

THELOTREMA

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Thelotrema Ach., *Methodus* 130 (1803); from the Greek *thele* (a nipple) and *trema* (an opening or hole), in reference to the morphology of the ascomata in the type species.

Type: *T. lepadinum* (Ach.) Ach.

Antrocarpum G.Mey., *Nebenst. Beschäft. Pflanzenk.* 1: 326 (1825), *nom. illeg.*, based on *Lichen lepadinus* Ach. [= *T. lepadinum* (Ach.) Ach.]

Brassia A.Massal., *Atti Reale Ist. Veneto Sci. Lett. Arti*, ser. 3, 5: 259 (1860). T: *Brassia porinoides* (Mont. & Bosch) A.Massal. [= *T. porinoides* Mont. & Bosch]

Thallus immersed to superficial, greyish to greenish or olive, with yellow, brown or white tones. Thallus ecorticate, or with a protocortex or a true cortex. Photobiont trentepohlioid. Prothallus thin to indistinct, brown. Ascomata \pm rounded, rarely slightly irregular, perithecioid or apothecioid, rarely becoming \pm indistinctly chroodiscoid. Proper exciple \pm free, rarely fused. Hymenium non-amyloid; paraphyses parallel to \pm distinctly interwoven, usually unbranched, rarely sparingly branched; tips slightly to distinctly thickened; lateral paraphyses present; true columella absent; columella-like structures rarely present in fused ascomata. Epithymenium usually hyaline, occasionally greyish or brownish, rarely yellowish, egranulose or granulose. Asci 1–8-spored, clavate, non-amyloid. Ascospores 1–3-seriate, transversely septate to muriform, hyaline to yellowish or brown, non-amyloid to distinctly amyloid; ascospore wall thin to thick, smooth or occasionally crenate, non-halonate to \pm distinctly halonate. Conidiomata pycnidial, with ellipsoidal to oblong conidia (not seen in Australian species).

Chemistry: β -Orcinol depsidones present or absent.

The original circumscription of *Thelotrema* has been modified to accommodate species with non-carbonised ascomata and lateral paraphyses. Meanwhile, other species have been transferred to genera such as *Topeliopsis*, *Reimnitzia* and *Chapsa*. *Thelotrema* s. str. is characterised by perithecioid to apothecioid ascomata, with a \pm free proper exciple and lateral paraphyses.

A genus of c. 75 species, 38 are known from Australia, and 12 are thought to be endemic. Australian species occur on bark, rarely on siliceous rocks, at altitudes to 1500 m. Most are found in tropical and subtropical rainforest, coastal forest and mangroves, rarely in wet-sclerophyll forest and scrub; a minority extend into temperate regions.

G.Salisbury, *Thelotrema* Ach. sect. *Thelotrema*. 1. The *T. lepadinum* group, *Lichenologist* 5: 262–274 (1972); T.Matsumoto, Taxonomic studies of the Thelotremataceae (Graphidales, lichenized Ascomycota) in Japan (1) Genus *Thelotrema*, *J. Hattori Bot. Lab.* 88: 1–50 (2000); A.Mangold, J.A.Elix & H.T.Lumbsch, The norstictic acid containing *Thelotrema* species in Australia, *Biblioth. Lichenol.* 95: 459–470 (2007); H.T.Lumbsch, A.Mangold, M.P.Martin & J.A.Elix, J.A., Species recognition and phylogeny of *Thelotrema* species in Australia (Ostropales, Ascomycota), *Austral. Syst. Bot.* 21: 217–227 (2008).

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|----|----------------------------------------------------------------------------------------------|-----------------------|
| 1 | Ascospores transversely septate (rarely with one longitudinal septum) | 2 |
| 1: | Ascospores submuriform to muriform | 19 |
| 2 | Ascospores brown (1) | 3 |
| 2: | Ascospores hyaline, \pm distinctly pigmented only when decayed | 5 |
| 3 | Asci 1-spored; ascospores 150–280 μ m long; apices appendiculate (2) | 8. T. crespoae |
| 3: | Asci with up to 8 ascospores; ascospores to 130 μ m long; apices not appendiculate | 4 |

4	Ascospores faintly amyloid, 30–75 × 10–15 µm, with 8–18 (–20) × 1 (–2) locules (3:)	25. T. pachysporum
4:	Ascospores strongly amyloid, (50–) 70–110 (–130) × 8–12 µm, with (12–) 16–24 (–26) locules	16. T. lacteum
5	Ascospores to 23 µm long, with up to 7 (–8) locules (2:)	6
5:	Ascospores > 23 µm long, with > 8 locules	8
6	Older ascomata with a layered margin; proper exciple slightly carbonised; secondary compounds absent (5)	26. T. parvizebrinum
6:	Older ascomata without a layered margin; proper exciple not carbonised; thallus containing the stictic acid chemosyndrome	7
7	Thallus dull, ecorticate; ascomata to 0.3 mm diam.; proper exciple free in the upper part (6:)	38. T. triseptatum
7:	Thallus glossy, corticate; ascomata to 0.7 mm diam.; proper exciple completely free	2. T. albo-olivaceum
8	Ascospores > 170 µm long, with > 28 locules (5:)	9
8:	Ascospores to 170 µm long, with up to 28 locules	10
9	Asci 2–4-spored; thallus containing the protocetraric acid chemosyndrome (8)	22. T. nostalgicum
9:	Asci 4–8-spored; secondary compounds absent	23. T. nureliyum
10	Ascospores > 60 µm long, with more than 16 locules (8:)	11
10:	Ascospores to 60 µm long, with up to 16 locules	13
11	Pores > 0.3 mm diam.; proper exciple erect to recurved in older ascomata (10)	16. T. lacteum
11:	Pores to 0.3 mm diam.; proper exciple incurved to slightly erect in older ascomata	12
12	Ascospores 50–90 (–110) × 8–12 µm, with 14–20 (–22) × 1 (–2) locules; secondary compounds absent (11:)	12. T. diplotrema
12:	Ascospores 40–150 (–170) × 15–22 µm, with 14–26 (–28) locules; stictic acid chemosyndrome present	29. T. porinoides
13	Thallus K+ yellow → red, containing norstictic acid (10:)	3. T. bicavatatum
13:	Thallus K– or K+ yellow to brown, containing the stictic acid chemosyndrome, or lacking secondary compounds	14
14	Ascospores becoming brownish when old; thallus lacking secondary compounds (13:)	35. T. subtile
14:	Ascospores remaining hyaline or becoming ±yellowish; thallus containing the stictic acid chemosyndrome, or secondary compounds absent	15
15	Thallus K+ yellow to brown, containing the stictic acid chemosyndrome (14:)	16
15:	Thallus K–, lacking secondary compounds	17
16	Ascomata to c. 0.4 mm diam.; ascospores 20–35 × 5–7 µm (15)	4. T. bicinctulum
16:	Ascomata to c. 0.7 mm diam.; ascospores 25–50 × 5–10 µm	5. T. capetribulense
17	Ascospores 8–15 µm wide; ascospore wall always very thick (15:)	36. T. succicum
17:	Ascospores 5–10 µm wide; ascospore wall thin or thick	18
18	Ascospores 10–30 (–40) µm long, with 4–12 locules; ascospore wall thin (17:)	11. T. defossum
18:	Ascospores 25–60 µm long, with 7–16 locules; ascospore wall thick, often crenate	30. T. pseudosubtile
19	Asci 1–4-spored (1:)	20
19:	Asci 4–8-spored	32
20	Ascospores to 100 µm long, brown at maturity; secondary compounds absent (19)	21
20:	Ascospores > 100 µm long, hyaline or brown; secondary compounds present or absent	22
21	Asci 1–4-spored; ascospores muriform, ±thin-walled, brown, with ±rounded ends (20:)	20. T. monosporum
21:	Asci 2–4-spored; ascospores submuriform to muriform, ±thick-walled, hyaline to brownish, with ±rounded to subacute ends	18. T. lepadodes
22	Ascomata perithecioid; asci 2–4-spored; thallus containing norstictic acid (20:)	13. T. eungellaense
22:	Ascomata perithecioid or apothecioid; asci 1–2-spored; thallus containing norstictic acid, or chemistry different	23
23	Ascospores 180–350 (–400) µm long, with distinctly tapered ends (22:)	15. T. gallowayanum
23:	Ascospores to 250 µm long, with ±rounded to subacute ends	24

24	Hymenium interspersed (23:)	25
24:	Hymenium not interspersed	27
25	Ascospores persistently hyaline; post-mature ascospores rarely pale yellowish; thallus containing the norstictic acid chemosyndrome (24:)	28
25:	Ascospores greyish or yellowish brown to brown, at least in post-mature stages; thallus containing the psoromic acid chemosyndrome, or secondary compounds absent	26
26	Ascomatal pores to 0.15 mm diam.; secondary compounds absent (25:)	24. T. oleosum
26:	Ascomatal pores to 0.05 (–0.10) mm diam.; thallus containing the psoromic acid chemosyndrome	33. T. saxicola
27	Thallus K+ yellow or K+ yellow → red; containing the norstictic or psoromic acid chemosyndrome	28
27:	Thallus K–; lacking secondary compounds (24:)	29
28	Ascomata perithecioid; thallus K+ yellow → red, containing the norstictic acid chemosyndrome (27:)	28. T. porinaceum
28:	Ascomata apothecioid when mature; thallus K+ yellowish, containing the psoromic acid chemosyndrome	14. T. foveolare
29	Ascospores persistently hyaline (27:)	30
29:	Ascospores becoming brown	31
30	Ascospores non-amyloid, non-halonate (29:)	32. T. saxatile
30:	Ascospores amyloid, halonate	31. T. rugatulum
31	Ascospores amyloid, initially hyaline, becoming yellowish to brownish with age, distinctly brown usually only at late stages of maturity or in decayed ascospores (29:)	6. T. conveniens
31:	Ascospores non-amyloid, brown from early maturity	32. T. saxatile
32	Mature ascospores brown (19:)	18. T. lepadodes
32:	Mature ascospores hyaline to yellowish	33
33	Ascospores to 30 (–40) µm long (32:)	34
33:	Ascospores > 40 µm long	39
34	Ascomata emergent; thalline rim entire; ascospores 12–20 µm long (33)	7. T. crassisporum
34:	Ascomata immersed to slightly raised, if emergent, thalline rim distinctly split; ascospores (15–) 20–30 (–40) µm long	35
35	Thallus endophloeodal to epiphloeodal, corticate (34:)	36
35:	Thallus endophloeodal, ecorticate	37
36	Ascomata inconspicuous, to 0.35 mm diam.; thalline rim thin, entire (35)	21. T. myriocarpum
36:	Ascomata conspicuous, to 1.8 mm diam.; thalline rim thick, split to lacerate	9. T. cupulare
37	Ascospores 25–35 × 8–10 µm, with 10–14 transverse locules (35:)	34. T. subadjectum
37:	Ascospores 17–27 µm long, with 6–9 transverse locules	38
38	Proper exciple free; ascomatal margin ±entire; thallus containing the stictic acid chemosyndrome (37:)	10. T. cyphelloides
38:	Proper exciple fused; ascomatal margin distinctly split; secondary compounds absent	27. T. polythecium
39	Ascospores 60–120 (–130) µm long (33:)	37. T. thesaurum
39:	Ascospores to 40 µm long	40
40	Ascomata inconspicuous, to 0.4 mm diam., immersed to slightly raised (39:)	1. T. adjectum
40:	Ascomata conspicuous, to 2 mm diam., emergent	41
41:	Pores to 0.5 mm diam.; thalline rim entire to slightly eroded; secondary compounds absent (40:)	17. T. lepadinum
41	Pores to 1.5 mm diam.; thalline rim split to lacerate and whitish-pruinose; thallus containing the stictic acid chemosyndrome	19. T. leucophthalmum