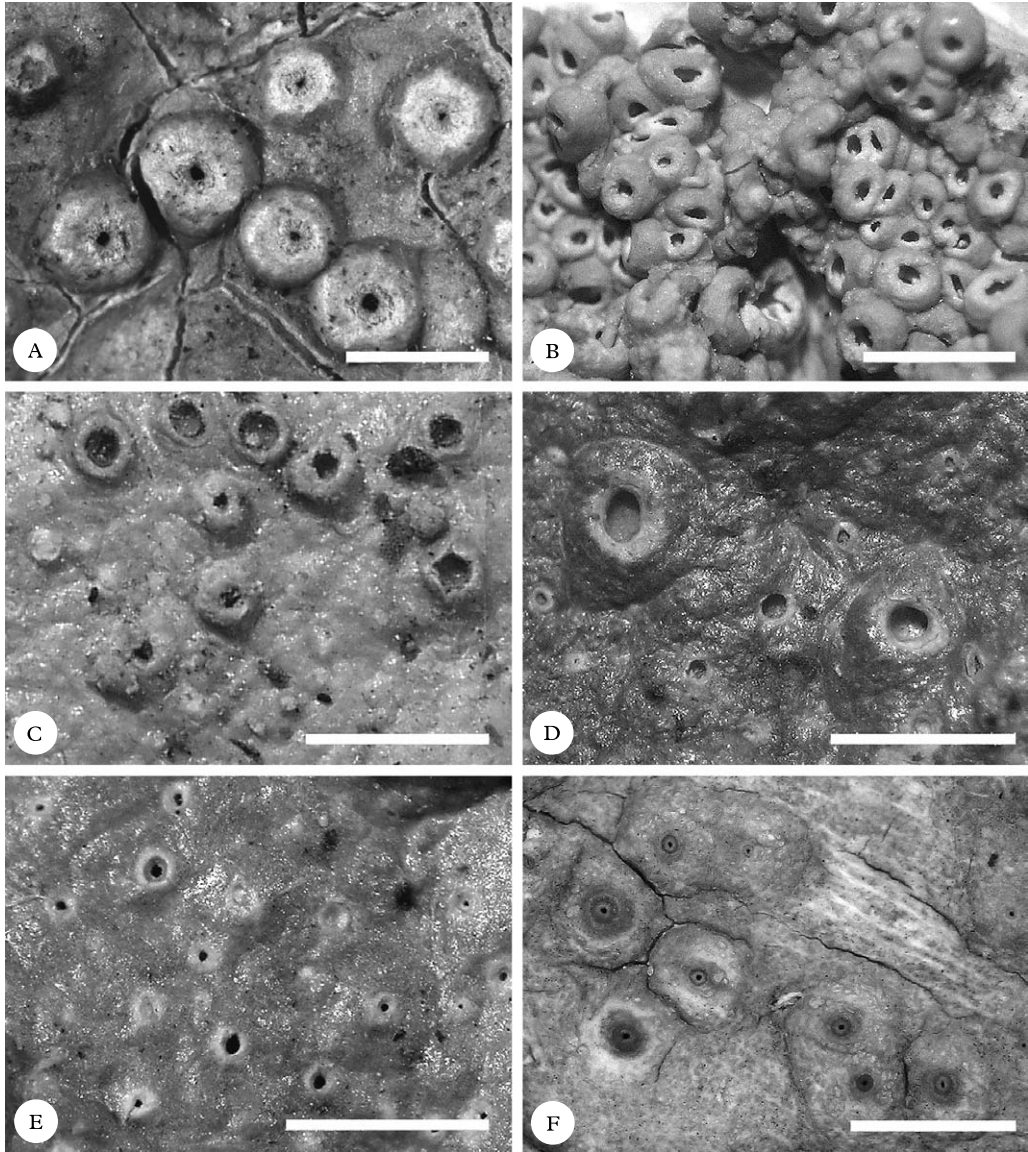


FIG. 7. Thelotremaoid *Graphidaceae*, apothecial types. A, ocellularioid (*Fibrillithecis vernicosa*). B–D, glaucophaenoid; B, *Fibrillithecis insignis*; C, *Wirthiotrema santessonii*; D, *W. glaucopallens* p.p.; E, myriotremoid (*W. glaucopallens* p.p.); F, porinoid (*Leucodecton compunctellum*). Scales: A–F = 1 mm.

thinner and ascending and the disc is more exposed, giving the apothecia a crater-like appearance; examples: *Fibrillithecis insignis*, *Myriotrema glaucophaenum*, *Wirthiotrema santessonii*.

Myriotremoid (Fig. 7E): apothecia are immersed and open with a narrow, entire

pore; examples: *Leptotrema*, *Leucodecton* (several species), *Myriotrema* (most species), *Wirthiotrema glaucopallens*.

Porinoid (Fig. 7F): similar to ocellularioid but with very narrow pore resembling an ostiolum of a genuine perithecium; contrary to genuine perithecia, the

hymenium remains organized in a distinct, compact layer with paraphyses and asci of similar height; examples: *Leucodecton bisporum*, *L. compunctellum*, *T. patwardhanii*.

Key to the Genera

While it is recommended to perform TLC to determine the secondary chemistry of species of *Graphidaceae*, in most cases spot tests will give a preliminary assessment and, if giving an unequivocal reaction, will be conclusive. Spot tests help to identify the most common substances, including norstictic, salazinic and stictic acids, as well as psoromic and protocetraric acids and related derivatives. Other substances will not give a positive spot reaction and need TLC. We recommend performing spot tests as follows: P and C should be tested on the thallus surface, preferably on a pale portion or with the medulla exposed or with a small piece of thallus on tissue paper. K should be used on microscopic sections under the microscope to test for a pale to deep yellow outflux; if it remains yellow it indicates stictic acid; if it forms large red, needle-shaped crystals it indicates norstictic acid. Small red crystals are characteristic of salazinic acid. In the keys we usually mention one substance for a particular taxon but this implies that accessory substances, such as connorstictic or constictic acid, are often also present.

- 1 Photobiont trebouxoid; growing on soil or rock (siliceous or calcareous rock in \pm exposed or dry situations); thallus frequently containing depsides (lecanoric, gyrophoric and diploschistesic acids) and C+ red; excipulum carbonized; ascospores dark **Diploschistes Norman** [p. 158]
- Photobiont trentepohlioid; growing on bark, wood, bryophytes or leaves, very rarely on rock (siliceous rock in \pm shaded, humid situations); thallus frequently containing depsidones (stictic, norstictic, salazinic, protocetraric, and psoromic acid chemosyndromes), C- (except for one species, *Topeliopsis lomatae*), but often K+ yellow or yellow turning red or P+ yellow or red; excipulum and ascospores variable 2
- 2(1) Apothecia stipitate **Pseudoramonia Kantvilas & Vězda** [p. 170]
- Apothecia immersed to sessile 3
- 3(2) Excipulum with periphysoids (lateral of hymenium) or apical fibrils (above level of hymenium) 4
- Excipulum lacking periphysoids and apical fibrils 11
- 4(3) Paraphyses and periphysoids apically spinulose; ascospores with thin septa, non-amyloid; apothecia fissurinoid-chroodiscoid
- **Acanthotrema A. Frisch** [p. 152]
- Paraphyses and periphysoids glabrous; ascospores variable but usually not with completely thin septa; apothecia variable 5
- 5(4) Excipulum laterally dark brown to carbonized 6
- Excipulum hyaline to (pale) brown, rarely slightly carbonized apically (then with free excipulum and double margin) 7
- 6(5) Apothecia prominent to sessile (if appearing half-immersed then base hidden among loose substratum), non-regenerating, melanotopelioid with denticulate black margins lacking a distinct thalline layer; over bryophytes or more rarely on bark . . .
- **Melanotopelia Lumbsch & Mangold** [p. 168]
- Apothecia erumpent to prominent, schizotremoid, regenerating with concentrically layered excipula and laterally covered by thalline layer; on bark
- **Schizotrema Mangold & Lumbsch** [p. 170]

- 7(5) Excipulum above level of hymenium with apical fibrils consisting of radiating, partially free hyphae converging against the pore; periphysoids absent; apothecia ocellularioid (but lacking a columella) to glaucophaenoid, rarely lepadinoid; usually with psoromic acid (thallus P+ yellow) **Fibrillithecis A. Frisch** [p. 160]
- Excipulum lacking apical fibrils but with horizontally to obliquely arranged periphysoids separating the lateral hymenium and excipulum (and continuing above the hymenial layer); apothecia fissurinoid, chroodiscoid, leprocarpoid, platycarpoid, lamelloid, lepadinoid, scabioid, topeliopsidoid, or urceolarioid; chemistry variable but psoromic acid rare 8
- 8(7) Apothecia lepadinoid or rarely urceolarioid or ocellularioid (to rarely porinoid), with more or less free excipulum and distinct split between excipulum and thalline margin (double margin; in specimens with narrow pore, dissection of the apothecium is necessary to detect the double margin); thalline margin usually entire (sometimes ± eroded) but free excipulum often undulate to fissured; ascospores often with thick outer wall **Thelotrema Ach.** [p. 171]
- Apothecia fissurinoid, chroodiscoid, leprocarpoid, platycarpoid, lamelloid, scabioid, or topeliopsidoid, with more or less fused excipulum and lacking distinct split between excipulum and thalline margin (except *Chapsa platycarpa* group) but sometimes thallus cortex or outer thallus layers exfoliating; combined thalline-excipular margin lobulate to recurved or denticulate; ascospores usually with thin outer wall 9
- 9(8) Apothecia topeliopsidoid (to rarely leprocarpoid), with the disc more or less concealed by the incurved, denticulate margins; the thallus margin usually exfoliating; paraphyses apically not distinctly thickened; tropical montane to temperate, often on bryophytes or dead plant material **Topeliopsis Kantvilas & Vězda** [p. 179]
- Apothecia fissurinoid, chroodiscoid, leprocarpoid, platycarpoid, lamelloid, or scabioid, with the disc more or less exposed (except in species with regenerating hymenia and excipula); paraphyses often apically thickened and moniliform; tropical lowland to lower montane, on bark, very rarely tropical montane to temperate and then also on bryophytes or dead plant material 10
- 10(9) Thallus with large clusters of columnar crystals which give the surface a warty appearance; young ascospores conspicuously thick-walled, mature ascospores dark brown and minutely ornamented . . . **Reimnitzia santensis (Tuck.) Kalb**
- Thallus with crystals irregularly dispersed or lacking crystals; young ascospores thin-walled or with gelatinous halo, mature ascospores usually hyaline, when brown lacking ornamentation **Chapsa A. Massal.** [p. 152]
- 11(3) Growing on living leaves in the understorey of lowland to lower montane rainforests; apothecia chroodiscoid; ascospores with thin septa, hyaline and non-amyloid **Chroodiscus (Müll. Arg.) Müll. Arg.** [p. 157]
- Growing on bark or other substrata; apothecia variable, not distinctly chroodiscoid but sometimes fissurinoid-chroodiscoid; ascospores distoseptate, hyaline to brown and I- to I+ violet-blue 12
- 12(11) Apothecia gyrotremoid, regenerating with new hymenia and excipula formed centrifugally in concentric circles, leaving the disc fully exposed (newest hymenia at the periphery of the disc); disc bright orange to cinnabar-red or pink (K+ purple); ascospores distinctly amyloid **Gyrotrema A. Frisch** [p. 163]
- Apothecia variable but not gyrotremoid and not regenerating; ascospores variable 13

- 13(12) Apothecia with broad-stump-shaped to complex columella
 **Melanotrema, Ocellularia** s. lat., **Redingeria, Stegobolus**
 [not treated, see keys in Frisch *et al.* 2006]
 Apothecia lacking columella 14
- 14(13) Apothecia erumpent, with strongly carbonized black, inclined, marginal lobules and
 pale disc (aulaxinoid) ‘**Thelotrema**’ **dislaceratum** Nyl.
 Apothecia variable, if excipulum carbonized then only with age and hidden below a
 thalline layer 15
- 15(14) Apothecia cruentodiscoid, with the covering lobules rupturing radially and horizon-
 tally to form a split between the outer thallus layer and the usually pigmented
 medulla; excipulum becoming carbonized with age
 ‘**Ocellularia**’ **cruentata group** [p. 169]
 Apothecia glaucescentoid, lepadinoid, glaucophaenoid, myriotremoid, or porinoid;
 excipulum hyaline to rarely brown 16
- 16(15) Excipulum composed of parallel, apically radiating hyphae (appearing prosoplecten-
 enchymatous in thin sections), apically often with hyphae terminating in a short
 hyphal felt; thallus often with prosoplectenchymatous cortex with internal split-
 ting; chemistry variable but psoromic acid common
 **Myriotrema Fée** [not treated]
 Excipulum composed of irregularly interwoven hyphae (appearing \pm
 paraplectenchymatous in thin sections), apically glabrous; thallus cortex variable
 but often reduced or absent; chemistry variable but psoromic acid absent and
 stictic acid common 17
- 17(16) Ascospores hyaline, non-amyloid; thallus with prosoplectenchymatous cortex with
 internal splitting
 **Wirthiotrema Rivas Plata, Kalb, Frisch & Lumbsch**
 (Rivas Plata *et al.* 2010, this volume, p. 201)
 Ascospores brown and often ornamented, rarely hyaline, non-amyloid or weakly
 amyloid (when young); thallus with \pm irregular, weakly developed cortex or cortex
 absent 18
- 18(17) Young ascospores conspicuously thick-walled; thallus loosely attached to substratum,
 often with gall-like appearance, with large clusters of columnar crystals which
 give the surface a warty appearance; clusters of red crystals usually present in
 medulla; apothecia myriotremoid . . . **Leptotrema Mont. & Bosch** [p. 163]
 Young ascospores thin-walled; thallus firmly attached to substratum, not appearing
 gall-like, with irregularly dispersed clusters of crystals, rarely crystals columnar and
 then apothecia porinoid with very narrow pore; red crystals in medulla absent;
 apothecia glaucescentoid, lepadinoid, or porinoid, rarely myriotremoid
 **Leucodecton A. Massal.** [p. 163]

Keys to the Species

Species names annotated with an asterisk* in the keys to species indicate new taxa or new combinations introduced at the end of this paper.

Acanthotrema A. Frisch

- 1 Ascospores submuriform, broadly oval with blunt ends; tropical Africa **Acanthotrema frischii Lücking***
- Ascospores predominantly transversely septate but with occasional longitudinal septa, fusiform with acute ends; tropical America **Acanthotrema brasilianum (Hale) A. Frisch**

Chapsa A. Massal.

- 1 Ascospores transversely septate 2
- Ascospores (sub)muriform 3
- 2(1) Ascospores hyaline **Group 1**
- Ascospores brown **Group 2**
- 3(1) Ascospores hyaline **Group 3**
- Ascospores brown **Group 4**

Group 1 (ascospores transversely septate, hyaline)

- 1 Apothecial disc with orange or pink-purple pigment 2
- Apothecial disc without pigments 4
- 2(1) Apothecial disc with orange pigment; ascospores 70–100 µm long, 15–27-septate **Chapsa magnifica (Berk. & Broome) Rivas Plata & Mangold***
- Apothecial disc with pink-purple or red-brown pigment; ascospores 15–25 µm long, 3–7-septate 3
- 3(2) Apothecial disc with pink-purple pigment; no other substances; ascospores 15–18 µm long **Chapsa waasii (Hale) Sipman & Lücking***
- Apothecial disc with red-brown pigment; also with stictic acid (K+ yellow); ascospores 17–25 µm long **Chapsa rubropruinosa Messuti & Codesal**
- 4(1) Hymenium inspersed 5
- Hymenium not inspersed 6
- 5(4) Ascospores 35–50 × 7–10 µm, 13–19-septate **Chapsa elabens (Müll. Arg.) Rivas Plata & Mangold***
- Ascospores 20–25 × 6–8 µm, 5–7-septate **Chapsa pseudoschizostoma (Hale) Sipman**
- 6(4) Ascospores (40–)50–200 µm long, 13–37-septate 7
- Ascospores 9–45 µm long, 1–13-septate 12
- 7(6) Thallus ecorticate, white-grey to pale green-grey; apothecial disc pruinose; ascospores non-amyloid 8
- Thallus with prosoplectenchymatous cortex, olive-green; apothecial disc non-pruinose; ascospores amyloid 9
- 8(7) Ascospores (40–)70–120 µm long, 25–37-septate **Chapsa indica A. Massal.**
- Synonyms: *Thelotrema albescens* Vain.; *Thelotrema pycnophragmium* Nyl.
- Ascospores 40–70 µm long, 13–19-septate **Chapsa pulchra (Müll. Arg.) Mangold**

- 9(7) Apothecia scabroid, with layered excipulum covering most of the disc, up to 0.8 mm diam. 10
 Apothecia chroodiscoid, with simple or indistinctly layered excipulum and disc widely exposed, up to 5 mm diam. 11
- 10(9) Ascospores $35\text{--}70 \times 6\text{--}12 \mu\text{m}$
 ***Chapsa imperfecta* (Hale) Rivas Plata & Lücking***
 Ascospores $100\text{--}200 \times 10\text{--}20 \mu\text{m}$
 ***Chapsa pseudoexanthismocarpa* (Patw. & C. R. Kulk.)
 Rivas Plata & Lücking***
- 11(9) Thallus with discrete soralia; lichen substances absent
 ***Chapsa soreliata* Lücking**
 Thallus lacking soralia; stictic acid present (K+ yellow)
 ***Chapsa sublilacina* (Ellis & Everhart) Sipman & Lücking**
- 12(6) Stictic acid present (K+ yellow) 13
 Lichen substances absent (K-) 18
- 13(12) Thallus ecorticate, white-grey to pale grey-green 14
 Thallus with irregular to prosoplectenchymatous cortex, grey-green to olive-green 15
- 14(13) Apothecia up to 2 mm diam., often irregularly elongate to almost lirellate; disc with thick white pruina; excipulum pale brown
 ***Chapsa dilatata* (Müll. Arg.) Kalb**
 Apothecia up to 0.8 mm diam., angular-rounded; disc with thin white pruina; excipulum colourless ***Chapsa phlyctidioides* (Müll. Arg.) Mangold**
 Synonym: *Ocellularia conglomerata* Hale.
- 15(13) Apothecia 0.7–2 mm diam. 16
 Apothecia 0.2–0.6 mm diam. 17
- 16(15) Thallus with prosoplectenchymatous cortex, olive-green; apothecia up to 2 mm diam., with recurved marginal lobules; ascospores $10\text{--}18 \times 3\text{--}5 \mu\text{m}$, non-amyloid ***Chapsa megaphlyctioides* Mangold**
 Thallus with irregular, indistinct cortex, pale grey-green; apothecia up to 1.2 mm diam., with erect marginal lobules; ascospores $15\text{--}23 \times 5\text{--}7 \mu\text{m}$, amyloid
 ***Chapsa esslingerii* (Hale) Sipman**
- 17(15) Apothecia aggregate; excipulum simple; ascospores $10\text{--}20 \mu\text{m}$ long, amyloid
 ***Chapsa albomaculata* (Sipman) Sipman & Lücking***
 Apothecia solitary; excipulum layered; ascospores $20\text{--}28 \mu\text{m}$ long, non-amyloid
 ***Chapsa minor* (Kantvilas & Vězda) Mangold & Lumbsch**
- 18(12) Ascospores 1-septate, less than $8 \mu\text{m}$ long
 ***Chapsa bicellularis* Sipman & Lücking**
 Ascospores 3–13-septate, more than $8 \mu\text{m}$ long 19
- 19(18) Excipulum brown; periphysoids indistinct; apothecia 0.2–0.3 mm diam.
 ***Chapsa chionostoma* (Nyl.) Rivas Plata & Mangold***
 Synonym: *Ocellularia phlyctellacea* Müll. Arg.
 Excipulum colourless; periphysoids usually distinct; apothecia 0.3–1(–5) mm diam.
 20

- 20(19) Apothecia 2–5 mm diam.; ascospores up to $45 \times 10 \mu\text{m}$, amyloid; thallus with prosoplectenchymatous cortex **Chapsa tibellii Mangold**
 Apothecia 0.3–1 – 5(–2.5) mm diam.; ascospores up to $30(–35) \times 8 \mu\text{m}$, usually non-amyloid, rarely amyloid; thallus ecorticate or cortex variable 21
- 21(20) Thallus with prosoplectenchymatous cortex 22
 Thallus ecorticate or rarely with irregular, loose cortex 24
- 22(21) Apothecial margin inclined to erect (fissurinoid); thallus pale olive; excipulum free; ascospores distoseptate, weakly amyloid . . . **Chapsa dissuta (Hale) Mangold**
 Apothecial margin recurved; thallus rather dark olive; excipulum fused; ascospores with thin septa, non-amyloid 23
- 23(22) Thallus olive-green, epiperidermal, lacking crystals . . . **Chapsa lassae Mangold**
 Thallus olive-brown, endoperidermal, with sparse to abundant crystals
 **Chapsa astroidea (Berk. & Broome) Cáceres & Lücking**
 Synonyms: *Ocellularia alba* var. *caesiascens* Räsänen; *Thelotrema platycarpellum* Vain.
- 24(21) Ascospores $10–15 \mu\text{m}$ long, 3–5-septate **Chapsa halei Mangold**
 Ascospores $15–30(–35) \mu\text{m}$ long, 5–13-septate 25
- 25(24) Ascospores distoseptate, amyloid 26
 Ascospores with \pm thin septa, non-amyloid 27
- 26(25) Thallus endoperidermal, ecorticate **Chapsa subpatens (Hale) Mangold**
 Thallus epiperidermal, with irregular cortex
 **Chapsa crispata (Müll. Arg.) Rivas Plata & Mangold***
- 27(25) Thallus thickly farinose **Chapsa farinosa Lücking & Sipman**
 Thallus \pm smooth to uneven or verrucose 28
- 28(27) Thallus verrucose, with irregular cortex
 **Chapsa albida (Nyl.) Lücking & Sipman***
 Thallus smooth to uneven, ecorticate 29
- 29(28) Apothecia frequently elongate-lirellate; ascospores halonate
 **Chapsa cinchonarum (Fée) A. Frisch**
 Synonym: *Ocellularia feeana* Müll. Arg.
 Ascomata angular-rounded; ascospores not halonate 30
- 30(29) Excipulum layered; ascospores $20–35 \mu\text{m}$ long
 **Chapsa diploschistoides (Zahlbr.) A. Frisch**
 Excipulum simple; ascospores $17–25 \mu\text{m}$ long 31
- 31(30) Thallus grey-green; ascospores $17–22 \mu\text{m}$ long, 5–9-septate
 **Chapsa alborosella (Nyl.) A. Frisch**
 Thallus white-grey; ascospores $20–25 \mu\text{m}$ long, 9–13-septate
 **Chapsa boninensis (Tat. Matsumoto) Rivas Plata & Mangold***
- Group 2 (ascospores transversely septate, brown)*
- 1 Thallus isidiate; chinchonarum unknown present
 **Chapsa isidiifera A. Frisch & Kalb**
 Thallus lacking isidia but sometimes with soredia-like granules; stictic acid present (K+ yellow) or lichen substances absent 2
- 2(1) Thallus with yellow, soredia-like granules; stictic acid present (K+ yellow)
 **Chapsa granulifera A. Frisch & Kalb**
 Thallus lacking vegetative propagules; chemistry variable 3

- 3(2) Stictic acid present (K+ yellow); apothecia with free excipulum and distinct double margin (\pm lepadinoid) but \pm fully exposed disc 4
Lichen substances absent; apothecia with fused excipulum, if double margin then disc \pm hidden 5
- 4(3) Apothecial disc dark-red to purple-brown; thallus white-grey, endoperidermal, ecorticate **Chapsa neei (Hale) Mangold & Lücking***
Apothecial disc grey-brown; thallus olive-green, epidermal, with prosoplectenchymatous cortex **Chapsa platycarpa (Tuck.) A. Frisch**
Synonyms: *Asteristion erumpens* Leight.; *Phaeotrema apertum* C. W. Dodge; *Platycarpa bivela* Berk. & Broome; *Platygrapha alborufa* Berk. & Broome; *Thelotrema platycarpoides* Tuck.
- 5(3) Apothecia 0.5–0.7 mm diam., aggregate; excipulum free; disc \pm hidden; margin not felty **Chapsa aggregata (Hale) Sipman & Lücking***
Apothecia 1–2 mm diam., solitary to rarely aggregate; excipulum fused; disc exposed; margin distinctly felty **Chapsa leprairiei (Mont.) A. Frisch**
Synonyms: *Graphis phlyctidea* Vain.; *Graphis subnivescens* Nyl.; *Leptotrema bahianum* var. *asiaticum* Zahlbr.; *Ocellularia confluentula* Zahlbr. [nom. nov. pro *Thelotrema confluens* Vain., non Kremp.]; *Thelotrema leucastrum* Tuck.; *Thelotrema leucastrum* var. *difforme* Tuck.

Group 3 (ascospores muriform, hyaline)

- 1 Hymenium inspersed 2
Hymenium clear 3
- 2(1) Over and between bryophytes on soil; apothecia sessile; thallus with prosoplectenchymatous cortex
. **Chapsa meridensis (Kalb & Frisch) Lücking, Lumbsch & Rivas Plata***
On bark; apothecia erumpent; thallus ecorticate . **Chapsa niveocarpa Mangold**
- 3(1) Ascospores 12–60 μ m long, (2–)4–8 per ascus 4
Ascospores 60–180 μ m long, 1–2(–4) per ascus 16
- 4(3) Ascospores 12–20 μ m long; thallus ecorticate; lichen substances absent 5
Ascospores 20–60 μ m long; thallus and chemistry variable 6
- 5(4) Ascospores 15–20 μ m long, with thickened septa and lens-shaped to rounded lumina **Chapsa kalbii A. Frisch**
Ascospores 12–15 μ m long, with thin septa and rectangular lumina
. **Chapsa hiata (Hale) Sipman**
- 6(4) Excipulum layered; protocetraric, fumarprotocetraric, and succinprotocetraric acids present (P+ red) 7
Excipulum simple; stictic acid present (K+ yellow) or lichen substances absent . 8
- 7(6) On dead leaves; apothecia prominent; disc non-pruinose; thallus with prosoplectenchymatous cortex; ascospores weakly amyloid
. **Chapsa asteliae (Kantvilas & Vězda) Mangold**
On bark; apothecia erumpent; disc white-pruinose; thallus with irregular, loose cortex; ascospores non-amyloid
. **Chapsa lamellifera (Kantvilas & Vězda) Mangold**
- 8(6) Stictic acid present (K+ yellow) 9
Lichen substances absent 12
- 9(8) Thallus ecorticate; apothecial margin inclined to erect, disc \pm covered
. **Chapsa laemensis (Homchantara & Coppins) Lumbsch & Papong**
Thallus with irregular or prosoplectenchymatous cortex; apothecial margin erect to recurved; disc exposed 10

- 10(9) Ascospores 2–4 per ascus, 30–60 × 15–20 µm; thallus cortex prosoplectenchymatous **Chapsa recurva (G. Salis.) A. Frisch**
 Ascospores 8 per ascus, 20–50 × 8–12 µm; thallus cortex loose, irregular 11
- 11(10) Apothecia aggregate, 0.2–0.3 mm diam.; ascospores 20–25 µm long
 **Chapsa paralbida (Riddle) Rivas Plata & Lücking***
 Apothecia solitary, 1–3 mm diam.; ascospores 25–50 µm long
 **Chapsa megalophthalma (Müll. Arg.) Mangold**
 Synonym: *Thelotrema leucophthalmum* var. *laceratum* Räsänen.
- 12(8) Thallus with irregular or prosoplectenchymatous cortex; apothecia 0.8–1.2 mm diam.; ascospores 6–8 per ascus, 20–30(–35) × 7–10(–12) µm 13
 Thallus ecorticate; apothecia 0.25–0.6 mm diam.; ascospores 2–4(–8) per ascus, 30–60 × 10–20 µm 14
- 13(12) Thallus with prosoplectenchymatous cortex, ± with internal splitting; apothecia up to 1.2 mm diam. **Chapsa sipmanii A. Frisch & Kalb**
 Thallus with irregular, loose cortex; apothecia up to 2 mm diam.
 **Chapsa alstrupii A. Frisch**
- 14(12) Excipulum free; apothecia often aggregate; ascospores 30–40 × 10–12 µm
 **Chapsa leprocarpoides (Hale) Cáceres & Lücking**
 Excipulum fused; apothecia solitary; ascospores 30–60 × 12–20 µm 15
- 15(14) Thallus white-grey; apothecial disc dark grey, thinly pruinose with bluish tinge
 **Chapsa velata (Nyl.) Lücking & Sipman**
 Synonym: *Thelotrema deightonii* C. W. Dodge.
 Thallus pale olive; apothecial disc pale brown, distinctly white-pruinose
 **Chapsa pseudophlyctis (Nyl.) A. Frisch**
 Synonyms: *Graphina pseudophlyctis* var. *monospora* Redinger; *Lecanactis confluens* var. *calcea* Mont.
- 16(3) Stictic acid present (K+ yellow) 17
 Lichen substances absent or protocetraric acid present (P+ red) 19
- 17(16) Thallus ecorticate; apothecial disc thickly white-pruinose; apothecia often irregularly elongate-lirellate **Chapsa aff. dilatata (Müll. Arg.) Kalb**
Notes. This material from Brazil (see Cáceres 2007) closely resembles *Chapsa dilatata* except that the ascospores are muriform. The specimen is too scanty to provide a formal description.
 Thallus with irregular or prosoplectenchymatous cortex; apothecial disc thinly pruinose; apothecia angular-rounded to irregular 18
- 18(17) Ascospores amyloid; thallus cortex irregular, loose
 **Chapsa lordhowensis Mangold**
 Ascospores non-amyloid; thallus cortex prosoplectenchymatous
 **Chapsa zahlbruckneri (Redinger) A. Frisch**
 Synonym: *Thelotrema ahtii* Sipman.
- 19(16) Thallus with prosoplectenchymatous cortex 20
 Thallus ecorticate 22
- 20(19) Apothecia fissurinoid, with inclined to erect marginal lobules, solitary; excipulum not layered **Chapsa perdissuta Sipman & Lücking**
 Apothecia scabioid, with erect to recurved marginal lobules, often aggregate; excipulum layered 21
- 21(20) Ascospores amyloid; apothecia to 1.5 mm diam.
 **Chapsa scabiomarginata (Hale) Rivas Plata & Lücking***
 Ascospores non-amyloid; apothecia to 0.8 mm diam.
 **Chapsa laceratula (Müll. Arg.) Rivas Plata & Lücking***

- 22(19) Ascospores usually 2 per ascus, 60–80 × 12–20 μm
 **Chapsa grossomarginata (Tat. Matsumoto) Mangold**
 Ascospores 1 per ascus, (60–)80–160 × 20–40 μm 23
- 23(22) Protocetraric acid present (P+ red) **Chapsa eitenii (Hale) A. Frisch**
 Lichen substances absent 24
- 24(23) Ascospores 90–160 μm long; apothecial margin usually recurved
 **Chapsa patens (Nyl.) A. Frisch**
 Ascospores 60–110 μm long; apothecial margin usually erect
 **Chapsa leprocarpa (Nyl.) A. Frisch**
 Synonyms: *Thelotrema colobicum* Nyl.; *Thelotrema poeltii* Patw. & C. R. Kulk. *Notes*. The types of the latter two species are extremely similar in morphology and differ mainly in ascospore size. Other material available suggests that the forms with larger ascospores usually have recurved marginal lobes whereas those with smaller ascospores have erect marginal lobes, but this difference needs to be evaluated further.

Group 4 (ascospores muriform, brown)

- 1 Excipulum free; pseudocolumella absent; ascospores 9–12 × 4–6 μm
 **Chapsa pulvereodisca (Hale) Rivas Plata & Mangold***
 Excipulum fused; irregular pseudocolumella sometimes present; ascospores 20–
 120 × 7–30 μm 2
- 2(1) Ascospores 100–120 × 20–30 μm **Chapsa stellata (Hale) Sipman**
 Ascospores 20–50 × 7–15 μm 3
- 3(2) Lichen substances absent; thallus ecorticate
 **Chapsa meghalayensis (Patw. & Nagarkar) Lumbsch & Divakar***
 Stictic acid present (K+ yellow); thallus with prosoplectenchymatous cortex . . . 4
- 4(3) Hymenium inspersed; excipulum carbonized; ascospores 40–50 × 11–15 μm;
 apothecial disc with thick white pruina
 **Chapsa mirabilis (Zahlbr.) Lücking***
 Hymenium clear; excipulum colourless to pale brown; ascospores 20–30 × 8–
 12 μm; apothecial disc thinly pruinose
 **Chapsa calathiformis (Vain.) Lumbsch & Papong**
 Synonyms: *Leptotrema phaeosporum* var. *vainioana* Räsänen.; *Thelotrema phliuense* Homchantara & Coppins.

Chroodiscus (Müll. Arg.) Müll. Arg.

- 1 Apothecia scarlet-red, K+ purple (unknown anthraquinone present) 2
 Apothecia brown-grey, K+ yellow (stictic acid present) 6
- 2(1) Ascospores 1-septate; thallus smooth-uneven; photobiont *Trentepohlia*; stictic acid present (K+ yellow) **Chroodiscus australiensis Vězda & Lumbsch**
 Ascospores 3–5-septate or submuriform; thallus verrucose or lacking crystals; photobiont *Phycopeltis*; stictic acid absent 3
- 3(2) Ascospores submuriform **Chroodiscus submuralis Lücking**
 Ascospores 3–5-septate 4
- 4(3) Ascospores (3–)5-septate; thallus lacking crystals, lichenicolous on *Porina rubentior*
 **Chroodiscus rubenticola Lücking, Grube & Kalb**
 Ascospores 3-septate; thallus with large crystal clusters; facultatively lichenicolous on the *Porina epiphylla* group 5

- 5(4) Apothecia round **Chroodiscus coccineus (Leight.) Müll. Arg.**
 Synonyms: *Chroodiscus igneus* Müll. Arg.; *Platygrapha rutila* Stirt.
 Apothecia lobate-lirellate **Chroodiscus graphideus Lücking & Kalb**
- 6(1) Thallus verrucose, with large crystal clusters; photobiont *Phycopeltis* 7
 Thallus smooth-uneven, with continuous crystal layer; photobiont *Trentepohlia* . 9
- 7(6) Ascospores 1-septate **Chroodiscus neotropicus Kalb & Vězda**
 Ascospores 3–5-septate 8
- 8(7) Ascospores 3-septate . **Chroodiscus verrucosus R. Sant., Lücking & Vězda**
 Ascospores (3–)5-septate . . . **Chroodiscus kaosokensis Papong & Lücking**
- 9(6) Disc-shaped isidia present; apothecia usually rare and ascospores often depauperate
 10
 Isidia absent; apothecia abundant and ascospores well-developed 11
- 10(9) Ascospores 3-septate **Chroodiscus homchantarae Papong & Lücking**
 Ascospores submuriform **Chroodiscus mirificus (Kremp.) R. Sant.**
 Synonyms: *Lecania beccarii* Jatta; *Lecania disserpens* Zahlbr.; *Phyllobrassia mirifica* var. *integra* Vain.;
Phyllobrassia mirifica var. *radians* Vain.
- 11(9) Ascospores consistently 1-septate . **Chroodiscus africanus R. Sant. & Lücking**
 Ascospores (1–)3-septate or submuriform 12
- 12(11) Ascospores submuriform **Chroodiscus defectus Papong & Lücking**
 Ascospores 3-septate 13
- 13(12) Ascospores 18–24 µm long . **Chroodiscus khaolungensis Papong & Lücking**
 Ascospores 8–10 µm long
 **Chroodiscus argillaceus (Müll. Arg.) Lücking & Papong**
 Synonyms: *Chroodiscus parvisporus* Kalb & Lücking; *Ocellularia argillacea* var. *radians* Müll. Arg.

Diploschistes Norman

- 1 Ascomata perithecioid 2
 Ascomata urceolate to lecanoroid 18
- 2(1) Thallus whitish pruinose; on calciferous rocks or soil 3
 Thallus epruinose; on siliceous rocks or soil 5
- 3(2) Species growing on calciferous rocks; diploschistes acid absent; cosmopolitan . .
 **Diploschistes candidissimus (Kremp.) Zahlbr.**
 Species growing on soil; diploschistes acid present or absent 4
- 4(3) Thallus containing diploschistes acid, ascospores 14–22 × 5–9 µm; Southern
 Hemisphere **Diploschistes hensseniae Lumbsch & Elix**
 Thallus lacking diploschistes acid, ascospores 20–30 × 12–19 µm; Madagascar .
 **Diploschistes thelenelloides Lumbsch & Aptroot**
- 5(2) Thallus on soil; Australia **Diploschistes elixii Lumbsch & Mangold**
 Thallus on siliceous rocks 6
- 6(5) Thallus lacking depsides (C–), ascospores broadly ellipsoid 7
 Thallus containing depsides (C+ red), ascospores of different shape 8
- 7(6) Thallus thick, whitish, apothecia not ridged; Northern Hemisphere
 **Diploschistes arabiensis Lumbsch**
 Thallus very thin, mostly restricted to margin of apothecia, whitish grey, apothecia
 ridged; Cosmopolitan . . . **Diploschistes euganeus (A. Massal.) J. Steiner**

- 8(6) Thallus containing gyrophoric acid as major constituent 9
 Thallus containing lecanoric and/or diploschistesic acid as major constituent 11
- 9(8) Thallus surface rough, containing 2'-*O*-methylgyrophoric acid, ascospores broadly ellipsoid; cosmopolitan **Diploschistes gyrophoricus Lumbsch & Elix**
 Thallus surface smooth, lacking 2'-*O*-methylgyrophoric acid, ascospores ellipsoid or broadly ellipsoid 10
- 10(9) Thallus up to 2.4 mm thick, reddish brown to brown; North and Central America **Diploschistes badius Lumbsch & Elix**
 Thallus up to 1.4 mm thick, dark bluish grey to bluish brown; Southern Hemisphere **Diploschistes sticticus (Körb.) Müll. Arg.**
- 11(8) Thallus yellowish or yellowish brown to dark brown 12
 Thallus grey to whitish or bluish grey 14
- 12(11) Ascospores 30–40 µm long; thallus yellowish brown; southern Africa **Diploschistes austroafricanus Guderley & Lumbsch**
 Ascospores 16–26 µm long 13
- 13(12) Thallus dark brown, ascomata epruinose; cosmopolitan **Diploschistes aeneus (Müll. Arg.) Lumbsch**
 Thallus yellowish, ascomata whitish pruinose; Northern Hemisphere **Diploschistes prominens (Vain.) Lumbsch**
- 14(11) Thallus thin (up to 0.7 mm thick), ascospores 10–18 × 8–13 µm; Australia **Diploschistes microsporus Lumbsch & Elix**
 Thallus thick (up to 2 mm thick), ascospores larger (16–65 × 10–20 µm) 15
- 15(14) Thallus pale grey to whitish grey, ascospores 16–32 × 10–20 µm; cosmopolitan **Diploschistes actinostomus (Pers. ex Ach.) Zahlbr**
 Thallus bluish grey, ascospores 28–65 × 12–26 µm 16
- 16(15) Ascospores amyloid, halonate 17
 Ascospores non-amyloid (only young ascospores sometimes faintly amyloid), non-halonate; Northern Hemisphere **Diploschistes caesioplumbeus (Nyl.) Vain.**
- 17(16) Ascospores 30–52 µm long, with 4–7- transverse septa; Southern Hemisphere **Diploschistes diploschistoides (Vain.) G. Salisb.**
 Ascospores 45–65 µm long, with 6–12 transverse septa; India **Diploschistes megalosporus Lumbsch & H. Mayrhofer**
- 18(1) Thallus K+ yellow turning red, containing norstictic acid, disc lecanoroid; cosmopolitan **Diploschistes ocellatus (Vill.) Norman**
 Thallus K- or K+ yellow, containing depsides or lacking lichen substances, disc urceolate 19
- 19(18) Thallus on siliceous or calciferous rocks 20
 Thallus on soil, mosses or lichens 22
- 20(19) Thallus on calciferous rocks, whitish pruinose, asci 4-spored; cosmopolitan **Diploschistes gypsaceus (Ach.) Zahlbr.**
 Thallus on siliceous rocks, asci 6–8-spored 21
- 21(20) Thallus greenish grey to grey, ascospores broadly ellipsoid, 10–20 µm broad; cosmopolitan **Diploschistes scruposus (Schreb.) Norman**
 Thallus yellowish grey to orange-yellow, ascospores ellipsoid, 7–12 µm broad; pantropical **Diploschistes rampoddensis (Nyl.) Zahlbr.**

- 22(19) Juvenile parasite on *Cladonia* spp. 23
 Not lichenicolous 24
- 23(22) Asci 8-spored; Southern Hemisphere
 **Diploschistes muscorum ssp. bartlettii** Lumbsch
 Asci 4-spored; mostly northern hemisphere
 **Diploschistes muscorum ssp. muscorum (Scop.) R. Sant.**
- 24(22) Thallus containing gyrophoric acid as major compound 25
 Thallus containing lecanoric and/or diploschistesic acid as major compounds . 26
- 25(24) Thallus whitish grey, pruinose, hymenium 80–100 µm high; semi-arid regions of
 Southern Hemisphere **Diploschistes conceptionis** Vain.
 Thallus yellowish brown to yellowish green, epruinose, hymenium 120–150 µm
 high; pantropical **Diploschistes hypoleucus** Zahlbr.
- 26(24) Thallus whitish grey and heavily pruinose 27
 Thallus yellowish brown to brownish grey, epruinose 28
- 27(26) Thallus verruculose to bullate or plane; asci 4–8-spored, ascospores up to 38 µm
 long; cosmopolitan **Diploschistes diacapsis (Ach.) Lumbsch**
 Thallus plane; asci 8-spored, ascospores up to 28 µm long; Southern Hemisphere
 **Diploschistes thunbergianus (Ach.) Lumbsch & Vězda**
- 28(26) Thallus very thin, brownish grey, apothecia small, up to 1 mm in diam.; southern
 Africa **Diploschistes isabellinus** Zahlbr.
 Thallus thick, yellowish brown, apothecia large, up to 3.6 mm in diam.; pantropical
 **Diploschistes cinereocaesius (Sw.) Vain.**

Fibrillithecis A. Frisch

With new information available, the key presented here deviates from recent concepts of *Fibrillithecis* and its species presented by Frisch *et al.* (2006) and Mangold *et al.* (2009), particularly with regard to nomenclature and species concepts. The extraordinary similarity between what has been called *Fibrillithecis insignis* and *Myriotrema hartii* in the literature led us to determine that both names have been misapplied. The two taxa involved have several important characters in common, including the formation of isidia, submuriform, amyloid ascospores, and the presence of psoromic acid. Sterile specimens with isidia were usually identified as *Myriotrema hartii*, whereas material with apothecia was assigned to *Fibrillithecis insignis*, for example, by Frisch *et al.* (2006). Re-examination of the type material and other collections available revealed that two taxa with both apothecia and isidia can be distinguished: one has apothecia with a narrow, dark-rimmed pore with distinct fibrils (*Fibrillithecis* type) and produces erect isidia which become brown-tipped with age, whereas the other has apothecia with a broad, pale-rimmed pore lacking fibrils (*Myriotrema* type), and forms decumbent isidia lacking a brown tip (Fig. 8). The type material of both *Thelotrema hartii* and *Thelotrema insignis* conform to the latter (Fig. 8) and *hartii* is the older name, making *Thelotrema insigne* a synonym of *Myriotrema hartii* (and *Thelotrema* sect. *Tremotylum* a synonym of *Myriotrema*). Frisch *et al.* (2006) already noted that the type of *Thelotrema insigne* does not agree with the other material named *Fibrillithecis 'insignis'*, so we introduce here a new name for this taxon, *F. confusa*, which is the isidiate counterpart of *F. argentea* (see below). Most sterile material that we revised has erect isidia with brown tips and hence must be assigned to *F. confusa*, not to *Myriotrema hartii*. The situation is complicated by the fact that a third species, *Fibrillithecis halei*, produces irregular isidioid structures; its apothecia are at first glance more similar to those of *Myriotrema hartii* but produce fibrils and usually have a free excipulum and double margin.

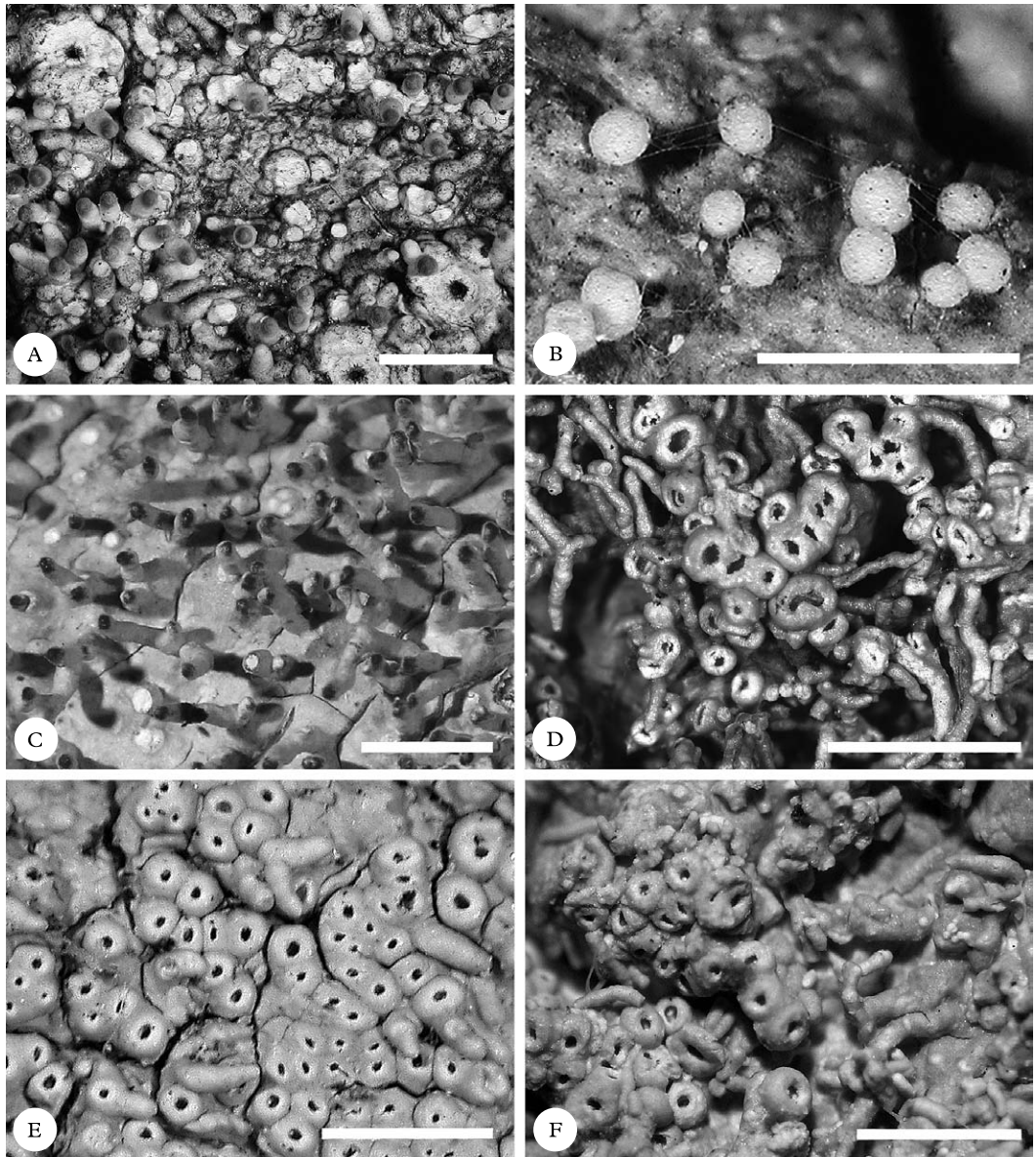


FIG. 8. *Fibrillithecis confusa* and similar taxa. A & B, *Fibrillithecis confusa* (holotype); A, thallus with apothecia (note the narrow pore with dark, fibrillate rim); B, isidia (note the dark tips in old isidia and the young isidia which are globose and white); C, *F. confusa*, sterile specimen previously confused with *Myriotrema hartii* (note the dark tips of the isidia); D–F, *Myriotrema hartii*; D, type of *Thelotrema insigne*; E type of *Thelotrema hartii*; F, typical specimen from Costa Rica; note the decumbent isidia lacking dark tips. Scales: A – F = 1 mm.

The taxonomy of psoromic-acid containing species with fibrillate apothecia lacking isidia and submuriform ascospores is not well understood. This complex includes a wide array of morphologically disparate forms (Figs 9 & 10) which have usually been identified as *Thelotrema pachystomum*, *T. piluliferum*, or more recently as *Fibrillithecis vernicosa* (Frisch *et al.* 2006) or

F. halei (Mangold *et al.* 2009), often accommodating all forms in a single species. However, experience and molecular phylogenetic studies (Staiger 2002; Kalb *et al.* 2004; Lumbsch *et al.* 2008) have shown that taxa can exhibit a certain morphological uniformity but the species are often delimited by subtle differences (e.g. in *Thelotrema*, Lumbsch *et al.* 2008). It is therefore unlikely that a single species would include such a variety of forms, especially if certain characters that have no functional association are intercorrelated, such as apothecial versus pore size and morphology (*F. argentea* s. str. has large apothecia with almost closed pores with dark, fibrillate rims whereas *F. diminuta* has small apothecia with open pores with pale, entire rims), thallus colour (silvery grey in *F. argentea* versus olive in *F. diminuta*), and geography (the large lepadinoid form with wide pores, *F. halei*, is known only from the Neotropics whereas the large ocellularioid form with narrow, dark-rimmed and fibrillate pores, *F. argentea*, is paleotropical). The fact that all have the same ascospore type and chemistry is by no means an indicator that they belong to the same species; many other cases are known where species variation is primarily morphological, whereas the ascospores are virtually identical (e.g., *Lecanora*), although such cases are rare in the *Graphidaceae*. Also, the isidiate counterpart, *F. confusa*, shows a very uniform apothecial morphology corresponding to that of *F. argentea*, but does not include any of the other forms separated here as *F. diminutum* and *F. gibbosum*.

1	Ascospores transversely septate	2
	Ascospores submuriform	5
2(1)	Isidia present; ascospores 1-septate, 8–12 µm long, brown-ornamented	
 Fibrillithecis eximia (R. C. Harris) Rivas Plata & Lücking*	
	Isidia absent; ascospores 3–7-septate, 8–30 µm long, hyaline	3
3(2)	Ascospores 3-septate, 8–12 µm long	
 Fibrillithecis pachystoma (Nyl.) Sipman	
	Ascospores 5–7-septate, 15–30 µm long	4
4(3)	Apothecia erumpent, with narrow pores; excipulum dark brown; ascospores 7-septate, 18–30 × 5–8 µm; psoromic acid (P+ yellow) present	
 Fibrillithecis fissurata (Nagarkar & Hale) Rivas Plata & Lücking*	
	Apothecia prominent, with narrow pores but conspicuously flesh-coloured; excipulum colourless; ascospores 5–7-septate, 15–20 × 4–6 µm; lichen substances absent	Fibrillithecis carneodisca (Hale) Rivas Plata & Lücking*
5(1)	Isidia present	6
	Isidia absent (<i>Fibrillithecis argentea</i> complex)	7
6(5)	Isidia sparse, remaining short and globose or becoming slightly elongate and irregular, pale; apothecia ± lepadinoid, with wide pores and pale rims	
 Fibrillithecis halei (Tuck. & Mont.) Mangold	
	Isidia abundant and well-developed, ± more or less erect and becoming brown-tipped with age [if isidia decumbent and lacking brown tips, cf. <i>Myriotrema hartii</i> (Müll. Arg.) Hale]; apothecia ± ocellularioid, with narrow pores and dark, fibrillate rims	Fibrillithecis confusa Lücking, Kalb & Rivas Plata*
7(5)	Apothecia 0.2–0.4 mm diam.	8
	Apothecia 0.5–1.5 mm diam.	10
8(7)	Apothecia usually aggregate and immersed in irregular thallus verrucae, with a completely closed pores; thallus silvery grey to almost white	
 Fibrillithecis gibbosa (H. Magn.) Rivas Plata & Lücking*	
	Apothecia solitary but numerous and dense, erumpent to substipitate, with a distinct, open pores; thallus olive-green to olive grey	9

- 9(8) Apothecia (prominent to) sessile to substipitate, usually with pale ridges radiating from the pore (resembling *Topeliopsis*) **Fibrillithecis diminuta (Hale) Rivas Plata & Lücking***
 Apothecia erumpent to prominent, excipulum becoming apically free and forming double margin (resembling *Thelotrema*) **Fibrillithecis aff. diminuta (Hale) Rivas Plata & Lücking**
- 10(7) Apothecia ± lepadinoid, with double margin and wide pore, prominent to sessile; Neotropical **Fibrillithecis halei (Tuck. & Mont.) Mangold**
 Apothecia ocellularioid, with narrow pores and dark, fibrillate rims, erumpent to prominent (rarely become sessile); Palaeotropical **Fibrillithecis argentea (Müll. Arg.) Rivas Plata & Lücking***
 Synonyms: *Thelotrema pachystomum* subsp. *piluliferum* Tuck.; *Thelotrema vernicosum* Zahlbr.; *Thelotrema platysporum* Zahlbr.

Gyrotrema A. Frisch

- 1 Apothecial disc pink; hypoprotocetraric acid present; ascospores 28–50 µm long **Gyrotrema sinuosum (Sipman) A. Frisch**
 Apothecial disc orange or cinnabar-red; hypoprotocetraric acid absent 2
- 2(1) Apothecial disc cinnabar-red; ascospores 20–28 µm long **Gyrotrema wirthii Rivas Plata, Lücking & Lumbsch**
 Apothecial disc orange; ascospores unknown **Gyrotrema aff. wirthii Rivas Plata, Lücking & Lumbsch**
Notes. This taxon is included here as it produces an orange pigment different from the other two recognized species; further collections with mature ascospores are required to describe the species formally.

Leptotrema Mont. & Bosch

- 1 Thallus with clusters of red crystals in medulla; otherwise lichen substances absent **Leptotrema wightii (Tayl.) Müll. Arg.**
 Synonyms: *Endocarpon baileyi* Stirt.; *Thelotrema ravenelii* Tuck.; *Thelotrema subconcretum* Leight.
 Thallus lacking red crystals; hypoprotocetraric acid present **Leptotrema zollingeri Mont. & Bosch**

Leucodecton A. Massal.

This genus is characterized by the excipulum formed by irregular hyphae (± paraplectenchymatous) versus parallel hyphae (± prosoplectenchymatous) in *Myriotrema*. Most species appear to contain stictic (or norstictic) acid and have brown ascospores, and the thallus cortex is usually weakly developed and large columnar clusters of crystals are often present. It therefore appears that, apart from the different excipulum structure, *Leucodecton* is characterized by thallus morphology and chemistry. Almost all genuine *Myriotrema* species have a prosoplectenchymatous cortex often with internal splitting and about half of these produce psoromic acid and most of the remaining protocetraric, fumarprotocetraric, or hypoprotocetraric acids. Species with *Myriotrema* morphology containing stictic acid are likely to belong to *Wirthiotrema*, especially if the ascospores are non-amyloid. Coincidentally, many of the species containing stictic or norstictic acid which were previously included in *Myriotrema* have already been transferred to *Leucodecton*, *Thelotrema*, or *Wirthiotrema* or have been shown to be synonyms of species in those genera, including the recently described *Myriotrema subanamaliense*, a synonym of *Wirthiotrema glaucopallens*, and *M. grandisporum*, a synonym of *Thelotrema patwardhanii* (see this key; Rivas Plata et al. 2010; Papong et al. 2010; this volume).

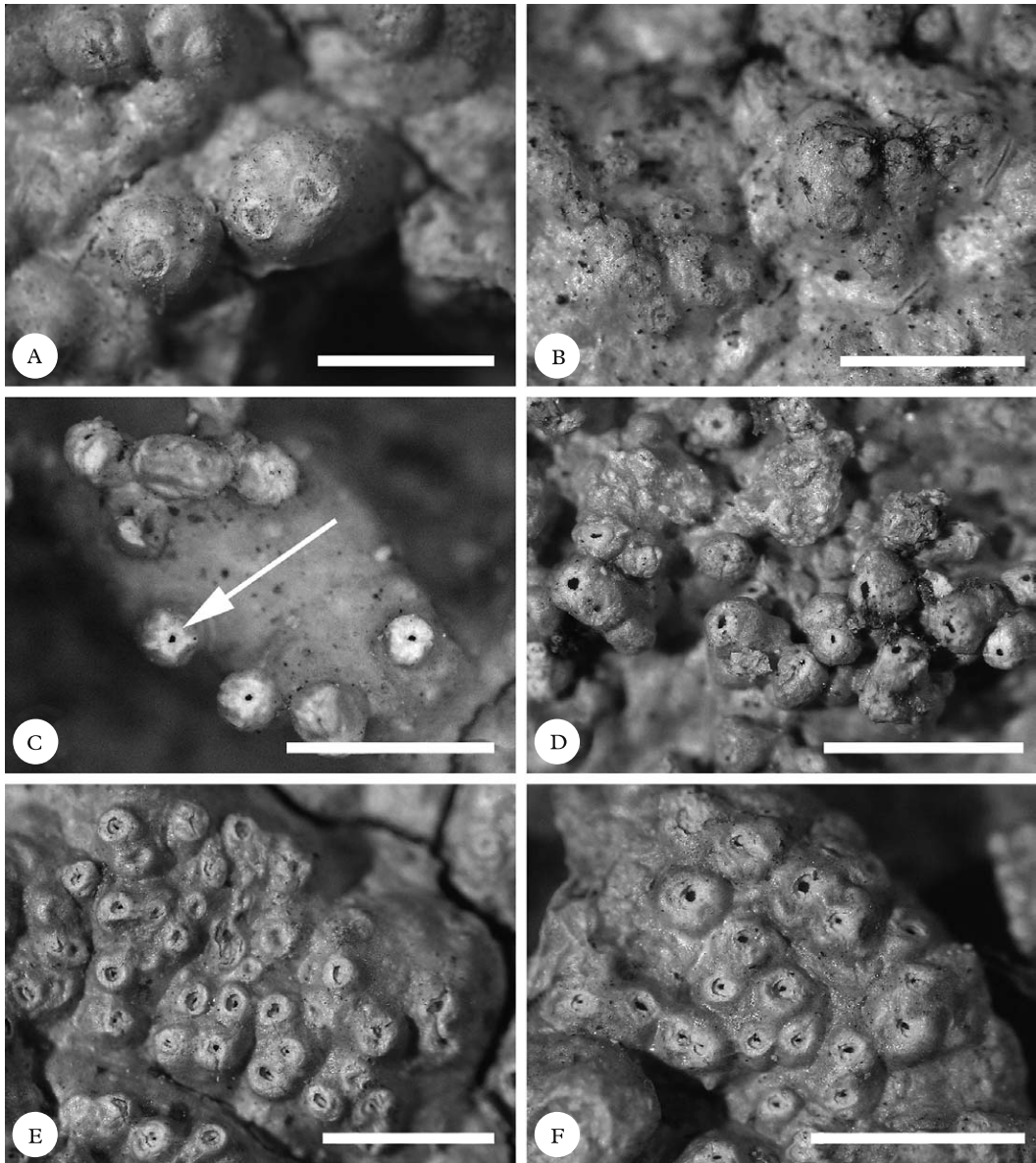


FIG. 9. Species in the *Fibrillithecis halei* complex. A & B, *F. gibbosa*; A, type; B, a specimen from Australia; C & D, *F. diminita*; A, type, note the pale radiate ridges; B, a specimen from Australia (*Lich. Exs.* 453); E & F, *Fibrillithecis* aff. *dimunita*, two specimens from Australia. Scales: A – F = 1 mm.

Species still remaining in *Myriotrema* with stictic or norstictic acid include *M. anamaliense*, *M. coppinsii*, *M. dactyliferum*, *M. desquamans*, *M. eminens*, *M. expallescens*, *M. frustillatum*, *M. norsticticum*, *M. peninsulae* and *M. phaeosporum*. *Myriotrema eminens* is an odd species which overgrows bryophytes, with narrow, sessile apothecia resembling those of *Topeliopsis*; it does not belong in *Myriotrema* s. str. and its generic affinities are unknown. The only other species in this list with a split cortex is *Myriotrema desquamans*, which basically represents the

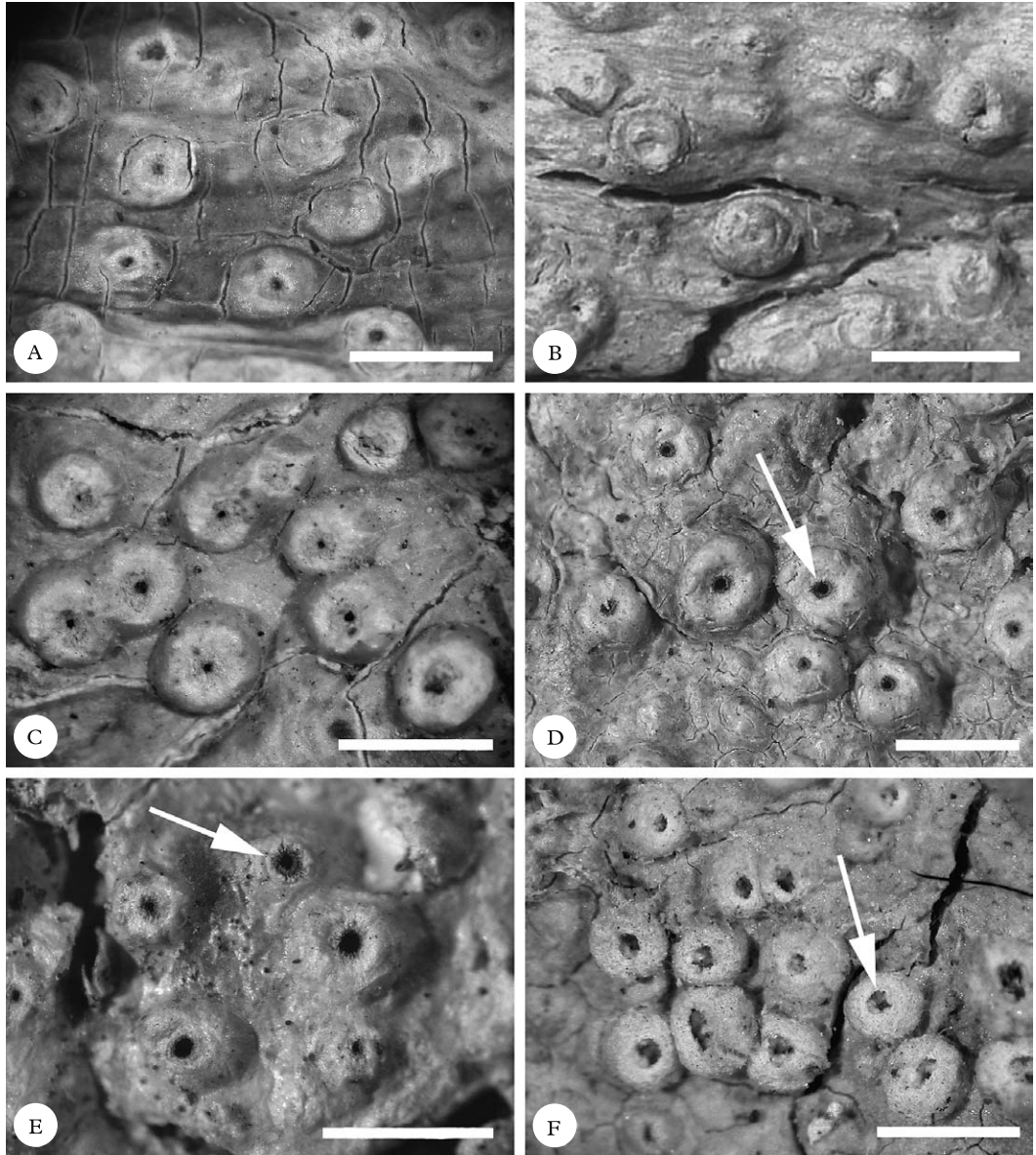


FIG. 10. Species in the *Fibrillithecia halei* complex. A–E, *F. argentea*; A, type of *Thelotrema argenteum*; B, type of *T. verrucosum*; C, type of *T. pachysporum* subsp. *piluliferum*; D & E two specimens from Australia, note the narrow pore with dark, fibrillate rim; F, *F. halei* type, note the lepadinoid apothecia with wide pore and double margin. Scales: A–F = 1 mm.

non-inspersed counterpart of *Wirthiotrema trypaneoides* and most probably belongs in that genus instead of *Myriotrema*. This is supported by its non-amyloid ascospores. *Myriotrema norsticticum* is most probably a genuine *Myriotrema* as it has a dense cortex and amyloid ascospores. *Myriotrema anamaliense* is identical to *Leucodecton compunctellum* except for the

- 9(5) Thallus sorediate; apothecia erumpent to prominent, often elongate, glaucophae-
noid; ascospores $35\text{--}50 \times 13\text{--}19 \mu\text{m}$, 2–4 per ascus; stictic acid present (K+
yellow) **Leucodecton sorediiferum A. Frisch**
Thallus lacking soralia; apothecia immersed to erumpent, rounded to angular,
porinoid, myriotremoid, lepadinoid, or glaucescentoid; ascospores $12\text{--}45 \times 5\text{--}$
 $17 \mu\text{m}$, 4–8 per ascus; stictic or norstictic acid present or lichen substances absent
. 10
- 10(9) Hymenium inspersed; apothecia myriotremoid-lepadinoid, with excipulum free;
ascospores $30\text{--}45 \mu\text{m}$ long; stictic acid present (K+ yellow)
. **Leucodecton oxysporum (Redinger) Rivas Plata & Lücking***
Hymenium clear; apothecia and excipulum variable; ascospores variable but usually
shorter; stictic or norstictic acid present or lichen substances absent 11
- 11(10) Norstictic acid present (K+ yellow forming red crystals); apothecia myriotremoid-
lepadinoid, with excipulum free
. **Leucodecton occultum (Eschw.) A. Frisch**
Synonyms: *Leptotrema compactum* Müll. Arg.; *Leptotrema compunctum* var. *purpuratum* Müll. Arg.;
Leptotrema norstictideum Patw. & Nagarkar; *Lichen compunctum* Sm. ex Ach.; *Thelotrema bahianum* var.
antillarum Vain.; *Thelotrema compunctum* f. *portoricense* Vain.; *Thelotrema com punctum* var. *antillarum*
Vain.; *Thelotrema compunctum* var. *praiense* Vain.; *Thelotrema loandense* Vain.
Stictic acid present (K+ yellow) or lichen substances absent; apothecia and excipu-
lum variable 12
- 12(11) Lichen substances absent
. **Leucodecton desquamescens (Vain.) Rivas Plata & Lücking***
Synonym: *Leptotrema desquamescens* var. *cervinum* Zahlbr.
Stictic acid present (K+ yellow) 13
- 13(12) Apothecia usually aggregate in whitish pseudostromata, chroodiscoid-lepadinoid;
ascospores less than $20 \times 10 \mu\text{m}$; thallus ecorticate
. **Leucodecton glaucescens (Nyl.) A. Frisch**
Apothecia solitary (although sometimes numerous), myriotremoid-lepadinoid or
porinoid; ascospores usually larger than $20 \times 10 \mu\text{m}$ and up to $40 \times 18 \mu\text{m}$; thallus
with loose, irregular (sometimes indistinct) to prosoplectenchymatous cortex . .
. 14
- 14(13) Apothecia porinoid; thallus with dense, shiny cortex
. **Leucodecton compunctum (Ach.) A. Massal.**
Synonym: ?*Thelotrema leucocarpoides* Nyl.; *Thelotrema pauperculum* Vain.
Apothecia myriotremoid to almost lepadinoid; thallus with loose, irregular cortex .
. 15
- 15(14) Ascospores $15\text{--}25 \mu\text{m}$ long; thallus with columnar clusters of crystals and finely
verruculose surface
. **Leucodecton phaeosporum (Nyl.) Rivas Plata & Lücking***
Synonym: *Leptotrema polyporum* Riddle.
Ascospores $20\text{--}40 \mu\text{m}$ long; thallus with irregular clusters of crystals and smooth to
uneven surface 16
- 16(15) Apothecia lepadinoid, with free excipulum
. **Leucodecton subcompunctum (Nyl.) A. Frisch**
Synonyms: *Leptotrema diffractum* Müll. Arg.; *Leptotrema inclusum* Zahlbr.; *Leptotrema polycarpum* Müll.
Arg.; *Myriotrema decorticatatum* Hale.
Apothecia myriotremoid, with \pm fused excipulum
. **Leucodecton fissurinum (Hale) A. Fisch**

- 17(4) Ascospores remaining hyaline 18
 Ascospores brown when mature 19
- 18(17) Thallus with irregular isidia developing from a pit-like base; ascospores 80–200 × 20–40 µm, 1–2 per ascus; norstictic acid present (K+ yellow forming red crystals) [Myriotrema frustillatum Mangold]
 Thallus lacking isidia; ascospores 50–80 × 15–20 µm, 2–4/ascus; stictic acid present (K+ yellow)
 **Leucodecton anamaliense (Patw. & C. R. Kulk.)**
 **Rivas Plata & Lücking***
- Notes.* This taxon might represent a form of *Leucodecton nuwarensense* (see below) in which the ascospores become brown often very late in their development.
- 19(17) Hymenium inspersed; ascospores up to 180 × 40 µm
 **Leucodecton bisporum (Nyl.) Sipman & Lücking**
 Hymenium clear; ascospores usually less than 100 µm long, rarely up to 140 µm in single-spored asci (*Leucodecton compunctellum* aggregate) 20
- 20(19) Apothecia myriotremoid to ocellularioid with 0.1–0.3 mm wide pore; thallus with irregular clusters of crystals, smooth to uneven 21
 Apothecia porinoid to myriotremoid with 0.05–0.1 mm wide pore; thallus in *Leucodecton compunctellum* s. str. with large, often columnar clusters of crystals and a rugulose-verruculose surface 22
- 21(20) Apothecia prominent, 0.3–0.6 mm diam. with 0.15–0.25 mm wide pore
 **Leucodecton tarmuguliense (Sethy, Nagarkar & Patw.) A. Frisch**
 Apothecia immersed, 0.3–0.4 mm with 0.2–0.3 mm wide pore
 **Leucodecton biokense A. Frisch**
- 22(20) Thallus with large, often columnar clusters of crystals and finely rugulose-verruculose surface; apothecia porinoid (to indistinctly myriotremoid or lepadinoid with apically free excipulum), immersed-erumpent, with a very narrow pore (less than 0.05 mm) surrounded by dark ring
 **Leucodecton compunctellum (Nyl.) A. Frisch (s. str.)**
Synonyms: *Anthracothecium oligosporum* Müll. Arg.; *Leptotrema deceptum* Hale; *Thelotrema elachistoteron* Leight.; *Thelotrema microglaenoides* Vain.; *Thelotrema monosporum* var. *subgenium* Nyl.; *Thelotrema reclusum* Kremp.
 Thallus with small, ± irregularly dispersed clusters of crystals and smooth to uneven surface; apothecia myriotremoid, immersed, with narrow pores (c. 1 mm) surrounded by white rings **Leucodecton nuwarensense (Hale) A. Frisch**

Melanotopelia Lumbsch & Mangold

- 1 Ascospores 70–120 × 20–30 µm; protocetraric acid present (P+ red)
 **Melanotopelia toensbergii (Vězda & Kantvilas) Lumbsch & Mangold**
 Ascospores 110–180 × 30–45 µm; stictic or salazinic acid present (K+ yellow) . 2
- 2(2) Salazinic acid present (K+ yellow forming red crystals)
 **Melanotopelia blepharostoma Lumbsch & Divakar**
 Stictic acid present (K+ persistently yellow) 3
- 3(2) Apothecia 0.5–1 mm diam., with wide pore
 **Melanotopelia rugosa (Kantvilas & Vězda) Lumbsch & Mangold**
 Apothecia 0.3–0.5 mm diam., with narrow pore
 **Melanotopelia africana Sérus. et al.**

Pseudoramonia Kantvilas & Vězda

- 1 Ascospores 3-septate, 10–14 µm long; stictic acid present (K+ yellow)
 **Pseudoramonia stipitata (Vězda & Hertel) Kantvilas & Vězda**
 Ascospores 7-septate, 15–30 µm long; succinprotocetraric acid present
 **Pseudoramonia richeae Kantvilas & Vězda**

Schizotrema Mangold & Lumbsch

The circumscription of this genus is provisional. There are similarities with certain species of *Chapsa*, which is a phylogenetically distinct genus. We have used the formation of a narrow pore, (partially) carbonized excipulum and non-amyloid ascospores, to place species in *Schizotrema*, but several species (*decolorata*, *fissiporum*, *parvizebrinum*, *petractoides*, *refertum*) require molecular data to confirm their systematic affinities with *Schizotrema*.

- 1 Ascospores transversely septate 2
 Ascospores (sub)muriform 6
- 2(1) Ascospores 30–80 × 6–12 µm, 9–21-septate 3
 Ascospores 12–25 × 4–8 µm, 3–7-septate 4
- 3(2) Ascospores 30–80 µm, 11–21-septate, non-amyloid; thallus pale to dark olive brown;
 stictic (K+ yellow) or fumarprotocetraric acids present (P+ red)
 **Schizotrema zebrinum Mangold**
Notes. The two different chemotypes possibly represent different species but we must await the results
 of molecular studies to test this hypothesis.
 Ascospores 30–35 µm, 9–11-septate, amyloid; thallus whitish, ecorticate; no lichen
 substances present [*Thelotrema petractoides* P. M. Jørg. & Brodo]
- 4(2) No lichen substances present; ascospores 12–20 µm long, amyloid; thallus ecorticate;
 apothecia 0.15–0.25 mm diam. . . . [*Thelotrema parvizebrinum* Mangold]
 Hypo-protocetraric acid and satellites or chinchonarum unknowns present; asco-
 spores 18–25 µm long, amyloid; thallus with irregular or prosoplectenchymatous
 cortex; apothecia 0.4–0.7 mm diam. 5
- 5(4) Hypo-protocetraric acid and satellites present; thallus with prosoplectenchymatous
 cortex [*Thelotrema refertum* (Hale) Hale]
 Chinchonarum unknowns present; thallus with irregular cortex
 [*Ocellularia decolorata* Hale]
- 6(1) Ascospores submuriform, 20–35 × 7–10 µm; no lichen substances present . . . 7
 Ascospores muriform, 35–180 × 15–40 µm; chemistry variable 8
- 7(6) Hymenium inspersed; ascospores amyloid [*Thelotrema fissiporum* Hale]
 Hymenium clear; ascospores non-amyloid
 **Schizotrema subzebrinum Mangold**
- 8(6) Ascospores 60–180 × 20–40 µm; salazinic acid or no lichen substances present . .
 **Schizotrema schizolomum (Müll.Arg.) Mangold & Lumbsch**
Notes. The two different chemotypes possibly represent different species but we must await the results
 of molecular studies to test this hypothesis.
 Ascospores 35–80 × 15–30 µm; psoromic or stictic acid or cinchonarum unknowns
 present 9

- 9(8) Stictic acid (K+ yellow) or chinchonarum unknowns present **Schizotrema guadeloupense (Hale) Mangold & Lumbsch**
Notes. The two different chemotypes possibly represent different species but we must await the results of molecular studies to test this hypothesis.
- Psoromic acid present (P+ yellow) **Schizotrema cryptotrema (Nyl.) Rivas Plata & Mangold***
Synonym: *Thelotrema annulatum*

Thelotrema Ach.

Lumbsch *et al.* (2008) provided a phylogenetic study of the lineages in *Thelotrema* species, concluding that species delimitation needs to be more subtle and that more species have to be recognized than previously assumed. Besides focusing on the *T. subtile* complex, the phylogenetic analysis also suggested a solution for the difficult *T. monosporum* complex. Re-study of the sequenced material and the available type specimens showed that the *T. monosporum* complex includes four different species, one of which is quite distinct from the remaining three. All specimens in the *T. monosporum* clade sequenced, including *T. pachysporum*, have the same thallus and apothecial morphology: an ecorticate, endoperidermal, ± farinose, white to pale yellowish grey thallus and erumpent to prominent, crateriform apothecia with an initially narrow pore that eventually widens or erodes to (partially) expose the disc and inner free excipulum, which is ± entire to undulate. This morphology, which is very characteristic and makes the specimens at first glance appear dead and barely recognizable as lichens, differs from that found in *T. lepadinum*, which has a corticate thallus and prominent apothecia with a thick thalline rim and distinct double margin and the inner free excipulum divided into irregular lobules (Fig. 12). Most of the type specimens of the synonyms previously assigned to *T. monosporum* s. lat. (Frisch *et al.* 2006) conform to the *monosporum* morphology, whereas the types of *T. saxatile* and *T. macrosporum* have a corticate, verrucose thallus and more *lepadinum*-like apothecia with a very thick thalline rim and persistently narrow pore. As a consequence, the clade named ‘*saxatile*’ in Lumbsch *et al.* (2008), characterized by very large ascospores but *monosporum* morphology, should correctly be named *T. monosporoides*, with three synonyms (*attenuatum*, *manosporum*, *monospermum*). *Thelotrema saxatile*, on the other hand, is a morphologically distinct species (Fig. 12) which has not been sequenced but probably does not belong to this clade.

The distinction between *Thelotrema lepadodes* and *T. monosporum* s. str., based on ascospore morphology (Lumbsch *et al.* 2008; Mangold *et al.* 2009), is tentative, as so far only one specimen of *lepadodes* has been sequenced and the application of the many available names is not exactly clear. More material from different parts of the world must be sequenced to resolve this problem satisfactorily, but it appears that the ascospore differences depicted in the key below separate the two species rather well.

- 1 Ascospores transversely septate 2
 Ascospores (sub)muriform 3
- 2(1) Ascospores hyaline **Group 1**
 Ascospores brown **Group 2**
- 3(1) Ascospores hyaline **Group 3**
 Ascospores brown **Group 4**

Group 1 (ascospores transversely septate, hyaline)

- 1 Ascospores (60–)80–240 × 10–25 µm, generally exceeding 100 × 12 µm, 15–37-septate 2
 Ascospores 10–60(–70) × 5–12(–13) µm, 3–15(–17)-septate 7

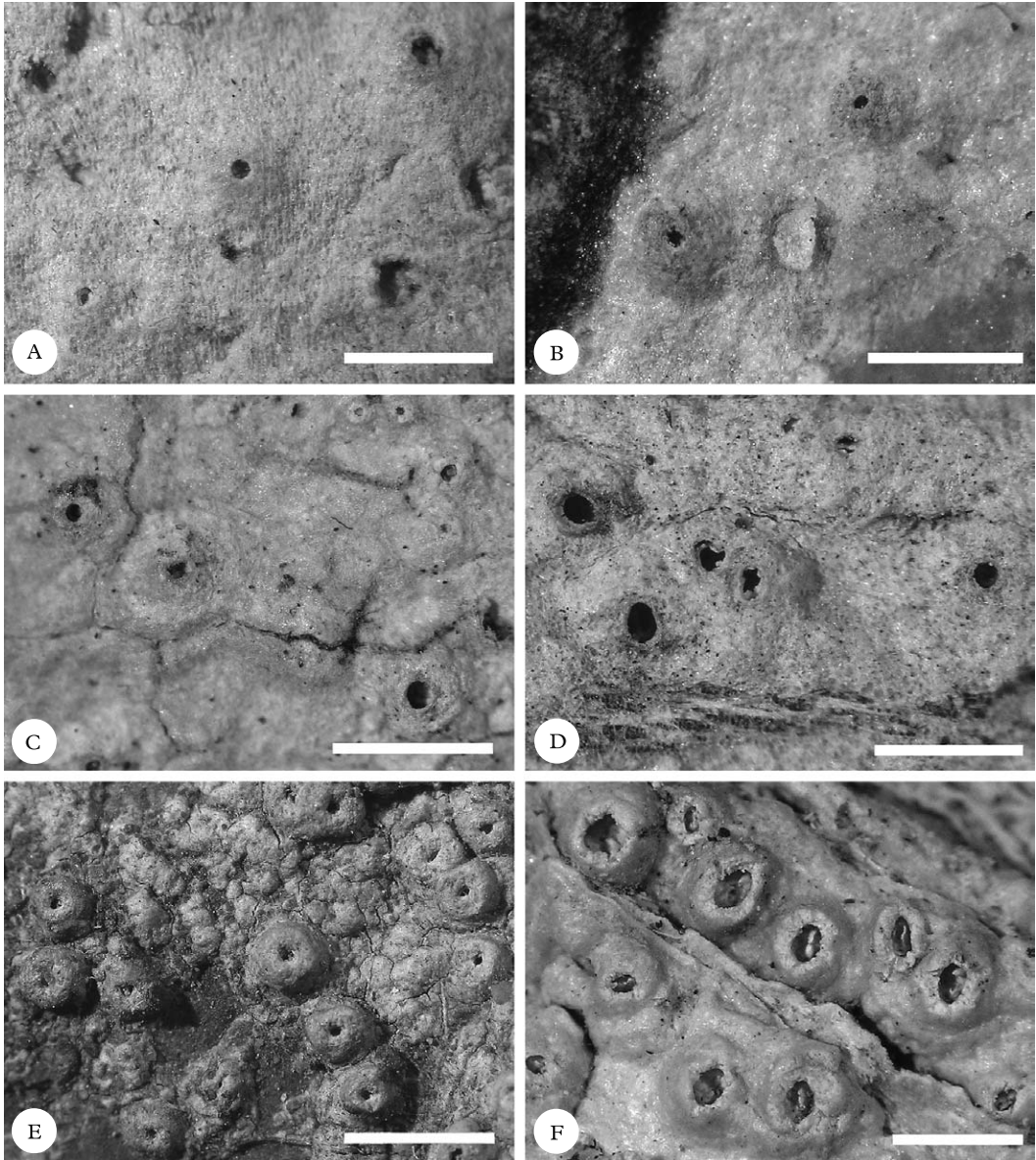


FIG. 12. Species in the *Thelotrema monosporum* complex. A, *T. pachysporum* (sequenced as *pachysporum* 2 by Lumbsch *et al.* 2008); B, *T. lepadodes* (sequenced by Lumbsch *et al.* 2008); C, *T. monosporum* s. str. (sequenced as *monosporum* 3 by Lumbsch *et al.* 2008); D, *T. monosporoides* (sequenced as “*saxatile*” 3 by Lumbsch *et al.* 2008); E, *T. saxatile* s. str. (type). F, *T. lepadinum* for comparison. Scales: A – F = 1 mm.

- 2(1) Norstictic or stictic acid present (K+ yellow) 3
- Fumarprotocetraric and protocetraric acid present (P+ red) or lichen substances absent 4

- 3(2) Norstictic acid present (K+ yellow forming red crystals); ascospores 1–2 per ascus; apothecia with minute pores and discs concealed; thallus verrucose
 **Thelotrema patwardhanii (Hale) Rivas Plata & Mangold***
 Stictic acid present (K+ persistently yellow); ascospores 8 per ascus; apothecia with wider pore and disc partially visible; thallus smooth to uneven
 **Thelotrema porinoides Mont. & Bosch**
 Synonyms: *Ocellularia agasthiensis* Nagarkar, Sethy & Patw.; *Ocellularia floridensis* Fink; *Ocellularia multilocularis* Zahlbr.; *Ocellularia platyklamys* Müll. Arg.; *Thelotrema albidiforme* Leight.; *Thelotrema exanthismocarpum* Leight.; *Thelotrema homothecium* Vain.; *Thelotrema isertii* Vain.; *Thelotrema obovatum* Stirt.
- 4(2) Fumarprotocetraric and protocetraric acid present (P+ red)
 **Thelotrema nostalgicum Salisb.**
 Lichen substances absent 5
- 5(4) Ascospores 2–4 per ascus, subdistoseptate and thin-walled
 **Thelotrema kamatii (Patw. & C. Kulk.) Hale**
 Ascospores (2–)4–8 per ascus, distoseptate and thick-walled 6
- 6(5) Apothecia up to 1.2 mm diam.; ascospores up to 220 × 20 µm
 **Thelotrema nureliyum Hale**
 Apothecia up to 0.7 mm diam.; ascospores up to 110 × 12 µm
 **Thelotrema diplotrema Nyl.**
 Synonym: *Ocellularia turgidula* Müll. Arg. [non *Thelotrema turgidulum* Vain.].
- 7(1) Stictic, norstictic, or salazinic acid present (K+ yellow) 8
 Norsubnotatic or hypostictic acid present or lichen substances absent 14
- 8(7) Norstictic or salazinic acid present (K+ yellow forming red crystals) 9
 Stictic acid present (K+ persistently yellow) 11
- 9(8) Excipulum apically dark brown; ascospores 5–9-septate; salazinic and stictic acid present **Thelotrema hians Stirt.**
 Excipulum colourless to pale brown; ascospores 7–15-septate; salazinic or norstictic acid present, stictic acid absent 10
- 10(9) Ascospores with rather thin septa and angular lumina, thin-walled; salazinic acid present **Thelotrema circumscriptum C. Knight**
 Ascospores with rather thick septa and lens-shaped lumina, thick-walled; norstictic acid present **Thelotrema bicavatum Nyl.**
- 11(8) Ascospores 3-septate, 15–20 µm long; thallus ecorticate
 **Thelotrema triseptatum Mangold**
 Ascospores 5–13-septate, (15–)20–50 µm long; thallus variable 12
- 12(11) Apothecia immersed; thallus with prosoplectenchymatous cortex; ascospores 15–30 µm long **Thelotrema bicinctulum Nyl.**
 Apothecia prominent; thallus ecorticate or with loose, irregular cortex and then verruculose; ascospores 25–50 µm long 13
- 13(12) Thallus ecorticate, smooth to uneven; ascospores 25–35 µm long; apothecia 0.2–0.4 mm diam. **Thelotrema infundibularis Tat. Matsumoto**
 Thallus with loose, irregular cortex, verruculose; ascospores 25–50 µm long; apothecia 0.3–0.7 mm diam. **Thelotrema capetribulense Mangold**
- 14(7) Ascospores 3-septate, 10–15 µm long; thallus cortex prosoplectenchymatous; nor-subnotatic acid present **Thelotrema configuratum (Hale) Mangold**
 Ascospores 5–17-septate, 15–70 µm long; thallus cortex irregular and loose or absent; hypostictic acid present or lichen substances absent 15

- 15(14) Hymenium interspersed; apothecia immersed-erumpent, myriotremoid; ascospores 30–40 µm long **Thelotrema parvulum Kremp.**
 Hymenium clear; apothecia immersed to prominent, ± lepadinoid with double margins; ascospores variable 16
- 16(15) Hypostictic acid present; ascospores with rather thin septa and angular lumina, I– **Thelotrema mogkolsukii Homchantara & Coppins**
Notes. This species finds a similar morphotype in *Chapsa neei* and *C. platycarpa* and molecular data are needed to confirm its position in *Thelotrema*.
 Lichen substances absent; ascospores with thin to thick septa and angular to lens-shaped lumina, usually at least weakly amyloid 17
- 17(16) Ascospores mostly over 60 µm long, with thick outer wall **Thelotrema diplotrema Nyl.**

 Synonym: *Ocellularia turgidula* Müll. Arg. [non *Thelotrema turgidulum* Vain.].
 Ascospores up to 60 µm long, with thin to thick outer wall 18
- 18(17) Apothecia immersed, 0.2–0.3 mm diam.; ascospores with rather thin septa and angular lumina and thin outer wall, 15–35 µm long, weakly amyloid **Thelotrema defossum (Müll. Arg.) Mangold**

 Synonyms: *Ocellularia demersa* Müll. Arg. [nom. nov. pro *Pyrenula clandestina* Fée]
 Apothecia erumpent to prominent, 0.3–0.8 mm diam.; ascospores with rather thick septa and lens-shaped lumina and ± thick outer wall, (20–)25–60 µm long, amyloidity variable 19
- 19(18) Ascospores (30–)40–60 µm long, usually exceeding 45 µm; excipulum yellowish to pale brown; (sub)tropical **Thelotrema pseudosubtile Mangold**
 Ascospores 20–40(–45) µm long; excipulum colourless; (subtropical to) temperate 20
- 20(19) Ascospores with thick outer walls from when young, remaining hyaline, weakly amyloid **Thelotrema succicum (H. Magn.) P. James**

 Synonym: *Ocellularia bonplandiae* var. *obliterata* Müll. Arg.
 Ascospores with thin walls in early stages, becoming partially grey-brown in old stages, ± strongly amyloid **Thelotrema subtile Tuck.**

Group 2 (ascospores transversely septate, brown)

- 1 Ascospores 150–280 × 25–35 µm, 25–35-septate, single **Thelotrema crespoae Mangold, Elix & Lumbsch**
 Ascospores 25–150 × 6–20 µm, 7–27-septate, (1–)2–8 per ascus 2
- 2(1) Ascospores (10–)12–20 µm broad 3
 Ascospores 6–12 µm broad 4
- 3(2) Stictic acid present (K+ yellow); ascospores 50–80 µm long, 6–8 per ascus **Thelotrema rockii (Zahlbr.) Hale**
 Lichen substances absent; ascospores 80–100 µm long, 1–2 per ascus **Thelotrema pidurutalagalum Hale**
- 4(2) Ascospores 17–27-septate, 60–150 µm long **Thelotrema lacteum Kremp.**
 Synonyms: *Ocellularia annulosa* Müll. Arg.; *Ocellularia cricota* F. Wilson; *Ocellularia japonica* Zahlbr.; *Ocellularia zeorina* Müll. Arg.; *Phaeotrema consimile* Müll. Arg.; *Thelotrema sitianum* Vain.
 Ascospores 7–15-septate, 25–75 µm long 5

- 5(4) Ascospores 25–45 × 6–10 µm; thallus corticate; excipulum colourless **Thelotrema subtile** Tuck.
 Ascospores 35–75 × 9–13 µm; thallus ecorticate; excipulum pale brown **Thelotrema pachysporum** Nyl.
 Synonyms: *Thelotrema cavatum* var. *dolichosporum* Nyl.; *Thelotrema exalbium* Stirt.; *Thelotrema galactinum* Vain.; *Thelotrema limae* Vain.; *Thelotrema palmense* Vain.
- Group 3 (ascospores muriform, hyaline)*
- 1 Ascospores 60–300 µm long 2
 Ascospores 10–60 µm long 22
- 2(1) Isidia present; thallus verrucose; apothecia sessile; ascospores 180–300 × 15–25 µm, more than 10 times as long as broad; stictic acid present (K+ yellow) **Thelotrema isidiophorum** (Kremp.) Zahlbr.
 Isidia absent; thallus, apothecia, ascospores and chemistry variable but ascospores less than 10 times long as broad 3
- 3(2) Hymenium inspersed 4
 Hymenium clear 5
- 4(3) Norstictic acid present (K+ yellow forming red crystals); excipulum pale; thallus ecorticate **Thelotrema aff. porinaceum** Müll. Arg.
Notes. This material differs from typical *Thelotrema porinaceum* in the inspersed hymenium. In other cases this is considered a specific feature, but we await the results of molecular studies to test this hypothesis.
 Psoromic acid present (P+ yellow); excipulum dark brown to brown-black in upper half; thallus with irregular, loose cortex . **Thelotrema saxicola** (Vain.) Salis.
Notes. The chemistry of this species is unusual for the *Chapsa-Thelotrema* clade; however, the type material has distinct periphysoids. Molecular data are required to clarify the systematic affinities of this taxon.
- 5(3) Norstictic or stictic acid present (K+ yellow) 6
 Psoromic acid (P+ yellow), hypoprotocetraric or 4-*O*-methylhypoprotocetraric acids present or lichen substances absent (P–) 12
- 6(5) Norstictic acid present (K+ yellow forming red crystals) 7
 Stictic acid present (K+ persistently yellow) 10
- 7(6) Ascospores with rather thick septa and lens-shaped lumina, I+ violet-blue; apothecia sessile 8
 Ascospores with rather thin septa and angular lumina, I–; apothecia erumpent to prominent 9
- 8(7) Ascospores 80–100 × 15–25 µm; apothecia 1–1.5 mm diam. **Thelotrema weberi** Hale
 Ascospores 170–250 × 30–40 µm; apothecia 0.5–0.8 mm diam. **Thelotrema subweberi** Sipman
- 9(7) Thallus ecorticate; ascospores 1–2 per ascus **Thelotrema porinaceum** Müll. Arg.
 Thallus with irregular, loose cortex; ascospores 2–4 per ascus **Thelotrema eungellaense** Mangold, Elix & Lumbsch
- 10(6) Ascospores I+ violet-blue, 2 per ascus, 100–150 µm long **Thelotrema conferendum** Hale
 Ascospores I–, (2–)4–8 per ascus, 60–100(–130 µm) long 11

- 11(10) Thallus verrucose, with a paraplectenchymatous cortex; apothecia 1–2 mm diam., with pore-like opening **Thelotrema thesaurum Mangold**
 Thallus uneven, ecorticate; apothecia 0.7–1.1 mm diam., with wider opening **Thelotrema hawaiiense (Hale) Hale**
- 12(5) Ascospores 4–8 per ascus, 40–80 × 12–20(–25) µm; apothecial disc flesh-coloured **Thelotrema adjectum Nyl.**
 Ascospores 1–4 per ascus, (60–)80–250 × (15–)20–50 µm; apothecial disc white pruinose 13
- 13(12) Thallus ecorticate; psoromic acid present (P+ yellow) or lichen substances absent 14
 Thallus with a prosoplectenchymatous or irregular and loose cortex; hypoprotocetraric or 4-*O*-methylhypoprotocetraric acid present or lichen substances absent 15
- 14(13) Psoromic acid present (P+ yellow); ascospores I–; apothecia 0.5–1.2 mm diam. **Thelotrema foveolare Müll. Arg.**
Notes. The chemistry of this species is unusual for the *Chapsa-Thelotrema* clade; however, the type material features distinct periphysoids. Molecular data are required to clarify the systematic affinities of this taxon.
 Lichen substances absent; ascospores I+ violet-blue; apothecia 0.3–0.6 mm diam. **Thelotrema conveniens Nyl.**
- 15(13) Hypoprotocetraric or 4-*O*-methylhypoprotocetraric acid present; thallus verrucose, with a prosoplectenchymatous cortex; ascospores 1 per ascus 16
 Lichen substances absent; thallus smooth to uneven or rarely verrucose, with an irregular, loose cortex; ascospores 1–4 per ascus 17
- 16(15) Apothecia 0.2–0.3 mm diam.; 4-*O*-methylhypoprotocetraric acid present **Thelotrema oclusum Nyl.**
 Apothecia 0.6–1 mm diam.; hypoprotocetraric acid present **Thelotrema cinereovirens Kremp.**
- 17(15) Ascospores single; excipulum pale to dark brown 18
 Ascospores 1–4 per ascus; excipulum colourless 19
- 18(17) Ascospores I+ violet-blue; excipulum dark brown **Thelotrema similans Nyl.**
 Ascospores I–; excipulum pale brown **Thelotrema capense Zahlbr.**
- 19(17) Ascospores 1–2 per ascus, up to 220 × 45 µm, with rather thin septa and angular lumina 20
 Ascospores 1–4 per ascus, up to 120 × 25 µm, with rather thick septa and rounded lumina 21
- 20(19) Thallus verrucose; apothecia erumpent **Thelotrema rugulatum Nyl.**
 Thallus smooth to uneven; apothecia immersed **Thelotrema armellense Patw., Sethy & Nagarkar**
- 21(19) Ascospores thick-walled, remaining hyaline; apothecia prominent, up to 1.8 mm diam. **Thelotrema lepadinum (Ach.) Ach.**
Synonyms: *Thelotrema aemulans* Kremp.; *Thelotrema flavescens* Darb.; *Thelotrema inclusum* Funk; *Thelotrema obconicum* Räsänen; *Thelotrema osornense* C. W. Dodge; *Thelotrema periphysatum* Darb.; *Volvaria truncigena* D.C.
 Ascospores thin-walled, sometimes becoming grey-brown when old; apothecia immersed, up to 0.7 mm diam. **Thelotrema lepademersum Nagarkar, Sethy & Patw.**
Synonym: *Thelotrema subarmellense* A. Frisch [nom. inval.].

- 22(1) Norstictic or stictic acid present (K+ yellow) 23
 Lichen substances absent 33
- 23(22) Norstictic acid present (K+ yellow forming red crystals); ascospores submuriform,
 18–22 × 6–9 µm **Thelotrema canarense Patw. & C. Kulk.**
 Stictic acid present (K+ persistently yellow) 24
- 24(23) Ascospores (30–)40–60 × (10–)12–15 µm, usually exceeding 40 × 12 µm; (1–)2–
 6(–8) per ascus; apothecia prominent 25
 Ascospores 15–40 × 5–10(–12) µm, 8 per ascus; apothecia usually erumpent 26
- 25(24) Thallus ecorticate; apothecia 0.5–1 mm diam.; ascospores 1–2 per ascus
 [*Topeliopsis novae-zelandiae* (Szatala) Lumbsch & Mangold]
 Thallus with loose, irregular cortex; apothecia 1–2 mm diam.; ascospores 6–8 per
 ascus **Thelotrema leucophthalmum Nyl.**
 Synonym: *Leptotrema albocoronata* C. Knight.
- 26(24) Thallus conspicuously folded; apothecia with pore-like opening
 **Thelotrema zimbabwense A. Frisch**
 Thallus not folded; apothecia with wider opening 27
- 27(26) Thallus ecorticate; apothecia 0.2–0.3 mm diam.
 **Thelotrema cyphelloides Müll. Arg.**
 Thallus with prosoplectenchymatous cortex; apothecia usually larger 28
- 28(27) Apothecia 0.25–0.35 mm diam., myriotremoid; ascospores up to 40 µm long
 **Thelotrema myriocarpum Fée**
 Apothecia (0.3–)0.4–1(–1.8 mm), variable but not myriotremoid; ascospores not
 exceeding 30 µm 29
- 29(28) Apothecia 0.8–1.8 mm diam., with recurved, lobulate thalline margin, more or less
 aggregate **Thelotrema cupulare Müll. Arg.**
 Synonym: *Thelotrema dissultum* Hale.
 Apothecia 0.3–1 mm diam., with erect to inclined, entire to slightly fissured margin,
 solitary 30
- 30(29) Ascospores I+ violet-blue 31
 Ascospores I– 32
- 31(30) Ascospores 10–15 µm long, with 3 transverse and 0–1 longitudinal septa per segment
 **Thelotrema alboannuliforme Nagarkar, Sethy & Patw.**
 Ascospores 15–24 µm long, with 3–7 transverse and 0–1 longitudinal septa per
 segment **Thelotrema albolivaceum Vain.**
- 32(30) Ascospores 12–20 × 8–12 µm, less than 2 times as long as broad; apothecia promi-
 nent **Thelotrema crassisporum Mangold**
 Ascospores 18–30 × 6–10 µm, about 3 times as long as broad; apothecia erumpent
 **Thelotrema subexpallesces Nagarkar, Sethy & Patw.**
- 33(22) Ascospores 40–80 µm long, usually exceeding 50 µm
 **Thelotrema adjectum Nyl.**
 Ascospores 12–40(–45) µm long 34
- 34(33) Ascospores 12–20 µm broad **Thelotrema defectum Hale ex R. C. Harris**
 Ascospores 4–10 µm broad 35

- 35(34) Ascospores 25–35 × 8–10 μm, weakly I+ violet-blue; apothecia with pore-like openings **Thelotrema subadjectum Mangold**
Ascospores 12–25 × 4–9 μm, I–; apothecia with wider openings 36
- 36(35) Thallus corticate; ascospores 4 per ascus, 12–16 × 4–6 μm, with 3–5 × 0–1 septa **Thelotrema confertum Nagarkar, Sethy & Patw.**
Thallus ecorticate; ascospores 8 per ascus 37
- 37(36) Ascospores 10–15 × 4–6 μm, with 3–5 × 0–2 septa
. **Thelotrema kalarensis Nagarkar, Sethy & Patw.**
Ascospores 17–25 × 6–9 μm, with 5–9 × 0–2 septa
. **Thelotrema polythecium Nagarkar, Sethy & Patw.**

Group 4 (ascospores muriform, brown)

- 1 Hymenium inspersed 2
Hymenium clear 4
- 2(1) Psoromic acid present (P+ yellow); excipulum dark brown to brown-black in upper half **Thelotrema saxicola (Vain.) Salis.**
Lichen substances absent; excipulum colourless 3
- 3(2) Ascospores single, up to 250 × 50 μm **Thelotrema oleosum Mangold**
Ascospores 8 per ascus, up to 35 × 17 μm **Thelotrema leiospodium Nyl.**
- 4(1) Norstictic acid present (K+ yellow forming red crystals); periphysoids absent; ascospores up to 400 μm long
. **Thelotrema gallowayanum Mangold, Elix & Lumbsch**
Hypoprotocetraric acid or canescens unknown present or lichen substances absent (K–); periphysoids present and distinct; ascospores up to 250 μm long 5
- 5(4) Ascospores 50–70 μm broad, single; thallus cortex prosoplectenchymatous; apothecia sessile, with pore-like opening **Thelotrema africanum (Hale) Hale**
Ascospores 15–45 μm broad, 1–4(–8) per ascus; thallus ecorticate or with irregular, loose cortex; apothecia immersed to prominent, if prominent with wider opening 6
- 6(5) Apothecia immersed, 0.2–0.3 mm diam.; disc with dark red to purplish tinge; ascospores 4–8 per ascus, 60–80 × 12–17 μm
. **Thelotrema rhodothecium Vain.**
Ascospores erumpent to prominent, 0.3–1.5 mm diam.; disc grey-brown and usually white-pruinose, lacking red or purple tinge; ascospores variable 7
- 7(6) Hypoprotocetraric acid present; thallus with paraplectenchymatous cortex; ascospores single, up to 250 μm long, amyloid
. **Thelotrema hypoprotocetraricum (Hale) Hale**
Canescens unknown present or lichen substances absent; thallus ecorticate or with irregular, loose cortex; ascospores 1–2(–8) per ascus, up to 200 μm long, non-amyloid or rarely amyloid 8
- 8(7) Canescens unknown present **Thelotrema canescens Tat. Matsumoto**
Lichen substances absent (*Thelotrema monosporum* complex) 9
- 9(8) Ascospores 120–200 μm long, 1–2 per ascus 10
Ascospores 60–120 μm long, (1–)2–8 per ascus 11

- 10(9) Apothecia prominent to almost sessile, with thick thalline rims and persistently narrow pores; non-amyloid; thallus with loose, irregular cortex, verrucose, grey-green to greenish yellow **Thelotrema saxatile C. Knight**
 Synonym: *Thelotrema macrosporum* P. M. Jørg. & P. James.
 Apothecia erumpent to prominent, crateriform with thin thalline rim and with initially narrow pore that eventually widens or erodes to expose the disc and inner, free excipulum; thallus ecorticate, endoperidermal and usually farinose, white to pale yellow **Thelotrema monosporoides Nyl.**
 Synonyms: *Ascidium attenuatum* Müll. Arg.; *Thelotrema monosporum* [sic] C. Knight; *Thelotrema monosporum* Kremp. [nom. illeg., non Nyl.]; *Thelotrema monospermum* R. C. Harris.
- 11(9) Thallus with loose, irregular cortex, yellow-olive to olive-grey; apothecia immersed-erumpent, distinctly lepadinoid with double margin; ascospores usually hyaline but becoming pale brown when old
 **Thelotrema lepademersum Nagarkar, Sethy & Patw.**
 Synonym: *Thelotrema subarmellense* A. Frisch [nom. inval.].
 Thallus ecorticate, endoperidermal and usually farinose, white to pale yellow; apothecia erumpent to prominent, indistinctly lepadinoid with initially narrow pores that eventually widen or erode to expose the discs and inner, free excipula; ascospores becoming (dark) brown 12
- 12(11) Ascospores remaining hyaline for a long time and \pm amyloid, becoming brown in later stages, with rather thick walls and septa and rounded lumina, usually with (1–)2–3(–4) locules per segment in side view near the middle, fusiform with \pm subacute ends, proximal end often tapering, 2–8 per ascus
 **Thelotrema lepadodes Tuck.**
 Synonyms: *Leptotrema bisporum* Szatala; *Leptotrema pinarocarpum* Zahlbr.; *Thelotrema aemulum* Müll. Arg.; *Thelotrema aquilinum* Vain.; *Thelotrema disciforme* Leight.; *Thelotrema monosporum* f. *album* Nyl.; *Thelotrema monosporum* var. *patulum* Nyl.; *Thelotrema rarotongae* Räsänen; *Thelotrema tantali* Zahlbr.
 Ascospores soon becoming brown, non-amyloid, with rather thin walls and septa and \pm angular lumina, usually with 4–6 locules per segment in side view near the middle, oblong-ellipsoid with \pm rounded ends, 1–4 per ascus
 **Thelotrema monosporum**

Topeliopsis Kantvilas & Vězda

- 1 Ascospores transversely septate 2
 Ascospores muriform 8
- 2(1) Stictic acid (K+ yellow) or lecanoric acid (C+ red) present; ascospores 3–15-septate, 12–60 \times 4–10 μ m, with relatively thin septa, hyaline or brown, I– or weakly I+ violet-blue 3
 Lichen substances absent; ascospores 15–31-septate, (50–)60–200 \times 10–20 μ m, distoseptate, I+ violet-blue 6
- 3(2) Lecanoric acid present (C+ red); apothecia with numerous marginal teeth
 . **Topeliopsis lomatae (Messuti, Lumbsch & Vězda) Messuti & Mangold**
 Stictic acid present (K+ yellow); apothecia with few marginal teeth 4
- 4(3) Ascospores brown, 3–7-septate, 12–25 \times 4–6 μ m
 **Topeliopsis kantvilasii Mangold & Lumbsch**
 Ascospores hyaline, 3–15-septate, 15–60 \times 5–10 μ m 5

- 5(4) Ascospores 3–7-septate, 15–30 × 5–7 µm
 [*Chapsa minor* (Kantvilas & Vězda) Mangold & Lumbsch]
 Ascospores 9–15-septate, 35–60 × 6–10 µm
 **Topeliopsis darlingtonii A. Frisch & Kalb**
- 6(2) Apothecia immersed, with distinctly layered margin forming concentric rings of
 excipula; ascospores up to 200 × 20 µm; thallus thick, waxy
 [*Chapsa pseudoexanthismocarpa* (Patw. & C. R. Kulk.) Rivas Plata & Lücking*]
 Apothecia prominent to sessile, with denticulate margin not forming concentric
 rings; ascospores usually up to 150 × 15 µm; thallus thin 7
- 7(6) Ascospores 19–35-septate, 90–130 × 8–12 µm, ends acute to subacute
 **Topeliopsis acutispora Kalb**
 Ascospores 15–25-septate, 55–100 × 10–16 µm, ends rounded
 **Topeliopsis subdenticulata (Zahlbr.) A. Frisch & Kalb**
- 8(1) Ascospores 30–80 × 10–20(–25) µm, 4–8 per ascus 9
 Ascospores (60–)80–180 × (15–)20–50 µm, 1–2(–8) per ascus 13
- 9(8) Stictic acid present (K+ yellow) 10
 Succinprotocetraric, fumarprotocetraric, and protocetraric acids present (P+ red) or
 lichen substances absent 11
- 10(9) Thallus ecorticate, smooth; apothecia sessile, 0·5–1·2 mm diam., with up to 0·5 mm
 wide opening and lobulate margin; ascospores less than 20 µm wide
 **Topeliopsis tasmanica (Kantvilas & Vězda) Mangold**
 Thallus with loose, irregular cortex, verrucose; apothecia prominent, 0·4–0·7 mm
 diam., with up to 0·15 mm wide pore and fissured margin; ascospores over 20 µm
 wide **Topeliopsis guaiquinimae (Sipman) Rivas Plata & Mangold***
 Synonym: *Thelotrema meridense* Hale [non *Topeliopsis meridensis* Kalb & A. Frisch].
- 11(9) Lichen substances absent; apothecia up to 1 mm wide; ascospores I+ violet-blue . .
 **Topeliopsis decorticans (Müll. Arg.) A. Frisch & Kalb**
 Synonym: *Topeliopsis corticola* Kalb.
 Succinprotocetraric, fumarprotocetraric, and protocetraric acids present (P+ red);
 apothecia up to 3 mm wide, usually lamellate when mature; ascospores I– or I+
 violet-blue 12
- 12(11) Ascospores I+ violet-blue, up to 15 µm broad; apothecia up to 1·5 mm wide
 [*Chapsa asteliae* (Kantvilas & Vězda) Mangold]
 Ascospores I–, up to 20 µm broad; apothecia up to 3 mm wide
 [*Chapsa lamellifera* (Kantvilas & Vězda) Mangold]
- 13(8) Hymenium interspersed
 [*Chapsa meridensis* (Kalb & Frisch) Lücking, Lumbsch & Rivas Plata]
 Hymenium clear 14
- 14(13) Stictic and/or hypostictic acid present 15
 Lichen substances absent 21
- 15(14) Ascospores up to 100 µm long, (1–)2–4 per ascus, I– 16
 Ascospores up to 200 µm long, 1–2(–8) per ascus, I+ violet-blue 17
- 16(15) Thallus much reduced, visible only around apothecia; ascospores ellipsoid with
 rounded ends **Topeliopsis athallina Lumbsch & Mangold**
 Thallus well-developed; ascospores fusiform with acute ends
 **Topeliopsis tasmanica (Kantvilas & Vězda) Mangold**

- 17(15) Ascospores 8 per ascus **Topeliopsis patagonica Mangold & Lumbsch**
 Ascospores 1–2 per ascus 18
- 18(17) Hypoconstrictic acid major substance present, stictic acid absent; apothecial margin
 fissured; thallus cortex prosoplectenchymatous
 **Topeliopsis elixii A. Frisch & Kalb**
 Stictic acid major substance present; apothecial margin lobulate; thallus cortex
 absent or loose and irregular 19
- 19(18) Apothecia up to 2 mm diam., with rather large, flabellate marginal lobules
 **Topeliopsis novae-zelandiae (Szatala) Lumbsch & Mangold**
 Apothecia up to 1.5 mm diam., with smaller, denticulate marginal lobules 20
- 20(19) Apothecia up to 0.8 mm diam.; thallus with loose, irregular cortex
 **Topeliopsis azorica (P. James & Purvis) Coppins & Aptroot**
Notes. This stictic-chemotype of *Topeliopsis azorica* possibly represents a different species but we await
 the results of molecular studies to test this hypothesis.
 Apothecia up to 1.5 mm diam.; thallus ecorticate
 **Topeliopsis macrocarpa (C. W. Dodge) Mangold & Lumbsch**
 Synonym: *Chroodiscus australis* Kantvilas & Vězda.
- 21(14) Apothecia immersed, with distinctly layered margin forming concentric rings of
 excipula; thallus thick, waxy 22
 Apothecia prominent to sessile, with denticulate margin not forming concentric
 rings; thallus thin, often inconspicuous 23
- 22(21) Ascospores amyloid; apothecia to 1.5 mm diam.
 [*Chapsa scabiomarginata* (Hale) Rivas Plata & Lücking*]
 Ascospores non-amyloid; apothecia to 0.8 mm diam.
 [*Chapsa laceratula* (Müll. Arg.) Rivas Plata & Lücking*]
- 23(21) Thallus verrucose; apothecia with entire margins
 **Topeliopsis tuberculifera (Vain.) Rivas Plata & Mangold***
 Thallus smooth; apothecia with fissured to denticulate-lobulate margins 24
- 24(23) Base of apothecia pale
 **Topeliopsis azorica (P. James & Purvis) Coppins & Aptroot**
 Base of apothecia conspicuously reddish brown and corticate 25
- 25(24) Ascospores with thickened septa, often brownish when old and producing ascoco-
 nidia; apothecia up to 1.2 mm diam. with up to 0.5 mm wide pores
 **Topeliopsis muscigena (Stiz.) Kalb**
 Synonym: *Thelotrema indicum* Hale.
 Ascospores with thin septa, remaining hyaline, not forming ascocidia; apothecia
 up to 0.4 mm diam. with up to 0.2 mm wide pores
 **Topeliopsis monospora (Aptroot) Rivas Plata & Lücking***

New species and new combinations

(Fig. 13)

***Acanthotrema frischii* Lücking sp. nov.**

Sicut *Acanthotrema brasiliense* sed ascosporis submuri-
 formibus differt.

Typus: Cameroon, East Province, Yokaduma, April
 1999, *Frisch & Tannjong Idi* 99/Ka40 (hb. Frisch!—
 holotypus).

Thallus with prosoplectenchymatous cor-
 tex, smooth, olive green.

Apothecia immersed-erumpent, at first
 fissurinoid but becoming round to irregular
 in outline when mature, 1–2 mm diam.,
 with irregular, erect to partially recurved,

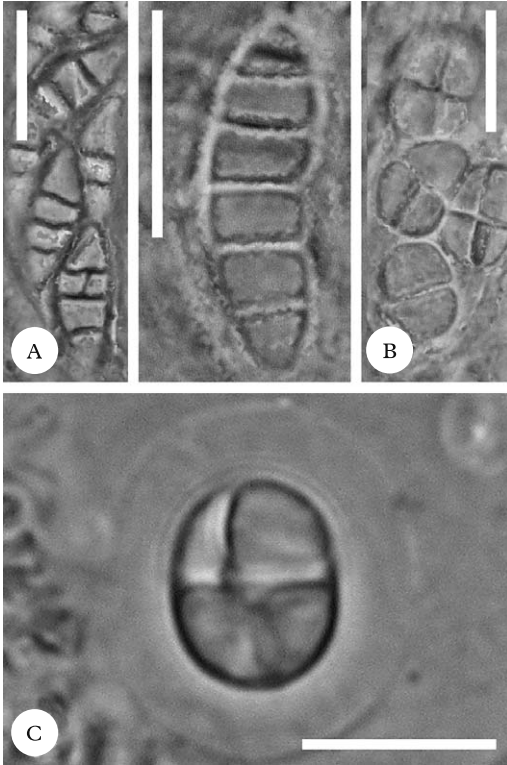


FIG. 13. *Acanthotrema*, ascospores. A, *A. brasilianum*, form with small 3-septate ascospores (left), form with larger 5-septate ascospores (right); B & C, *A. frischii*. Scales: A – C = 10 μ m.

marginal lobules. *Excipulum* pale, prosoplectenchymatous, 20–30 μ m thick, with apically spinulose periphysoids up to 15 μ m long. *Hymenium* clear. *Paraphyses* apically spinulose. *Ascospores* 8 per ascus, broadly oval with blunt ends, submuriform with 3–4 transverse and 0–1 longitudinal septa per segment, with completely thin septa and walls, 8–12 \times 5–6 μ m, hyaline, with up to 4 μ m thick halo.

Secondary chemistry. No lichen substances detected.

Etymology. This new species is named after Andreas Frisch for his significant contributions to the systematics of *Graphidaceae* (*Thelotremataceae*).

Notes. This new species was considered to represent the neotropical *Acanthotrema bra-*

silianum (Frisch *et al.* 2006). However, as Frisch *et al.* (2006) noted, the ascospores of the African material are invariably submuriform, whereas those of neotropical specimens are predominantly 3-septate, but with some submuriform ascospores intermixed in the material from south-eastern Brazil. The main character separating the African *A. frischii* from the neotropical *A. brasilianum* is the form of the ascospores: broadly oval with blunt ends and thick halo in *A. frischii* and fusiform with acute ends and thin or indistinct halo in *A. brasilianum*.

***Chapsa aggregata* (Hale) Sipman & Lücking comb. nov.**

Phaeotrema aggregatum Hale, *Smiths. Contr. Bot.* 16: 29 (1974).— *Thelotrema aggregatum* (Hale) Hale, *Mycotaxon* 11: 131 (1980).

***Chapsa albida* (Nyl.) Lücking & Sipman comb. nov.**

Thelotrema albidum Nyl., *Acta Soc. Sci. Fenn.* 7: 451 (1863).— *Ocellularia albida* (Nyl.) Zahlbr., *Catal. Lich. Univ.* 2: 582 (1923).

***Chapsa albomaculata* (Sipman) Sipman & Lücking comb. nov.**

Thelotrema albomaculatum Sipman in Sipman & Aptroot, *Trop. Bryol.* 5: 89 (1992).

***Chapsa boninensis* (Tat. Matsumoto) Rivas Plata & Mangold comb. nov.**

Thelotrema boninense Tat. Matsumoto, *J. Hattori Bot. Lab.* 88: 17 (2000).

***Chapsa chionostoma* (Nyl.) Rivas Plata & Mangold comb. nov.**

Thelotrema chionostomum Nyl., *Ann. Sci. Nat. Bot., Ser. 4*, 19: 329 (1863).— *Ocellularia chionostoma* (Nyl.) Riddle, *Bull. Torrey Bot. Club* 44: 325 (1917).

***Chapsa crispata* (Müll. Arg.) Rivas Plata & Mangold comb. nov.**

Ocellularia crispata Müll. Arg., *J. Linn. Soc. London* 30: 452 (1895).

Chapsa elabens (Müll. Arg.) Rivas Plata & Mangold comb. nov.

Ocellularia elabens Müll. Arg., *J. Linn. Soc. London* **30**: 452 (1895).

Chapsa imperfecta (Hale) Rivas Plata & Lücking comb. nov.

Thelotrema imperfectum Hale, *Bull. Brit. Mus. Nat. Hist., Bot. Ser.* **8**: 255 (1981).

Chapsa laceratula (Müll. Arg.) Rivas Plata & Lücking comb. nov.

Thelotrema laceratum Müll. Arg., *Flora* **70**: 399 (1887).

Chapsa magnifica (Berk. & Broome) Rivas Plata & Mangold comb. nov.

Platygrapha magnifica Berk. & Broome, *J. Linn. Soc. (Bot.)* **14**: 110 (1875).—*Ocellularia magnifica* (Berk. & Broome) Sherwood, *Mycotaxon* **3**: 234 (1976).

Chapsa meghalayensis (Patw. & Nagarkar) Lumbsch & Divakar comb. nov.

Leptotrema meghalayense Patw. & Nagarkar, *Bio-vigyanam* **6**: 3 (1980).—*Myriotrema meghalayense* (Patw. & Nagarkar) D. D. Awasthi, *Biblioth. Lichenol.* **40**: 180 (1991).

Chapsa meridensis (Kalb & A. Frisch) Lücking, Lumbsch & Rivas Plata comb. nov.

Topeliopsis meridensis Kalb & A. Frisch, in Frisch & Kalb, *Lichenologist* **38**: 42 (2006).

Chapsa mirabilis (Zahlbr.) Lücking comb. nova;

Phaeographina mirabilis Zahlbr. in Handel-Mazetti, *Symb. Sin.* **3**: 60 (1930).—*Leptotrema mirabile* (Zahlbr.) Hale, *Smiths. Contr. Bot.* **38**: 54 (1978); *Thelotrema mirabile* (Zahlbr.) Hale, *Mycotaxon* **11**: 132 (1980).

Chapsa neei (Hale) Mangold & Lücking comb. nov.

Ocellularia neei Hale, *Smiths. Contr. Bot.* **38**: 25 (1978).—*Thelotrema neei* (Hale) Hale, *Mycotaxon* **11**: 132 (1980).

Chapsa paralbida (Riddle) Rivas Plata & Lücking comb. nov.

Thelotrema paralbicum Riddle, in Britton & Millspaugh, *The Bahama Flora* (New York): 544 (1920).

Chapsa pseudoexanthismocarpa (Patw. & C. R. Kulk.) Rivas Plata & Lücking comb. nov.

Ocellularia pseudoexanthismocarpa Patw. & C. R. Kulk., *Norw. J. Bot.* **24**: 130 (1977).—*Thelotrema pseudoexanthismocarpum* (Patw. & C. R. Kulk.) Hale, *Mycotaxon* **11**: 132 (1980).

Chapsa pulvereodisca (Hale) Rivas Plata & Mangold comb. nov.

Thelotrema pulvereodiscum Hale, *Bull. Brit. Mus. Nat. Hist., Bot. Ser.* **8**: 268 (1981).

Chapsa scabiomarginata (Hale) Rivas Plata & Lücking comb. nov.

Thelotrema scabiomarginatum Hale, *Bull. Brit. Mus. Nat. Hist., Bot. Ser.* **8**: 269 (1981).

Chapsa waasii (Hale) Sipman & Lücking comb. nov.

Thelotrema waasii Hale, *Bull. Brit. Mus. Nat. Hist., Bot. Ser.* **8**: 270 (1981).

Fibrillithecis argentea (Müll. Arg.) Rivas Plata & Lücking comb. nov.

Thelotrema argenteum Müll. Arg., *Hedwigia* **30**: 50 (1891).

Fibrillithecis carneodisca (Hale) Rivas Plata & Lücking comb. Nov.

Ocellularia carneodisca Hale, *Mycotaxon* **3**: 173 (1975).

Fibrillithecis confusa Lücking, Kalb & Rivas Plata sp. nov.

Sicut *Fibrillithecis brasiliano* sed ascosporis submuri-formibus differt.

Typus: Brazil. São Paulo, Praia de Peruibe near Itanhaém, in a dense mangrove forest on *Laguncularia racemosa*, February 1979, Kalb s.n. (hb. Kalb 37602!—holotypus).

(Fig. 8)

Thallus with loose, irregular cortex, smooth, pale to dark olive-grey to almost white; *isidia* usually abundant, cylindrical,

erect, up to 2 mm high and 0.25 mm thick, with rounded white top when young but becoming brown-tipped with age.

Apothecia erumpent to prominent (or sometimes sessile), 0.7–1.3 mm diam., with steep sides and flattened top and usually depressed pore region with narrow pore surrounded by dark, fibrillate rim. *Excipulum* hyaline, prosoplectenchymatous, 50–150 µm thick, terminating in long fibrils overarched the hymenium. *Hymenium* clear. *Ascospores* 8 per ascus, broadly ellipsoid, submuriform with 3–4 transverse and 0–2 longitudinal septa per segment, with thick septa and walls and rounded lumina, 14–24 × 8–12 µm, hyaline, amyloid.

Secondary chemistry. Psoromic, subpsoromic, and 2'-*O*-demethylpsoromic acids.

Notes. As discussed in the introduction to the key to *Fibrillithecis* species, the concept of *F. insignis* by Frisch *et al.* (2006) included a type that is conspecific with a very similar taxon but with *Myriotrema* type excipulum (lacking fibrils), *M. hartii*. As a consequence, the fibrillate taxon with isidia required a separate formal description. We choose the epithet *confusa* as it reflects the confusion regarding the correct identification of these isidiate species with psoromic acid.

***Fibrillithecis diminuta* (Hale) Rivas Plata & Lücking comb. nov.**

Thelotrema diminitum Hale, *Phytologia* 27: 494 (1974).

***Fibrillithecis eximia* (R. C. Harris) Rivas Plata & Lücking comb. nov.**

Thelotrema eximium R. C. Harris, *Some Florida Lichens*: 97 (1990).

***Fibrillithecis fissurata* (Nagarkar & Hale) Rivas Plata & Lücking comb. nov.**

Thelotrema fissuratum Nagarkar & Hale, *Mycotaxon* 35: 445 (1989).

***Fibrillithecis gibbosa* (H. Magn.) Rivas Plata & Lücking comb. nov.**

Thelotrema gibbosum H. Magn. in Magnusson & Zahlbruckner, *Ark. Bot.* 31A(1): 53 (1943).

***Leucodecton desquamescens* (Vain.) Lücking comb. nov.**

Thelotrema desquamescens Vain., *Bot. Magaz. Tokyo* 35: 71 (1921).—*Leptotrema desquamescens* (Vain.) Zahlbr., *Catal. Lich. Univ.* 2: 633 (1923).

***Leucodecton anamalaiense* (Patw. & C. R. Kulk.) Rivas Plata & Lücking comb. nov.**

Thelotrema anamalaiense Patw. & C. R. Kulk., *Norw. J. Bot.* 24: 127 (1977).—*Myriotrema anamalaiense* (Patw. & C. R. Kulk.) Hale, *Mycotaxon* 11: 132 (1980).

***Leucodecton expallescens* (Nyl.) Rivas Plata & Lücking comb. nov.**

Thelotrema expallescens Nyl., *Flora* 59: 560 (1876).

***Leucodecton oxysporum* (Redinger) Lücking comb. nov.**

Leptotrema oxysporum Redinger, *Hedwigia* 73: 63 (1933).

***Leucodecton peninsulae* (Hale) Rivas Plata & Lücking comb. nov.**

Myriotrema peninsulae R.C. Harris, *Some Florida Lichens* (New York): 90 (1990).

***Leucodecton phaeosporum* (Nyl.) Rivas Plata & Lücking comb. nov.**

Thelotrema phaeosporum Nyl., *Ann. Sci. Nat. Bot., Sér.* 4: 242 (1859).—*Leptotrema phaeosporum* (Nyl.) Müll. Arg., *Flora* 65: 499 (1882); *Myriotrema phaeosporum* (Nyl.) Hale, *Mycotaxon* 11: 134 (1980).

***Schizotrema cryptotrema* (Nyl.) Rivas Plata & Mangold comb. nov.**

Thelotrema cryptotrema Nyl., *Ann. Sci. Nat. Bot., Sér.* 5, 7: 318 (1867).—*Ocellularia cryptotrema* (Nyl.) Kalb, *Lichenes Neotropici*, Fasc VII: no. 283 (1983).

***Thelotrema patwardhanii* (Hale) Rivas Plata & Mangold comb. nov.**

Ocellularia patwardhanii Hale, *Mycotaxon* 7: 379 (1978).

***Topeliopsis guaiquinimae* (Sipman) Rivas Plata & Mangold comb. nov.**

Thelotrema guaiquinimae Sipman, *Trop. Bryol.* 6: 12 (1992).

Topeliopsis monospora (Aptroot) Rivas Plata & Lücking comb. nov.

Ramonia monospora Aptroot, in Aptroot et al., *Biblioth. Lichenol.* **64**: 170 (1997).

Topeliopsis tuberculifera (Vain.) Rivas Plata & Mangold comb. nov.

Thelotrema tuberculiferum Vain., *Ann. Acad. Sci. Fenn., Ser. A*, **6**(7): 136 (1915).

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