DIRINARIA

John A. Elix[1]

Dirinaria (Tuck.) Clem., *Gen. Fungi* 84 (1909)

From the crustose genus *Dirina* Fr. (Roccellaceae) and the Latin suffix *-arius* (indicating connection), in reference to the superficial resemblance of these genera.

Type: *D. picta* (Sw.) Schaer. ex Clem.

Thallus foliose, continuous, lobate, adnate to tightly adnate, 2–12 (–20) cm wide. Lobes irregular to radiating, discrete or confluent, 0.2–3.0 (–5.0) mm wide, eciliate; apices rounded to truncate or flabellate. Upper surface white, grey-white to bluish grey or ochre-yellow, plane to convex or concave towards the periphery, dull or glossy, pruinose or not; soredia, isidia and dactyls present or absent; pseudocyphellae absent; upper cortex paraplechtenchymatous, formed by vertically oriented hyphae. Medulla white or pale yellow to scarlet. Lower surface pale brown to brown-black or black, erhizinate, attached by hapters; lower cortex prosoplectenchymatous, formed by longitudinally arranged hyphae. Ascomata apothecial, laminal, orbicular, sessile to subpedicellate; disc black but often whitish to pale grey- or purple-pruinose; thalline exciple prominent or reflexed, well defined and persistent. Epihymenium pale brown to brown or red, K– or decolourising in K. Hymenium colourless to pale yellow, I+ blue. Hypothecium pale brown to brown or brown-black. Paraphyses septate, simple or with short branches near the apices; apices generally capitate, brown, K–. Asci of *Lecanora*-type, clavate, unitunicate, 8-spored; apex wall layers thickened, the apex amyloid, with a distinct axial mass. Ascospores brown, 1-septate, thick-walled, mischoblastiomorphic (*Dirinaria*-type), ellipsoidal, 10–24 × (4–) 5–9 (–10) µm. Conidiomata pycnidial, laminal, immersed in elevated warts; conidiophores of type VI (*sensu* Vobis, 1980), pleurogenous. Conidia bacilliform to fusiform.

Dirinaria is mainly a pantropical and subtropical genus with several species extending to temperate or oceanic regions; currently considered to contain c. 36 species world-wide, 13 are known from Australia. These lichens grow on bark, wood, mosses or rocks.

References

Awasthi, D.D. (1975), A monograph of the lichen genus *Dirinaria*, *Biblioth. Lichenol.* 2: 1–108.

Swinscow, T.D.V. & Krog, H. (1978), The genus *Dirinaria* in East Africa, *Norweg. J. Bot.* 25: 157–168.

Vobis, G. (1980), Bau und Entwicklung der Flechten-Pycnidien und ihrer Conidien, *Biblioth. Lichenol.* 14: 1–141.

Allen, D., Lumbsch, H.T., Madden, S. & Sipman, H. (2001), New Australian and Australian State lichen records and lichenicolous lichen reports, *J. Hattori Bot. Lab.* 90: 269–291.

Kalb, K. (2001), New or otherwise interesting lichens I, *Biblioth. Lichenol.* 78: 141–167.

Kalb, K. (2004), *Dirinaria*, *Lichen Fl. Greater Sonoran Desert Region* 2: 98–103.

Elix, J.A. (2008), Four new lichens (lichenized Ascomycota) from tropical and subtropical Australia, *Australas. Lichenol.* 62: 35–40.

[1] Research School of Chemistry, Building 33, Australian National University, Canberra, Australian Capital Territory 0200.

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Key

1 Thallus lacking vegetative propagules 2
1: Thallus with soredia or dactyls 9
2: Lower surface black *(1)* 3
2: Lower surface white to pale brown 7
3 Thallus containing sekikaic acid *(2)* ..... **9. D. minuta**
3: Thallus containing divaricatic acid 4
4 Apothecial disc purple-pruinose *(3:)* ..... **11. D. purpurascens**
4: Apothecial disc epruinose or whitish-pruinose 5
5 Hypothecium pale brown to yellow-brown *(4:)* ..... **3. D. batavica**
5: Hypothecium brown to dark brown 6
6 Hymenium less than 80 µm thick; ascospores 13–18 × 5–8 µm *(5:)* ..... **13. D. subconfluens**
6: Hymenium more than 80 µm thick; ascospores 16–24 × 7–10 µm ..... **5. D. confluens**
7 Thallus loosely adnate; lobes 1–5 mm wide *(2:)* ..... **4. D. complicata**
7: Thallus tightly adnate; lobes 0.2–1.5 mm wide 8
8 Thallus containing divaricatic acid *(7:)* ..... **3. D. batavica**
8: Thallus containing sekikaic acid ..... **9. D. minuta**
9 Thallus containing sekikaic acid *(1:)* 10
9: Thallus containing divaricatic acid 11
10 Dactyls present; orbicular soralia absent *(9)* ..... **6. D. consimilis**
10: Dactyls absent; orbicular soralia present ..... **12. D. sekikaica**
11 Dactyls present; orbicular soralia absent *(9:)* ..... **1. D. aegialita**
11: Dactyls absent; orbicular soralia present 12
12 Thallus ochre-yellow; C+ orange; xanthones present *(11:)* ..... **7. D. flava**
12: Thallus whitish to pale grey; C–; xanthones absent 13
13 Apothecial disc purple-pruinose *(12:)* ..... **8. D. melanoclina**
13: Apothecial disc epruinose or whitish-pruinose 14
14 Lobes contiguous; apices flabellate; thallus longitudinally plicate and rugose *(13:)* ..... **2. D. applanata**
14: Lobes slightly disjunct or adjacent; apices not flabellate; thallus not longitudinally plicate or rugose ..... **10. D. picta**

1. Dirinaria aegialita (Afzel. ex Ach.) B.J.Moore, *Bryologist* 71: 248 (1968)

Parmelia aegialita Afzel. ex Ach., *Methodus* 191 (1803); *Physcia aegialita* (Afzel. ex Ach.) Nyl., *Ann. Sci. Nat., Bot.*, sér. 4, 15: 43 (1861). T: Sierra Leone, ad lapides mari inundatos prope litora, *A.Afzelius s.n.* in Herb. Swartz; lecto: S *n.v.*, *fide* D.D.Awasthi, *Biblioth. Lichenol.* 2: 64 (1975).

Dirinaria aspera (H.Magn.) D.D.Awasthi, *Bryologist* 67: 371 (1964); *Physcia aspera* H.Magn., *in* H.Magnusson & A.Zahlbruckner, *Ark. Bot.* 32A(2): 63 (1945). T: 1859 flow, N of Hualalai, Puuwaawaa region, Hawai'i, Hawaiian Islands, on bark, 11 Sept. 1938, *O.Selling 5668* (*Hawaii Bog Survey*); holo: S *n.v.*

Illustrations: D.D.Awasthi, *op. cit.* figs 38–41 (1975); I.M.Brodo, S.D.Sharnoff & S.Sharnoff, *Lichens of North America* 306, fig. 316 (2001).

Thallus 5–12 cm wide, loosely adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, plane to convex, but often concave towards the tips, 0.2–3.0 mm wide, distinctly flabellate towards the apices. Upper surface grey, bluish grey to yellow-grey or off-white, ±pruinose, dactylate and ±sorediate; dactyls clavate, bursting open at the apices and producing corticated granules and soredia, eventually apically crateriform. Medulla white in the upper part; lower medulla often orange, particularly towards the apices. Lower surface black in the centre, ±brown at the margins. Apothecia rare, sessile to ±constricted at base, 0.5–1.5 mm wide; disc black, rarely grey-pruinose. Epihymenium pale brown, 6–8 µm thick. Hymenium colourless, 80–90 µm thick. Hypothecium dark brown to brown-black, lentiform, 100–150 µm thick. Ascospores 16–22 × 7–9 µm. Conidia bacilliform, 4–5 × 0.8–1.0 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on bark, wood and rocks in the N.T., Qld and N.S.W.; in monsoon vine forest and in coastal and montane rainforest. Also in Africa, Asia, North, Central and South America and the Pacific Islands.

N.T.: Umbrawarra Gorge, 22 km SW of Pine Creek, *J.A.Elix 22523* (CANB). Qld: O'Keefe Ck, Big Tableland, 26 km S of Cooktown, *J.A.Elix 17321 & H.Streimann* (CANB). N.S.W.: Evans Head, *J.A.Elix 1098* (CANB).

This species is characterised by the thalline dactyls that burst open to become granulose and sorediate and by the presence of divaricatic acid.

2. Dirinaria applanata (Fée) D.D.Awasthi, *in* D.D.Awasthi & M.R.Agarwal, *J. Indian Bot. Soc.* 49: 135 (1970)

Parmelia applanata Fée, *Essai Crypt. Écorc.* 126 (1825). T: "supra Cinchonas nec non Insula Santo Domingo ad arbores et epidermidem Lauri Cassiae", Peru; lecto: G *n.v.*, *fide* A.Aptroot, *Fl. Guianas*, ser. E, 1: 18 (1987).

Placodium flavostramineum Müll.Arg., *Hedwigia* 34: 29 (1895); *Lecanora flavostraminea* (Müll.Arg.) Zahlbr., *Cat. Lich. Univ.* 5: 621 (1928). T: Vic., 'ad saxa quartosa', 1893, *F.R.M.Wilson 331*; holo: G *n.v.*

Parmelia redacta Stirt., *Trans. & Proc. New Zealand Inst.* 32: 76 (1899). T: Illawarra, N.S.W., 1882, *W.Kirton*; holo: GLAM *n.v.*; iso: BM.

For further synonymy see Awasthi (1975).

Illustrations: D.D.Awasthi, *Biblioth. Lichenol.* 2: figs 48–51 (1975); A.Aptroot, *Fl. Guianas*, ser. E, 1: 19, pl. 3 (1987); W.M.Malcolm & D.J.Galloway, *New Zealand Lichens: Checklist, Key, and Glossary* 121, fig. 66b (1997).

Thallus 5–10 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, plane to convex, ±concave towards the tips, 0.5–2.0 mm wide, distinctly flabellate towards the apices. Upper surface grey, bluish grey to yellow-grey or off-white, ±pruinose, sorediate; dactyls absent. Soralia laminal, hemispherical or becoming elongate, sometimes erose and crateriform; soredia farinose. Medulla white, rarely the lower medulla orange towards the apices. Lower surface black in the centre, ±brown at the margins. Apothecia rare, sessile to ±constricted at base, 0.5–1.5 mm wide; disc black, rarely sparsely grey-pruinose. Epihymenium dark yellow-brown, c. 10 µm thick. Hymenium colourless, 75–85 µm thick. Hypothecium dark brown to brown-black, 160–200 µm thick. Ascospores 15–22 × 6–8 µm. Conidia bacilliform, 3.5–5.0 × 0.8–1.0 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

In Australia this pantropical-subtropical species often extends into the temperate zone. It occurs on bark, wood and rocks from coastal areas to montane forests in all States and Territories except S.A. and Tas. Also on Lord Howe Island and Norfolk Island, several other Pacific islands, North, Central and South America, Asia and Africa.

W.A.: Bird Observatory, Broome, *K.Ralston 604* (MEL). N.T.: Darwin River Dam Recreation Park, 77 km S of Darwin, *J.A.Elix 37526* (CANB). Qld: Three-Mile Ck, 5 km N of Townsville, *J.A.Elix 20046 & H.Streimann* (CANB). N.S.W.: Hakea Walk, Washpool Natl Park, Gibraltar Ra., 78 km E of Glen Innes, *J.A.Elix 37256* (CANB). A.C.T.: Cowen Forest, 16 km E of Canberra, *J.A.Elix 33203* (CANB). Vic.: Mallacoota, 1979, *D.Verdon s.n.* (CANB).

Dirinaria applanata is characterised by the contiguous, longitudinally plicate and rugose lobes with flabellate apices, the distinctly farinose soredia and the presence of divaricatic acid.

3. Dirinaria batavica D.D.Awasthi, *Biblioth. Lichenol.* 2: 42 (1975)

T: Batavia [Djakarta], Java, [Indonesia], on tile, 9 May 1941, *P.Groenhart 1763*; holo: L, not located.

Illustrations: D.D.Awasthi, *op. cit.* figs 8, 16, 23; P.M.McCarthy & W.M.Malcolm, *Key to the Genera of Australian Macrolichens* 51 (2004).

Thallus 2–7 cm wide, very tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, ±plane or slightly concave towards the tips,

0.2–0.8 (–1.0) mm wide, distinctly flabellate at the apices. Upper surface grey to yellow-grey at the periphery, grey-brown to dark brown towards the centre, ±pruinose, becoming ±subcrustose, verrucose and areolate in the centre; soredia and dactyls absent. Medulla white or the lower medulla yellow-orange in part. Lower surface pale brown to brown-black or black. Apothecia common, initially sessile, becoming substipitate, 0.1–0.5 mm wide; disc black, epruinose. Epihymenium dark brown, c. 10 µm thick. Hymenium colourless, 80–100 µm thick. Hypothecium pale brown, 60–80 µm thick. Ascospores 10–16 × 4.5–6 µm. Conidia bacilliform, 3.5–5.0 × c. 0.8 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±skyrin (minor), ±unknown terpenes (minor).

Occurs on rocks in the Pilbara and Kimberley regions of W.A. and in coastal and hinterland areas of the N.T. and north-western Qld. Also in Indonesia.

W.A.: along road to Mt Joseph Yard, 25 km E of Lennard River Crossing along the Gibb River Rd, *J.A.Elix 22264 & H.Streimann* (CANB); Skew Valley, S end of Burrup Penin., 400 m from Dampier Salt haul road, 7 Nov. 1983, *N.Sammy* (CANB). N.T.: Wangi Rd, Finniss Ra., 69 km SSW of Darwin, *H.Streimann 8797* (CANB). Qld: Cloncurry–Townsville highway, 18 km ESE of Cloncurry, *J.A.Elix 20685 & H.Streimann* (CANB).

This species is characterised by the tighly adnate, saxicolous, ±subcrustose thallus, the narrow lobes, the pale brown to black lower surface, the absence of soredia and dactyls and the presence of divaricatic acid.

4. **Dirinaria complicata** D.D.Awasthi, *Biblioth. Lichenol.* 2: 51 (1975)

T: 6 miles [c. 10 km] S of Ngong Hills, Kenya, on bark of *Acacia* in grove alongside watercourse, 29 Jan. 1953, *C.F.Hemming 219*; holo: EA *n.v.*

Illustration: D.D.Awasthi, *op. cit.* fig. 24.

Thallus 4–10 cm wide, loosely adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, ultimately convoluted to folded and plicate-complicate, plane to convex, 1–5 mm wide, distinctly flabellate at the apices, ±discrete to contiguous at the periphery. Upper surface white to pale grey or pale greenish grey, finely pruinose; soredia and dactyls absent. Medulla white. Lower surface white to pale yellow or pale brown. Apothecia common, crowded centrally, innate, then sessile and ±constricted at base, 0.5–2.0 mm wide; disc black, epruinose. Epihymenium pale brown, c. 10 µm thick. Hymenium colourless, 90–110 µm thick. Hypothecium dark brown to brown-black, 180–200 µm thick, lentiform. Ascospores 12–22 × 6–10 µm. Pycnidia not seen.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on rock and bark in *Eucalyptus* woodland in central Qld. Also in East Africa and Madagascar.

Qld: Dawson Hwy, Staircase Ra., 18 km SE of Springsure, *H.Streimann 52221* (B, CANB).

This species is characterised by the loosely adnate thallus, the comparatively broad lobes (1–5 mm wide), the white to pale brown lower surface, the absence of soredia and dactyls and the presence of divaricatic acid.

5. **Dirinaria confluens** (Fr.) D.D.Awasthi, *Biblioth. Lichenol.* 2: 28 (1975)

Parmelia confluens Fr., *Syst. Orb. Veg.* 1: 284 (1825). T: 'India Orientalis, ad cortices' (lost); India, Neelgherries [Nilgiri Hills], *Perrottet*; neo: H-NYL 31808 *n.v.*, *fide* D.D.Awasthi, *loc. cit.*; isoneo: BR, H-NYL 31809, M, PC, REN *n.v.*

Illustrations: D.D.Awasthi, *op. cit.* figs 2, 11, 20, 27, 29; K.Kalb, *Lichen Fl. Greater Sonoran Desert Region* 2: 100, fig. 8 (2004).

Thallus 3–10 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, plane to convex or occasionally concave towards the tips, 0.5–2.5 mm wide, distinctly flabellate at the apices, ±discrete to contiguous at the periphery. Upper surface white to grey, lead-grey, bluish grey or yellow-grey, usually finely white-pruinose, rarely epruinose; soredia and dactyls absent. Medulla mostly white; lower medulla occasionally orange, especially towards the lobe tips. Lower surface black in the centre, brown towards the periphery. Apothecia common, crowded centrally, sessile to constricted at the base, 0.5–2.0 mm wide; disc black, epruinose or weakly grey-pruinose. Epihymenium pale brown, c. 10 µm thick. Hymenium colourless to pale yellow, 80–110 µm thick. Hypothecium dark brown to brown-black, 100–250 µm thick, ±lentiform. Ascospores 16–24 × 7–10 µm. Conidia bacilliform, 4–5 × 0.8–1.1 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

This pantropical-subtropical species occurs on bark, wood and rocks in coastal and montane forest and woodland in W.A., N.T., Qld, and N.S.W. Also in Africa, Asia, North, Central and South America and the Pacific Islands.

W.A.: Great Northern Hwy, 3 km SW of Ord River Crossing, between Halls Creek and Turkey Creek, *J.A.Elix 22387 & H.Streimann (*CANB). N.T.: Manton Dam, 51 km SE of Darwin, *H.Streimann 8752* (CANB, H, MSC, US). Qld: Coochiemudlo I., Moreton Bay, *G.N.Stevens 1640* (BRI). N.S.W.: Park Beach, Coffs Harbour, *J.A.Elix 3413* (CANB).

Dirinaria confluens is characterised by the adnate thallus, the broad lobes, the black lower surface, the absence of soredia and dactyls and the presence of divaricatic acid. The relatively thick hymenium and larger ascospores distinguish it from *D. subconfluens*.

6. Dirinaria consimilis (Stirt.) D.D.Awasthi, *in* D.D.Awasthi & M.R.Agarwal, *J. Indian Bot. Soc.* 49: 135 (1970)

Physcia consimilis Stirt., *Proc. Roy. Philos. Soc. Glasgow* 11: 310 (1879); *Pyxine consimilis* (Stirt.) Stirt., *Trans. & Proc. New Zealand Inst.* 30: 395 (1898). T: near Chinsurah, India, on bark of *Artocarpus integrifolia* tree, *G.Watt 111*; lecto: GLAM *n.v.*, *fide* D.D.Awasthi, *Biblioth. Lichenol.* 2: 91 (1975); isolecto BM.

Illustrations: D.D.Awasthi, *op. cit.* figs 5, 52, 56.

Thallus 5–13 cm wide, adnate, subdichotomously to subpinnately lobate. Lobes radiating, contiguous, plane to convex but often concave towards the tips, 0.5–2.0 mm wide, distinctly flabellate towards the apices. Upper surface grey, bluish grey to yellow-grey or off-white, ±pruinose, dactylate and ±sorediate; dactyls clavate, bursting open at the apices and producing corticated granules and soredia, eventually apically crateriform. Medulla white in the upper part; lower medulla ±orange towards the apices. Lower surface black in the centre, pale brown at the margins. Apothecia rare, sessile, 0.5–1.5 mm wide; disc dark brown to brown-black, rarely grey-pruinose. Epihymenium pale brown, 9–10 µm thick. Hymenium colourless, 70–80 µm thick. Hypothecium dark brown to brown-black, lentiform, 180–220 µm thick. Ascospores 14–23 × 6–8 µm. Conidia bacilliform, 4–5 × 0.8–1.0 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), sekikaic acid (major), 4'-*O*-demethylsekikaic acid (minor), homosekikaic acid (trace), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

This pantropical-subtropical species usually occurs on bark or wood and rarely on rocks in monsoon vine forest in the N.T. and in coastal and montane forest in Qld and N.S.W. Also in Africa and Asia.

N.T.: Berry Springs Nature Park, 47 km S of Darwin, *J.A.Elix 37328* (CANB). Qld: Ellis Beach, 27 km N of Cairns, *J.A.Elix 2571* (CANB). N.S.W.: Grassy Head, *J.A.Elix 21845* (CANB).

This species is characterised by the dactyls that burst open to become granulose and sorediate and by the presence of sekikaic acid.

7. Dirinaria flava (Müll.Arg.) C.W.Dodge, *Beih. Nova Hedwigia* 38: 181 (1971)

Physcia flava Müll.Arg., *Hedwigia* 31: 277 (1892). T: NW of Red Hill, Ascension Island, 900 m, on rocks, July 1889, *H.J.Gordon 90*; lecto: BM, *fide* D.D.Awasthi, *Biblioth. Lichenol.* 2: 87 (1975); isolecto: G *n.v.*

For further synonymy see Awasthi (1975).

Illustrations: D.D.Awasthi, *op. cit.* figs 19, 57; P.M.McCarthy & W.M.Malcolm, *Key to the Genera of Australian Macrolichens* 51 (2004).

Thallus 2–6 cm wide, adnate to tightly adnate, pinnately to subdichotomously lobate. Lobes radiating, contiguous, becoming verrucose to subcrustose in the centre, plane to convex, 0.5–1.5 mm wide; apices discrete. Upper surface yellow to pale yellow-brown, tinged grey or blue-grey at the apices, delicately pruinose, sorediate; dactyls absent. Soralia laminal, globose to capitate, 0.2–0.3 mm wide, rarely erose and crateriform; soredia granular to, rarely, farinose. Medulla pale yellow to yellow. Lower surface brown-black. Apothecia very rare, sessile, 0.4–0.7 mm wide; disc dark brown to brown-black, epruinose. Epihymenium pale brown, c. 8 µm thick. Hymenium colourless, 65–75 µm thick. Hypothecium dark brown, 90–125 µm thick, lentiform. Ascospores 10–15 × 4–7 µm. Pycnidia not seen.

Chemistry: Cortex K+ yellow, C+ orange-red, KC+ red, P–; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), arthothelin (major), 4,5-dichloronorlichexanthone (minor), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on bark and rocks in coastal and montane forests in Qld and eastern N.S.W. Also in Africa and on Ascension Island (South Atlantic Ocean).

Qld: Hervey Ra., 45 km SW of Townsville, *J.A.Elix 20456 & H.Streimann* (BRI, CANB); Callide Lookout, Callide Ra., 15 km NE of Biloela, *J.A.Elix 34875* (CANB); Castle Hill, Townsville, *H.Streimann 31278A* (CANB). N.S.W.: Alum Mtn, Buladelah, *J.A.Elix 24596* (CANB).

This lichen is characterised by the yellow to yellow-brown upper surface, the globose to capitate soralia and the presence of divaricatic acid and arthothelin.

8. Dirinaria melanoclina (C.Knight) D.D.Awasthi, *Biblioth. Lichenol.* 2: 77 (1975)

Physcia melanoclina C.Knight, *Trans. Linn. Soc. London, Bot.* 2: 49 (1882). T: [near Sydney], N.S.W., 1880, *C.Knight 13*; lecto: WELT, *fide* D.D.Awasthi, *loc. cit.*; isolecto: H-NYL 31807, M *n.v.*

Illustration: D.D.Awasthi, *op. cit.* fig. 46.

Thallus 2–5 cm wide, adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally weakly plicate, plane to convex to weakly concave, 0.5–1.0 mm wide; apices rounded, discrete. Upper surface grey, greenish grey to yellow-grey or off-white, epruinose, sorediate; dactyls absent. Soralia laminal, capitate, 0.5–1.0 mm wide; soredia farinose. Medulla white. Lower surface brown-black. Apothecia rare, sessile to ±constricted at the base, 0.6–1.0 mm wide; disc red-brown to brown-black, purple-pruinose. Epihymenium dark brown, 10–15 µm thick. Hymenium colourless, 65–75 µm thick. Hypothecium dark brown-black, 140–160 µm thick. Ascospores 16–20 × 6–9 µm. Pycnidia not seen.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on bark in coastal and hinterland forests in south-eastern Qld and eastern N.S.W. Also in South Africa.

Qld: Coochiemudlo I., 28 km ESE of Brisbane, *R.Moberg & B.Owe-Larsson A97:1* (CANB); Serpentine Ck, Moreton Bay, *G.N.Stevens 1119* (BRI). N.S.W.: Forster, *J.A.Elix 3364b* (CANB); Tomaga R. estuary, c. 1 km S of Tomakin, *J.A.Elix 22635 & K.Kalb* (CANB).

Dirinaria melanoclina is characterised by the purple-pruinose apothecia, the capitate soralia with farinose soredia and the presence of divaricatic acid.

9. Dirinaria minuta Kalb, *Biblioth. Lichenol.* 78: 145 (2001)

T: Keep River Natl Park, N.T., [40 km NE of Kununurra, W.A.], 15°50'S, 129°07'E, 9 Aug. 1995, *K. & A.Kalb 29565*; holo: CANB; iso: Herb. Kalb.

Illustration: K.Kalb, *op. cit.* 146, fig. 3.

Thallus 2–3 cm wide, tightly adnate, subdichotomously to subpinnately lobate, becoming subcrustose, verrucose and areolate in the centre. Lobes radiating, contiguous, longitudinally plicate and rugose, ±plane, 0.8–1.5 mm wide; apices rounded, discrete. Upper surface grey to yellow-grey or olive-grey, epruinose or with whitish pruina along the margins and on the surface of the lobe tips; soredia and dactyls absent. Medulla white, rarely lower medulla partly yellow-orange. Lower surface pale brown to brown-black or black. Apothecia common, sessile or constricted at the base, 0.3–0.8 mm wide; disc black, epruinose. Epihymenium brown, c. 10 µm thick. Hymenium colourless, 70–90 µm thick. Hypothecium pale yellow-brown, 30–40 µm thick, lentiform. Ascospores 12–14 × 4.5–5.5 µm. Pycnidia not seen.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (trace), sekikaic acid (major), 4'-*O*-demethylsekikaic acid (minor), homosekikaic acid (trace), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Endemic; occurs on rocks in hinterland areas of the N.T.

N.T.: Lichfield Natl Park, c. 100 km S of Darwin, *K. & A.Kalb 25570* (Herb. Kalb).

Dirinaria minuta is characterised by the small, tighly adnate, saxicolous, ±subcrustose thallus, often with a pale lower surface, the absence of soredia and dactyls and the presence of sekikaic acid. The morphologically similar *D. batavica* contains divaricatic acid.

10. Dirinaria picta (Sw.) Schaer. ex Clem., *Gen. Fungi* 323 (1931)

Lichen pictus Sw., *Nova Gen. Sp. Pl.* 146 (1788); *Parmelia picta* (Sw.) Ach., *Methodus* 211 (1803); *Physcia picta* (Sw.) Nyl., *Mém. Soc. Sci. Nat. Cherbourg* 3: 175 (1855); *Pyxine picta* (Sw.) Tuck., *Syn. N. Amer. Lich.* 1: 79 (1882). T: India Occidentalis, Jamaica, *Swartz*; lecto: S, Herb. Swartz ex Herb. Thunberg 26168 *n.v.*, *fide* D.D.Awasthi, *Biblioth. Lichenol.* 2: 73 (1975); isolecto: UPS *n.v.*

Parmelia plumosa Taylor, *J. Bot. (Hooker)* 6: 173 (1847). T: Low Island, [near Tahiti, Society Islands], on bark, *Beechy*; lecto: FH-TAYL *n.v.*, *fide* D.D.Awasthi, *loc. cit.*; isolecto: BM, H-NYL 31803 *n.v.*

Illustrations: D.D.Awasthi, *op. cit.* figs 1, 9, 10, 42–45; I.M.Brodo, S.D.Sharnoff & S.Sharnoff, *Lichens of North America* 307, fig. 318 (2001); K.Kalb, *Lichen Fl. Greater Sonoran Desert Region* 2: 103, fig. 11 (2004).

Thallus 2–8 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, not longitudinally plicate, plane to convex, but ±weakly concave near apices, 0.5–1.0 mm wide; apices discrete. Upper surface grey, bluish grey to yellow-grey or off-white, epruinose or very weakly pruinose, sorediate; dactyls absent. Soralia laminal, globose, ±capitate, 0.5–1.0 mm wide; soredia farinose. Medulla mostly white; lower medulla rarely yellow near the lobe tips. Lower surface black in the centre, paler towards the lobe tips. Apothecia rare, sessile to ±constricted at the base, 0.6–1.3 mm wide; disc black, epruinose. Epihymenium pale brown, 8–10 µm thick. Hymenium colourless, 80–90 µm thick. Hypothecium red-brown to brown-black, 120–200 µm thick, lentiform. Ascospores 12–21 × 5–9 µm. Conidia bacilliform to fusiform, 3–4 × 0.9–1.1 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

In Australia this pantropical-subtropical species often extends into temperate regions; occurs on bark, wood and rocks from coastal areas to montane forest in W.A., N.T., Qld and N.S.W. Also on Christmas and Norfolk Islands, North, Central and South America, Asia, Africa and many Pacific islands.

W.A.: 1 km N of Gnamagun Well, Cape Leveque, *K.Ralston 606* (MEL). N.T.: Howard Springs Nature Park, 37.5 km SE of Darwin, *J.A.Elix 36709* (CANB). Qld: Yorkeys Knob, 12 km N of Cairns, *J.A.Elix 2643* (CANB). N.S.W.: Bermagui, *J.A.Elix 28839* (CANB).

This species is characterised by the globose, ±capitate soralia with farinose soredia and by the presence of divaricatic acid. *Dirinaria applanata* differs in having the central lobes becoming longitudinally plicate and rugose and the flabellate apices; the lobe apices of *D. picta* are discrete, and the central lobes not longitudinally plicate.

11. **Dirinaria purpurascens** (Vain.) B.J.Moore, *Bryologist* 71: 251 (1968)

Physcia purpurascens Vain., *Ann. Acad. Soc. Fenn*., ser. A, 6: 68 (1915). T: Fair Plane, St Croix, West Indies, on bark, 1906, *Boergesen 235*; lecto: FH *n.v.*, *fide* D.D.Awasthi, *Biblioth. Lichenol.* 2: 45 (1975).

Illustrations: D.D.Awasthi, *op. cit.* figs 14, 30, 31; A.Aptroot, *Fl. Guianas*, ser. E, 1: 22, pl. 5 (1987); I.M.Brodo, S.D.Sharnoff & S.Sharnoff, *Lichens of North America* 307, fig. 319 (2001).

Thallus 2–8 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous to discrete, ±weakly plicate, plane to weakly convex, 0.2–0.7 mm wide; apices flabellate or truncate and ±discrete. Upper surface white to grey, greenish grey, or yellow-grey, usually finely white-pruinose; soredia and dactyls absent. Medulla predominantly white; lower medulla rarely orange towards the lobe tips. Lower surface black in the centre, brown towards the periphery. Apothecia common, crowded centrally, sessile to constricted at the base, 0.5–1.5 mm wide; disc black, purple-pruinose, pruina ±evanescent with age. Epihymenium pale red, c. 10 µm thick. Hymenium colourless, 80–90 µm thick. Hypothecium dark brown to brown-black, 70–80 µm thick, lentiform. Ascospores 11–20 × 5–7 µm. Conidia bacilliform, 4–5 × c. 1 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

This tropical-subtropical species occurs on bark, wood and rocks in hinterland forest and woodland in eastern Qld and N.S.W. Also in Africa and North, Central and South America.

Qld: Mowbray R. estuary, 7 km S of Port Douglas, *J.A.Elix 17480* (CANB); Mt Farrenden, 26 km SSW of Charters Towers, *J.A.Elix 20553* (CANB); Proserpine R. valley, 20 km WSW of Proserpine, *J.A.Elix 21106* (CANB). N.S.W.: Diehard Ck, Mann River Nature Reserve, 50 km E of Glen Innes, *J.A.Elix 37060 p.p.* (CANB).

Dirinaria purpurascens is characterised by the narrow lobes (0.2–0.7 mm wide), the purple-pruinose discs, the thin hypothecium, the absence of soredia and dactyls and the presence of divaricatic acid.

12. **Dirinaria sekikaica** Elix, *Australas. Lichenol.* 62: 36 (2008)

T: Stuarts Pt, Old Macleay River estuary, N.S.W., 30°49'S, 153º00'E, alt. 1 m, on *Casuarina glauca* in strand vegetation adjacent to mangrove swamp, 18 Jan. 1987, *J.A.Elix 21346*; holo: CANB.

Illustration: J.A.Elix, *op. cit.* 40, fig. 2.

Thallus 5–10 cm wide, adnate to tightly adnate, pinnately to subpinnately lobate. Lobes radiating, contiguous, longitudinally plicate and rugose, plane to convex, ±concave and distinctly flabellate towards the tips, 0.5–2.0 mm wide. Upper surface grey, bluish grey to yellow-grey or off-white, ±pruinose, sorediate; dactyls absent. Soralia laminal, hemispherical or becoming elongate, occasionally erose and crateriform; soredia farinose. Medulla white, rarely the lower medulla orange towards the apices. Lower surface black in the centre, ±brown at the margins. Apothecia rare, sessile to ±constricted at the base, 0.5–1.5 mm wide; disc black, rarely sparsely grey-pruinose. Epihymenium dark yellow-brown, c. 10 µm thick. Hymenium colourless, 75–85 µm thick. Hypothecium dark brown to brown-black, 160–200 µm thick. Ascospores 15–22 × 6–8 µm. Conidia bacilliform, 3.5–5 × 0.8–1.0 µm. Fig. 169D.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), sekikaic acid (major), 4'-*O*-demethylsekikaic acid (minor), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on bark, wood and rocks in coastal and montane forest in south-eastern Qld and eastern N.S.W. Also in Africa.

Qld: New England Hwy, 10 km NW of Crows Nest, c. 50 km N of Toowoomba, *K.Kalb 21459 & R.W.Rogers* (Herb. Kalb). N.S.W.: c. 2 km N of Gloucester, *K. & A.Kalb 20362* (Herb. Kalb).

This species is characterised by the contiguous, longitudinally plicate and rugose lobes with flabellate apices, the distinctly farinose soredia and the presence of sekikaic acid.

13. Dirinaria subconfluens D.D.Awasthi, *Biblioth. Lichenol.* 2: 33 (1975)

T: New Caledonia, on bark, 1863–64, *E.Vieillard*; holo: H *n.v.*; iso: H *n.v.*

Illustrations: D.D.Awasthi, *op. cit.* figs 36, 37.

Thallus 3–20 cm wide, adnate to tightly adnate, pinnately to subdichotomously lobate. Lobes radiating, discrete to contiguous, not or very weakly plicate, plane to convex, 0.3–1.0 mm wide, discrete to contiguous at the periphery. Upper surface white to grey, greenish white or pale bluish grey, usually epruinose, rarely slightly white-pruinose; soredia and dactyls absent. Medulla mostly white; lower medulla rarely yellow-orange towards the lobe tips. Lower surface black. Apothecia common, crowded centrally, initially innate, then sessile or slightly constricted at the base, 0.5–1.5 mm wide; disc black, epruinose or weakly grey-pruinose. Epihymenium pale brown, c. 10 µm thick. Hymenium colourless to pale yellow, 60–75 µm thick. Hypothecium dark brown, 70–150 µm thick, lentiform. Ascospores 13–18 × 5–8 µm. Conidia bacilliform, 4–5 × 0.8–1.1 µm.

Chemistry: Cortex K+ yellow, C–, KC–, P+ yellow; medulla K–, C–, KC–, P–; containing atranorin (minor), chloroatranorin (minor), divaricatic acid (major), 3β-acetoxyhopane-1β,22-diol (minor), ±unknown terpenes (minor).

Occurs on bark, wood and rocks in coastal and montane forests and woodland in the N.T. and Qld. Also in Asia, New Caledonia, Vanuatu, French Polynesia and the Hawaiian Islands.

N.T.: Charles Darwin Natl Park, Winnellie, 6 km E of Darwin, *J.A.Elix 36859* (CANB). Qld: Forrest Beach, 18 km ESE of Ingham, *J.A.Elix 36795* (CANB).

Dirinaria subconfluens is characterised by the adnate thallus, the narrow lobes (0.3–1.0 mm wide) with a black lower surface, the absence of soredia and dactyls and the presence of divaricatic acid. *Dirinaria confluens* differs in having a plicate-rugose upper surface, a thicker hymenium (> 80 µm thick) and larger ascospores (16–24 × 7–10 µm).