

**Three new species and a new record of *Trapelia*  
(lichenized Ascomycota, Trapeliaceae) from Australia**

**John A. Elix**

Research School of Chemistry, Building 137  
Australian National University, Canberra, A.C.T. 2601, Australia

**e-mail:** John.Elix@anu.edu.au

**Patrick M. McCarthy**

64 Broadsmith St, Scullin, A.C.T. 2614, Australia

**e-mail:** pmcc2614@hotmail.com

**Abstract**

*Trapelia occidentalis* Elix, *T. rosettiformis* Elix & P.M.McCarthy and *T. terrestris* Elix & P.M.McCarthy (Trapeliaceae) are described as new from siliceous soil and rocks in southern Australia. *Trapelia placodioides* Coppins & P.James is reported from Australia for the first time, and an updated key to *Trapelia* in Australia is provided.

**Introduction**

This paper continues our investigation of *Trapelia* (lichenized Ascomycota, Trapeliaceae) species in Australia. For the more recent additions see Elix & McCarthy (2019, 2020) and references cited therein.

Eleven species of *Trapelia* have been reported from Australia (Elix & McCarthy 2019, 2020; McCarthy 2020), including the widespread, probably cosmopolitan *T. coarctata* (Sm.) M.Choisy and *T. involuta* (Taylor) Hertel, as well as the Australasian *T. macrospora* Fryday and eight Australian endemics, viz. *T. atrocarpa* Elix & P.M.McCarthy, *T. calvariana* Kantvilas & Lumbsch, *T. concentrica* Elix & P.M.McCarthy, *T. crystallifera* Kantvilas & Elix, *T. kosciuszkoensis* Elix, *T. lilacea* Kantvilas & Elix, *T. pruinosa* Elix & P.M.McCarthy and *T. thieleana* Kantvilas, Lumbsch & Elix. In this paper, three new species are described and illustrated, viz. *T. terrestris* and *T. rosettiformis* from siliceous rocks and soil in the Australian Capital Territory, New South Wales and Victoria and *T. occidentalis* from siliceous rocks in Western Australia. In addition, *Trapelia placodioides* Coppins & P.James is reported from Australia for the first time.

**New species**

**1. *Trapelia occidentalis*** Elix, sp. nov.  
Mycobank No. **MB834759**

Fig. 1

Similar to *Trapelia glebulosa* (Sm.) J.R.Laundon, but differs in having larger squamules, 0.3–1.5 mm wide, and immersed, cupuliform apothecia with pale discs.

Type: Australia, Western Australia, Porongurups National Park, slopes of Angwin Peak, 19 km ESE of Mount Barker, 34°40'S, 117°51'E, 360 m alt., on rocks in low, heathy, dry sclerophyll forest, *J.A. Elix 41321, H.T. Lumbsch & H. Streimann*, 16.ix.1994 (holotype – CANB).

*Thallus* to 50 mm wide and 0.1 mm thick, white or pale grey, squamulose; upper surface smooth, epruinose, lacking soredia; squamules, 0.3–1.5 mm wide, roundish to irregular, weakly concave to plane, discrete and dispersed, or contiguous and often linearly arranged; prothallus not apparent; medulla white, lacking calcium oxalate (H<sub>2</sub>SO<sub>4</sub>-), I-. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–12 × 5–9 μm, solitary or in pairs, triads or tetrads. *Apothecia* rare, scattered, 0.1–0.4 mm wide, cupuliform, irregularly roundish, mainly immersed, rarely becoming adnate, with a persistent thalline rim; disc deeply concave to plane, pale brown to brown, epruinose. *Excipulum* in section cupular, dark brown, 15–30 μm thick at the sides, 100–110 μm thick at the base. *Hypothecium* 60–80 μm thick, pale brown, poorly differentiated from the hymenium. *Epihymenium* 20–25 μm thick, pale brown. *Hymenium* 120–140 μm thick, colourless, I+ blue,

not interspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1.5–2 μm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, 100–125 × 20–27 μm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, broadly ellipsoid, 14–[19.5]–22 × 8–[11.7]–13 μm. *Pycnidia* punctiform, brown, immersed in upper surface; conidia filiform, straight to curved, 13–22 × 0.7 μm.

*Chemistry*: Thallus K-, C+ red, KC+ red, P-, UV-; containing gyrophoric acid (major), lecanoric acid (trace or absent).

*Etymology*: The specific epithet *occidentalis* (L., of the west) refers to the occurrence of this species in Western Australia.

**Remarks**

*Trapelia glebulosa* from Europe and North America is chemically similar to *T. occidentalis*, but the squamules are smaller, 0.2–0.4(–0.7) mm wide, they are often arranged in small rosettes, and the mature apothecia are sessile with plane to convex discs (Orange 2018). The larger squamules of *T. occidentalis* can be dispersed, but they are often arranged in irregular lines. The new species could also be confused with the cosmopolitan *T. involuta*, with both species having similarly sized squamules with a smooth upper surface. However, *T. involuta* contains 5-*O*-methylhiassic acid as major secondary substance and has larger ascospores, 19–[21.3]–24.5 × 9–[10.4]–12.5 μm (Orange 2018).

At present, this species is known from siliceous rocks in dry *Eucalyptus* woodland in the south-west of Western Australia. Common associated lichens include numerous *Xanthoparmelia* species, *Buellia homophyllia* (C.Knight) Zahlbr., *Diploicia canescens* (Dicks.) A.Massal. subsp. *canescens*, *Heterodermia reagens* (Kurok.) Elix, *Hypotrachyna revoluta* (Flörke) Hale, *Rhizocarpon geographicum* (L.) DC., *R. reductum* Th.Fr. and *Rinodina thiomela* (Nyl.) Müll.Arg.

**ADDITIONAL SPECIMEN EXAMINED**

*Western Australia*. ● Type locality, *H.T. Lumbsch 10819f, J.A. Elix & H. Streimann*, 16.ix.1994 (CANB).

**2. *Trapelia rosettiformis*** Elix & P.M.McCarthy, sp. nov.  
Mycobank No. **MB834760**

Fig. 2

Similar to *Trapelia involuta*, but differs in having smaller ascospores, 11–19 × 6–10 μm, and squamules that often expand to form fan-shaped to round, sometimes subumbilicate rosettes up to 2.5 mm wide.

Type: Australia, New South Wales, Collector–Gundaroo road, 3 km WSW of Collector, 34°55'12"S, 149°24'19"E, 630 m alt., on roadside shale rocks in dry *Eucalyptus* woodland, *J.A. Elix 46746 & P.M. McCarthy*, 22.v.2019 (holotype – CANB; isotype – HO).

*Thallus* to 30 mm wide and 1 mm thick, pale grey, glaucous grey or dark grey, squamulose; upper surface mainly epruinose but sometimes with a narrow, submarginal pruinose zone, not sorediate; squamules 0.5–1 mm wide, roundish to irregular, weakly concave to plane, often expanding to form small, fan-shaped to round, sometimes subumbilicate rosettes up to 2.5 mm wide, the rosettes with dissected, commonly elevated margins, sometimes becoming crowded and bullate; medulla white, lacking calcium oxalate (H<sub>2</sub>SO<sub>4</sub>-), I-. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–10 × 5–8 μm, solitary or in pairs, triads or tetrads. *Apothecia* rare, 0.4–0.6 mm wide, irregularly roundish, at first immersed in elevated papillae, then superficial, adnate; proper margin very thin, brownish, sometimes with a poorly developed, rather ragged, discontinuous thalline rim; disc plane to weakly convex, corrugate, dark brown to brown-black, epruinose. *Excipulum* in section cupular, dark brown at the sides, paler brown within, K+ yellow-brown solution, 20–30 μm

thick at the sides and base. *Hypothecium* 100–150 µm thick, colourless to pale brown, poorly differentiated from the hymenium. *Epihymenium* 15–20 µm thick, pale brown to brown. *Hymenium* 150–180 µm thick, colourless, I+ blue, not interspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1.5–2 µm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, 70–110 × 20–25 µm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, ellipsoid, 11–[14.1]–19 × 6–[7.5]–10 µm. *Pycnidia* punctiform, black, immersed in upper surface; conidia filiform, straight to weakly curved, 11–21 × 0.7 µm. *Chemistry*: Thallus K–, C+ red, KC+ red, P–, UV–; containing 5-*O*-methylhiascic acid (major), gyrophoric acid (minor).

*Etymology*: This species is named after the growth form of the thallus.

#### Remarks

*Trapelia rosettiformis* is somewhat similar to the widespread *T. involuta*, both species having an esorediate, effigurate-squamulose thallus and identical chemistry. There are, however, marked differences between the two taxa. In *T. rosettiformis*, the squamules are better developed, relatively large and crenulate-lobate throughout, forming distinct rosettes up to 2.5 mm wide with elevated and/or fan-shaped margins. In contrast, the squamules of *T. involuta* are only 0.2–0.6 mm wide, they become crowded and weakly convex, and the ascospores are significantly larger, 19–[21.3]–24.5 × 9–[10.4]–12.5 µm (Orange 2018). *Trapelia rosettiformis* appears to be most closely related to the rather widespread, Australian endemic *T. pruinosa*, with both species having an esorediate, squamulose thallus, with often separate, well-developed, crenulate-lobate squamules. However, *T. pruinosa* has a pruinose, crystalline to mealy upper surface, somewhat larger ascospores, 13–[16.6]–20 × 7–[9.1]–12 µm, and it contains calcium oxalate (Elix & McCarthy 2020).

At present, this species is known from siliceous rocks and consolidated soil in *Eucalyptus* woodland in the Australian Capital Territory, southern New South Wales and Victoria. Common associated lichens on rock include various *Xanthoparmelia* species, *Buellia amandineiformis* Elix & Kantvilas, *B. suttonensis* Elix & A.Knight, *Candelariella vitellina* (Hoffm.) Müll.Arg., *Diploschistes euganeus* (A.Massal.) J.Steiner, *Lecanora pseudistera* Nyl., *Lecidea terrena* Nyl., *Pertusaria lophocarpa* Körb., *Rhizocarpon geographicum* (L.) DC. and *R. reductum* Th.Fr.

#### ADDITIONAL SPECIMENS EXAMINED

*New South Wales*. ● Mt Ulandra, 30 km ENE of Junee, 34°49'S, 147°55'E, 700 m alt., on granite rocks in *Callitris*-dominated dry sclerophyll forest, *J.A. Elix 23169*, 16.xi.1989 (CANB); ● Shingle Ridge, 5 km N of Molong, along road to Yeoval, 33°04'22"S, 148°49'45"E, 595 m alt., on sandstone rock in remnant *Eucalyptus* woodland, *J.A. Elix 38562, 38563 pr. p.*, 13.x.2005 (CANB); ● Killarney State Forest, 16.6 km N of Narrabri, 30°13'19"S, 149°50'47"E, 270 m alt., on pebbles in *Eucalyptus-Callitris* woodland, *J.A. Elix 45352*, 11.v.2005 (CANB); ● type locality, on roadside shale rocks in dry *Eucalyptus* woodland, *J.A. Elix 46890, 46891*, 27.xi.2019 (CANB); ● Merungie Gap Road, 20 km WSW of Rankins Springs, 33°52'S, 146°02'E, 260 m alt., on shaded boulder in *Eucalyptus-Acacia*-dominated ridge, *H. Streimann 44847*, 12.vi.1990 (CANB); ● Wamboin Road, 500 m S of junction with Macs Reef Road, 35°12'18"S, 149°20'46"E, 685 m alt., on consolidated soil in dry *Eucalyptus* woodland, *J.A. Elix 46764*, 15.v.2019 (CANB); ● Warraderry Range, Gooloogong–Grenfell road, 38 km N of Grenfell, 33°38'42"S, 148°22'15"E, 330 m alt., on sandstone in *Eucalyptus-Callitris* woodland, *J.A. Elix 46844*, 2.x.2019 (CANB).

*Australian Capital Territory*. ● Booroomba Rocks, 30 km SSE of Canberra, 35°32'S, 149°00'E, 1240 m alt., on exposed northerly rock face with scattered *Leptospermum*, *H. Streimann 9049*, 11.vii.1979 (CANB).

*Victoria*. ● Lake Nillahcootie foreshore, 32 km S of Benalla, 36°51'20"S, 146°00'26"E, 280 m alt., on consolidated soil in open parkland, *J.A. Elix 36510*, 5.v.2006 (CANB, HO, MEL); ● Chiltern-Mount Pilot National Park, 2 km N of Chiltern, 36°07'47"S, 146°36'42"E, 200 m

alt., on soil at base of *Eucalyptus*, *J.A. Elix 36947*, 5.v.2006 (CANB); ● *loc. id.*, on sandstone rocks in open *Eucalyptus* woodland, *J.A. Elix 36956 pr. p.*, 5.v.2006 (CANB); ● Three Sisters, Three Sisters Track, 23 km NNE of Cann River, 37°23'S, 149°06'E, 920 m alt., on sandstone rocks in dry *Eucalyptus* forest, *J.A. Elix 19546 & H. Streimann*, 27.ix.1985 (CANB); ● Argus Gap Road, 27 km NNW of Bairnsdale, 37°36'S, 147°32'E, 430 m alt., on old termite mound in regenerating wet sclerophyll forest, *H. Streimann 50301*, 31.x.1992 (CANB).

**3. *Trapelia terrestris* Elix & P.M.McCarthy, sp. nov.**  
Mycobank No. **MB834761**

Fig. 3

Similar to *Trapelia coarctata*, but differs in having sessile apothecia with rough, coarsely granular discs and somewhat larger ascospores, 14–30 × 8–15 µm.

Type: Australia, Australian Capital Territory, Canberra Nature Park, Aranda Bushland, Powerline Track, c. 4 km W of Canberra, 35°16'00"S, 149°04'54"E, 650 m alt., on soil bank in dry *Eucalyptus* woodland, *J.A. Elix 46819*, 14.viii.2019 (CANB – holotype).

*Thallus* micro-areolate, whitish grey to glaucous grey or grey-green, not sorediate; areoles dispersed to contiguous, 0.05–0.2 mm wide, roundish, plane to convex; medulla white, lacking calcium oxalate (H<sub>2</sub>SO<sub>4</sub>–), I–. *Photobiont* green, of the *Chlorella*-type, with individual cells irregularly roundish or rhomboid, 6–12 × 5–8 µm, solitary or in pairs, triads or tetrads. *Apothecia* common, 0.3–1.5 mm wide, irregularly roundish, sessile, at first appearing as a slightly paler convex mound, then splitting at the apex, the disc soon becoming superficial and sometimes with ragged, thalline margins at first but usually excluded with age, medium brown to dark brown or brown-black, coarsely granular, rough, epruinose; proper margin thick, brownish, usually lacking a thalline rim at maturity. *Excipulum* in section cupular, brown at the sides, pale brown to colourless within, unchanged in K, 70–80 µm thick at the sides, 100–120 µm thick at the base. *Hypothecium* 80–120 µm thick, hyaline to pale yellow, poorly differentiated from the hymenium. *Epihymenium* pale brown, 20–25 µm thick. *Hymenium* 100–150 µm thick, colourless, I+ blue, not interspersed with granules or oil droplets. *Paraphyses* richly branched, particularly at the base and near the apices, slender, 1–2.5 µm thick, flexuose, tangled, separating readily in K; apices not markedly expanded. *Asci* 8-spored, of the *Trapelia*-type, with an amyloid wall and a prominent, non-amyloid tholus, elongate-clavate, often with a long tapering stalk, 75–100 × 20–27 µm. *Ascospores* simple, non-halonate, thin-walled, often vacuolate, ellipsoid to ovate, 14–[19.6]–26(–30) × 8–[11.3]–13(–15) µm. *Pycnidia* punctiform, brown, immersed in areoles; conidia filiform, curved, 20–25 × 0.7 µm. *Chemistry*: Thallus K–, C+ red, KC+ red, P–, UV–; containing gyrophoric acid (major), 5-*O*-methylhiascic acid (trace or absent).

*Etymology*: The specific epithet is based on the preferred soil substratum of this species.

#### Remarks

The new species is characterized by the conspicuous apothecia with brown to brown-black epruinose discs that lack a thalline rim, the nondescript, areolate thallus with a smooth surface, the relatively large, ovate to ellipsoid ascospores and the presence of gyrophoric acid. *Trapelia terrestris* is similar to the cosmopolitan *T. coarctata*, both species having a rather poorly developed thallus that contains gyrophoric acid but lacks calcium oxalate. There are, however, clear differences between the two taxa; in *T. terrestris*, the thallus is micro-areolate (coherent and cracked in *T. coarctata*), the apothecia are larger (only up to 0.6 mm wide in *T. coarctata*), the apothecial discs are coarsely roughened and granular (slightly roughened in *T. coarctata*), and the ascospores of *T. coarctata* are smaller, 14–21 × 7.5–10.5 µm (Orange 2018). The two species also exhibit different substratum preferences, *T. coarctata* being common on moist stones in disturbed and forested areas, whereas *T. terrestris* prefers consolidated soil banks.

This species is a common, early colonizer of consolidated soil in dry *Eucalyptus* woodland in the Australian Capital Territory, New South Wales and Victoria, and rarely occurs on siliceous rocks in similar areas. Common associated lichens on soil include several *Caloplaca*

species, *Cladia aggregata* (Sw.) Nyl. *sens. lat.*, *Buellia suttonensis* Elix & A.Knight, *Diplo-schistes thunbergianus* (A.Massal.) Lumbsch & Vězda, *Lecidea terrena* Nyl., *Trapelia pruino-sa* and *T. involuta* (Taylor) Hertel.

#### ADDITIONAL SPECIMENS EXAMINED

*New South Wales.* ● Weddin State Forest, 25 km WSW of Grenfell, 34°01'S, 148°01'E, on boggy soil in *Callitris* woodland, *J.A. Elix 4756*, 14.vii.1978 (CANB); ● Mountain Creek, Jimberoo State Forest, 14 km NNE of Rankins Springs, 33°43'S, 146°20'E, 280 m alt., on consolidated soil in *Eucalyptus*- and *Callitris*-dominated flats, *J.A. Elix 25315 pr. p.*, 13.vi.1990 (CANB); ● Wamboin Road, 500 m S of junction with Macs Reef Road, 10.5 km NW of Bungendore, 35°12'18"S, 149°20'46"E. 685 m alt., on consolidated soil in dry *Eucalyptus* woodland, *J.A. Elix 46765*, 15.v.2019 (CANB).

*Australian Capital Territory.* ● Kowen Road, Kowen Forest, 17 km E of Canberra, 35°19'02"S, 149°15'07"E, 700 m alt., on soil bank bordering open *Eucalyptus* woodland, *J.A. Elix 46797*, 31.vii.2019 (CANB); ● trail to Aranda Bushland, 35°15'32"S, 149°04'53"E, 672 m alt., on soil bank in dry *Eucalyptus* woodland, *J.A. Elix 46801, 46802, 46805*, 9.viii.2019 (CANB); ● Type locality, on consolidated soil in open *Eucalyptus* woodland, *J.A. Elix 46811, 46812, 46813, 46815, 46817 & P.M. McCarthy 4882*, 14.viii.2019 (CANB); ● *loc. id.*, on sandstone pebble in open *Eucalyptus* woodland, *J.A. Elix 46826*, 14.viii.2019 (CANB); ● Latham, 11 km NW of Capital Hill, Canberra, 35°14'S, 149°02'E, 550 m alt., on consolidated soil in grassy area with small trees, *H. Streimann 44977*, 18.vii.1990 (CANB).

*Victoria.* ● Tallarook, 37°06'S, 145°06'E, on soil in dry sclerophyll forest, *J.A. Elix 4884*, 29.vii.1978 (CANB).

#### New record

**Trapelia placodioides** Coppins & P.James, *Lichenologist* **16**, 257 (1984)

This species was previously known from Europe, North America, the Falkland Islands and New Zealand (Orange 2018). It is characterized by the pale, pinkish grey, cracked, wide-spreading thallus with farinose soredia. Soralia develop at the margins of secondary areoles or at the margin of cracks in the thallus. The species contains gyrophoric acid (major). A detailed description and illustrations are given in Orange (2018).

#### SPECIMENS EXAMINED

*Western Australia.* ● The Cascades, 4 km S of Pemberton, 34°29'S, 116°02'E, 180 m alt., on granite rocks in disturbed wet sclerophyll forest, *J.A. Elix 41091, H.T. Lumbsch & H. Streimann*, 13.ix.1994 (CANB).

*South Australia.* ● Kangaroo Island, Western River Conservation Park, Waterfall Creek, 30 km ENE of Cape Borda, 35°42'S, 136°54'E, 140 m alt., on semi-exposed rock face in dry sclerophyll forest, *H. Streimann 54951*, 28.ix.1994 (CANB).

*New South Wales.* ● Woomargama State Forest, 19 km S of Holbrook, 35°54'S, 147°19'E, 580 m alt., on granite rocks in dry sclerophyll forest, *J.A. Elix 23066, 23085*, 15.ix.1989 (CANB); ● Grove Creek Falls, 45 km SSE of Blayney, 33°56'S, 149°22'E, 550 m alt., on volcanic rocks in dry sclerophyll forest, *J.A. Elix 25560*, 12.ix.1990 (CANB); ● Moonbi Range, 9 km NE of Tamworth, 28°30'S, 152°45'E, 450 m alt., on granite rock in dry sclerophyll forest, *H. Streimann 9814*, 12.i.1980 (CANB).

*Victoria.* ● Kooyoorra State Park, 16 km W of Inglewood, 37°51'S, 144°22'E, on semi-exposed boulder in *Eucalyptus* woodland, *H. Streimann 59145*, 7.xii.1996 (CANB).

*Germany.* ● Schleswig-Holstein. Closed down part of the shunting yard of Meimersdorf, c. 4 km S of city of Kiel (54°20'N, 10°08'E), on brick fragments lying on the ground, *P. Jacobsen 6143*, 14.iv.1989 (CANB, [H.Hertel, *Lecideaceae Exsiccatae* No. 260]).

*U.S.A.* ● Pennsylvania, Wyoming County. State Game Lands No. 57, Henry Lott Road, c. 2 miles SW of Kasson Brook, Forkston Township, 41°26'45"N, 76°08'45"W, 490–610 m alt., on sandstone outcrops in mature *Acer-Betula-Fagus* forest, *J.C. Lendemer 13670*, 21.vii.2008 (CANB).

#### Key to *Trapelia* in Australia

- 1 Soralia present.....2  
 1: Soralia absent.....3
- 2 Thallus squamulose or subsquamulose..... **T. pruinosa**<sup>1</sup>  
 2: Thallus crustose, coherent, continuous..... **T. placodioides**
- 3 Thallus squamulose or subsquamulose.....4  
 3: Thallus crustose; surface continuous, rimose or areolate.....8
- 4 Upper surface smooth or minutely rugose.....5  
 4: Upper surface pruinose, scabrid, mealy or coarsely crystalline.....6
- 5 Apothecia sessile; 5-*O*-methylhiascic acid (major)..... **T. involuta**<sup>2</sup>  
 5: Apothecia mainly immersed; gyrophoric acid (major)..... **T. occidentalis**
- 6 Ascospores 9–16 × 4–8 µm; gyrophoric acid (major)..... **T. crystallifera**  
 6: Ascospores 11–20 × 6–12 µm; 5-*O*-methylhiascic acid (major).....7
- 7 Squamules expanding to form small rosettes to 2.5 mm wide; margins elevated, dissected; ± with submarginal or marginal pruina; squamules lacking calcium oxalate [H<sub>2</sub>SO<sub>4</sub>-]..... **T. rosettiformis**  
 7: Squamules not forming rosettes; margins adnate to substratum; pruina concentrated in shallow depression in the centre of squamules; squamules containing calcium oxalate [H<sub>2</sub>SO<sub>4</sub>+]..... **T. pruinosa**
- 8 Ascospores 17–34 × 12–20 µm; apothecia persistently immersed; alpine.....9  
 8: Ascospores 9–30 × 4–15 µm; apothecia immersed at first, then adnate to sessile.10
- 9 Ascospores 25–34 µm long; hypothecium 150–180 µm thick; gyrophoric acid (major); Tasmania..... **T. macrospora**  
 9: Ascospores 17–30 µm long; hypothecium 70–100 µm thick; 5-*O*-methylhiascic acid (major); N.S.W..... **T. kosciuszkoensis**
- 10 Thallus surface scabrid, mealy, coarsely crystalline; disc pruinose at least in part..... **T. concentrica**  
 10: Thallus surface smooth to rugulose, not crystalline; disc epruinose.....11
- 11 Thallus thicker at margins; 5-*O*-methylhiascic acid (major).....12  
 11: Thallus thinner at margins or of poorly developed areoles; gyrophoric acid (major).13
- 12 Ascospores 16–23 × 9–15 µm; conidia 10–17 µm long; containing additional 5-methoxylecanoric acid..... **T. lilacea**  
 12: Ascospores 11–18 × 5–10 µm; conidia 16–30 µm long; lacking 5-methoxylecanoric acid..... **T. calvariana**
- 13 Thallus micro-areolate; ascospores 15–30 µm long.....14  
 13: Thallus crustose, forming extensive patches; ascospores 14–21 µm long.....15
- 14 Thallus containing calcium oxalate [H<sub>2</sub>SO<sub>4</sub>+]; disc usually black, with a well-developed white thalline rim..... **T. atrocarpa**  
 14: Thallus lacking calcium oxalate [H<sub>2</sub>SO<sub>4</sub>-]; disc brown; thalline rim fragmentary or absent..... **T. terrestris**
- 15 Upper surface often yellow-pigmented; 5-*O*-acetylhiascic acid present.. **T. thieleana**  
 15: Upper surface greenish grey; 5-*O*-acetylhiascic absent..... **T. coarctata**

<sup>1</sup> in older, highly pruinose specimens, the pruina often becomes eroded, and such specimens can appear sorediate.

<sup>2</sup> Australian collections of this species have somewhat smaller ascospores than their European counterparts, and possibly represent a separate taxon.

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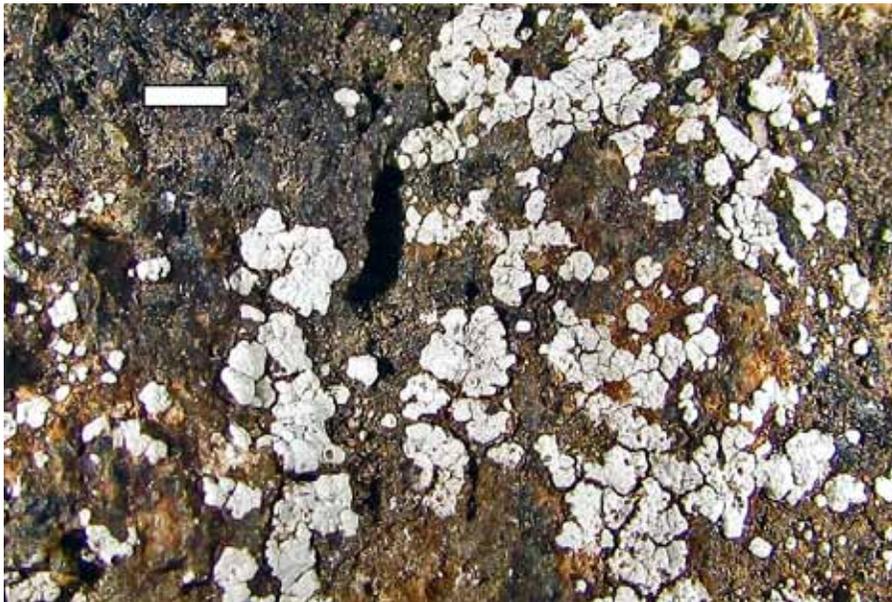


Figure 1. *Trapelia occidentalis* (holotype in CANB). Scale = 2 mm.



Figure 2. *Trapelia rosettiformis* (holotype in CANB). Scale = 1 mm.

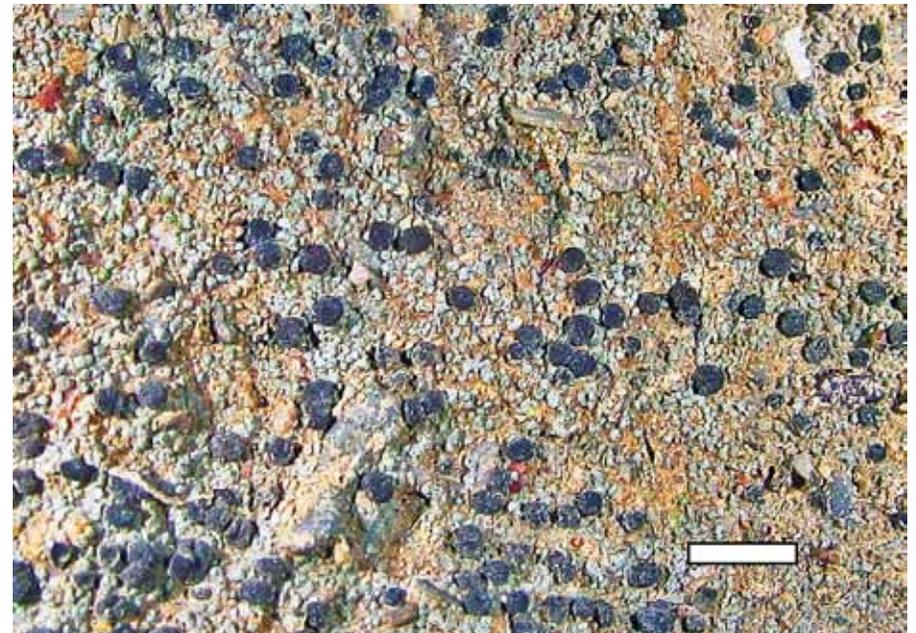


Figure 3. *Trapelia terrestris* (holotype in CANB). Scale = 2 mm.