The Lichen genera *Graphis* and *Graphina* (Graphidaceae) in Australia 1. Species based on Australian type specimens

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Abstract

Archer, Alan W. (*Royal Botanic Gardens Sydney, Mrs Macquaries Road, Sydney NSW 2000, Australia*) *1999*. *The Lichen Genera* Graphis *and* Graphina (*Graphidaceae*) *in Australia 1. Species based on Australian Type Specimens*. Telopea *8(2): 273–295*. The type specimens of 25 Australian species in the genus *Graphis* Adans. and 12 in the genus *Graphina* Müll. Arg. were examined. *Graphis aulacothecia* C. Knight is synonymous with *Phaeographis australiensis* Müll. Arg., *Graphis baileyana* Müll. Arg. and *Graphis innata* C. Knight are later synonyms of *Graphis circumfusa* Stirt., and *Graphis robustior* Müll. Arg. is a later name for *Graphis subcontexta* Nyl. *Graphina brachyspora* Müll. Arg. is a later name for *Graphina pertenella* (Stirt.) Shirley. *Graphis laevigata* Müll. Arg. is placed in the genus *Graphina* and the new combination **Graphina laevigata** (Müll. Arg.) A.W. Archer is made. Lectotypes are chosen for *Graphis immersella* Müll. Arg., *G. vinosa* Müll. Arg., *G. subcontexta* Nyl. and *Graphina subaggregans* Müll. Arg. Two new varieties of *Graphina repleta* (Stirt.) Shirley are described: var. **macrospora** A.W. Archer and var. **stictica** A.W. Archer.

Introduction

The lichen genera *Graphis* Adans. and *Graphina* Müll. Arg. are included, *inter alia*, in the family Graphidaceae (Rogers & Hafellner 1992). 43 species of *Graphis* and 18 species of *Graphina* have been reported from Australia (Filson 1996) but neither genus in Australia has previously been studied. Detailed generic descriptions are given by Rogers (1981).

Between 1882 and 1895 J. Müller [Müll. Arg.] described 19 new species of *Graphis* (Graphidaceae) and 6 new species of *Graphina* (Graphidaceae), based on specimens collected in Australia (Müller 1882, 1883, 1887a, 1891a, 1891b, 1893a, 1893b, 1895). Additional species of *Graphis* were described by Stirton (1881), Knight (1882), Shirley (1889), Räsänen (1949) and Archer (1998) and additional species of *Graphina* were described by Krempelhuber (1880), Stirton (1881, 1899) and Shirley (1892) giving a total of 37 species based on Australian type material. The type specimens of most of these species have received little study apart from examination for inclusion in the *Index to Type Specimens of Australian Lichens* (Filson 1986); an account of these is given here. As a large number of new species in these genera, and in *Phaeographis* and *Phaeographina*, remain to be described, a fuller treatment, with keys, is not provided here.

Species of *Graphis* and *Graphina* are characterised by the structure of the lirelline apothecia, the size and septation of the ascospores and the number of locules therein and the chemistry. Lirellae may be black, sometimes almost hidden by a conspicuous thalline margin and may be open or closed, and sessile or immersed. The proper exciple is often carbonised apically, laterally or completely. Ascospores are rounded oblong, *c.* 10–100 µm long with 4–*c.* 30 locules, the number of locules being approximately proportional to the length of the ascospore. Ascospores of *Graphina* are

muriform in contrast to the transversely septate ascospores in the genus *Graphis*. No pycnidia were observed in the specimens examined. The chemistry of the genera is relatively simple; species may contain norstictic acid, stictic acid or, rarely, psoromic acid or protocetraric acid, or they may lack lichen compounds. Lecanoric acid occurs in *Graphis afzelii* Ach., a pantropical species found in Queensland and the Northern Territory.

Material and methods

The material examined consisted of type and other specimens from BM, BRI, G, H, M, NSW and WELT and additional specimens from CANB, ESS, GZU, herb. J. Hafellner, herb. K.Kalb and the author's own collections.

Manual cross-sections of lirellae were examined in water to determine the structure of the proper exciple and ascospores were stained with weak aqueous iodine (KI/I) to reveal the locules. Lichen compounds were identified by thin-layer chromatography, performed on acetone extracts using the mobile phase C (Culberson 1972) with silica gel plates (Merck GF 254) and compounds were detected with dilute sulphuric acid (Culberson 1972). The red colour given by norstictic acid with alkali (the K reaction) is unreliable with many *Graphis* and *Graphina* specimens due to the sometimes false positive reaction given by the substrate.

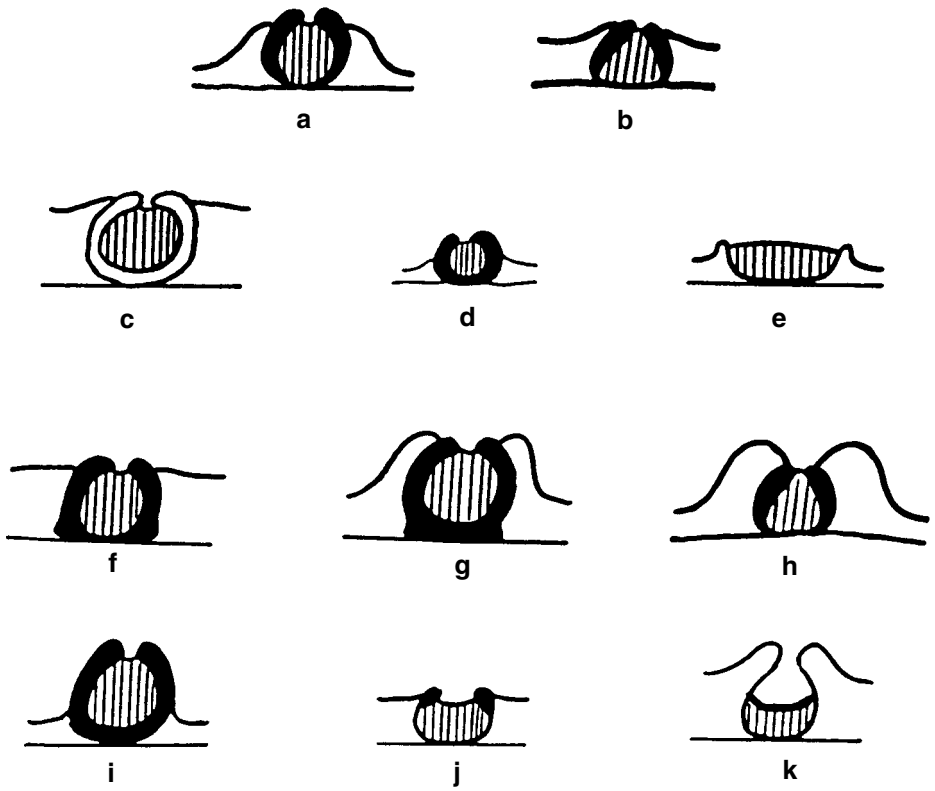

Fig. 1. Diagrammatic cross sections of lirellae (not to scale). **a**, *Graphis albissima*; **b**, *G. albonitens*; **c**, *G. argopholis*; **d**, *G. centrifuga*; **e**, *G. circumfusa*; **f**, *G. crassilabra*; **g**, *G. decissa*; **h**, *G. elixii*; **i**, *G. emersa*; **j**, *G. epimelaena*; **k**, *G. glauca*.

Graphis Species

Graphis albissima Müll. Arg. (Fig. 1a)

(Müller 1895: 319)

Type: Queensland: sine loc., *C. Knight 147* (holo G).

Thallus chalky white, thin, corticolous, becoming evanescent at the margin, surface smooth and dull; apothecia lirelliform, black, conspicuous, thin, numerous, subimmersed, curved and sinuous, sometimes branched, 1–4 mm long, c. 0.1 mm wide, terminally acute, lips closed, not sulcate, with a conspicuous white thalline margin; proper exciple laterally carbonised, hymenium 100–125 µm tall; ascospores 8 per ascus, fusiform, 30–41 µm long, 7–8 µm wide, 10–12-locular.

Chemistry: no compounds found.

Also examined: Queensland: D'Aguilar Range, *J. Hafellner 16951* p.p., Aug 1986 (GZU); Maroochydore Island, *J. Hafellner 18059*, Nov 1986 (GZU); 29 km S of Cooktown, *H. Streimann 31018*, July 1984 (CANB, H).

New South Wales: Track to Dangar Falls, c. 2 km N of Dorrigo, *A.W. Archer G 217*, Apr 1998 (NSW).

Graphis albissima is characterised by the thin black lirellae, the laterally carbonised proper exciple and the absence of lichen compounds. It resembles *G. xanthospora* (q.v.) but the proper exciple in that species is apically carbonised.

Graphis albonitens Müll. Arg. (Fig. 1b)

(Müller 1891a: 53).

Type: Queensland: Bellenden Ker, *F.M.Bailey 582*, 1889 (holo G).

Thallus off-white, thin, corticolous, surface smooth and shiny; apothecia lirelliform, inconspicuous, immersed, slit-like, indicated by a thin black line on (or just below) the surface of the thallus, simple, rarely branched, 1–2 mm long, c. 0.05 mm wide, lips closed or rarely very slightly open; proper exciple laterally carbonised; hymenium 100–125 µm tall; ascospores 8 per ascus, imbricate 1-seriate, 10–11 µm long, 5–6 µm wide, 4-locular.

Chemistry: no compounds found

Graphis albonitens is characterised by the slit-like lirellae, the small, 4-locular ascospores and the absence of lichen compounds. It is distinguished from other Australian *Graphis* species with slit-like lirellae by the laterally carbonised exciple.

The species resembles *G. humilis* Vain., described from the Philippines (Vainio 1920), but that species has more conspicuous lirellae and larger ascospores, 14–25 µm long, 7–9 µm wide (fide Vainio, loc. cit.). *Graphis albonitens* is so far known only from the type specimen.

Graphis argopholis C. Knight ex Müll. Arg. (Fig. 1c)

(Müller 1887a: 401).

Type: Australia: sine loc., *C. Knight s.n.*, 1886 (holo G).

Thallus off-white, thick, corticolous, surface smooth and dull; apothecia lirelliform, white, inconspicuous, immersed, numerous, crowded, curved or sinuous, often branched, visible as a slit with marginal pale lines on the surface of the thallus, 1–2 mm long, 0.2–0.3 mm wide; proper exciple pale yellow-brown, complete, uncarbonised; hymenium 125–150 µm tall; ascospores 8 per ascus, 2-seriate, 28–32 µm long, 7–8 wide, 6–10-locular.

Chemistry: no compounds found.

Graphis argopholis is characterised by the inconspicuous white lirellae, the pale brown, uncarbonised proper exciple and the absence of lichen compounds.

The species is so far known only from the type specimen.

Graphis aulacothecia C. Knight

(Knight 1882: 41).

Type: New South Wales: [near Sydney], *C. Knight,* 1880, Syntypes:, *C. Knight 7*, 1880 (WELT); *C. Knight 46*, 1880 (WELT).

Graphis aulacothecia is a taxonomic synonym of *Phaeographis australiensis* Müll. Arg. (Müller 1882); this synonymy will be discussed in detail elsewhere.

Graphis baileyana Müll. Arg. see **Graphis circumfusa** Stirt.

Graphis centrifuga Räsänen (Fig. 1d, 4a)

(Räsänen 1949: 187)

Type: New South Wales: sine loc., *F.R.M. Wilson s.n.*, 1892 (holo H).

Thallus pale fawn, thin, surface smooth to subtuberculate and dull, corticolous; apothecia lirelliform, black, conspicuous, thin, numerous, lips closed, scattered or crowded or arranged in conspicuous well-defined stellate clusters, semi-immersed to sessile, with a very thin thalline margin; lirellae 1–4(–6) mm long, 0.05–0.1 mm wide, the clusters up to 8–12 mm diam.; proper exciple black, complete, hymenium 100–120 µm tall. Ascospores 8 per ascus, 2-seriate, 15–26 µm long, 5–8 µm wide, 6–8-locular [Räsänen (loc. cit.) reported (14–)17–29 µm long, 6–8 µm wide, 6–8-locular].

Chemistry: norstictic acid.

Also examined (7 out of 35): Queensland: Glasshouse Mountains, *J. Hafellner 19460*, Aug 1986 (GZU); Connors Range, c. 30 km S of Mackay, *H.T. Lumbsch 10983a*, Oct 1994 (ESS); 68 km N of Injune, *J.A. Elix 34036,* Aug1993 (CANB).

New South Wales: New England National Park, *G. Kantvilas 672/88,* Aug 1988 (HO, NSW); Monga State Forest, *H.T. Lumbsch 5648b*, Sep 1987 (ESS); Myall River State Forest, *K. Kalb 17918*, Aug 1988 (herb. Kalb).

Victoria: Lake Tyers, *F.R.M. Wilson 1492,* Mar 1888 (NSW); Coast Range Road, 18 km SSE of Bendoc, *H. Streimann 36671*, Apr 1986 (CANB).

Graphis centrifuga is characterised by narrow lirellae (which may sometimes occur in well-defined stellate clusters), a complete proper exciple, small ascospores and the presence of norstictic acid. The species resembles the tropical species *G. radiata* (Mont.) Nyl., which also has radiating, branched lirellae (Magnusson & Zahlbruckner 1943) but that species has 4-locular ascospores.

Graphis centrifuga may be a later name for the South American species *G. intricata* Fée (Fée 1824) which is also characterised by clusters of thin, intricately branched lirellae, but the protologue gives no further morphological details. Müller (1887b) examined Fée's specimens and reported the ascospores to be c. 14 µm long, 5.5 µm wide and 6-locular but qualified his remarks by noting that 'the spores were not fully developed and would probably become a little longer and more divided' (i.e. with more locules). Later reports of *G. intricata* from Brazil (Redinger 1935) and Japan (Nakanishi 1966) describe material both morphologically and chemically similar to *G. centrifuga*, but as the chemistry of *G. intricata* is not known with certainty, *G. centrifuga* is retained as a separate species.

Graphis circumfusa Stirt. (Fig. 1e, 4b)

(Stirton 1881: 73)

Type: Queensland: Brisbane, *F.M. Bailey 201* (holo GLAM; iso BM, BRI [AQ720195]).

Graphis innata C. Knight

(Knight in Shirley 1889: 201)

Type: Queensland: Mount Perry, *C. Knight* 689 (holo WELT; iso BRI [AQ 720201]).

Graphis baileyana Müll. Arg.

(Müller 1893a: 132)

Type: Queensland: Brisbane, *F.M. Bailey 1586, 1617, 1618*, 1891 (syntypes G).

Thallus pale greyish white, corticolous, surface smooth and dull; apothecia lirelliform, inconspicuous, scattered, open, subimmersed, ellipsoid or irregular in outline, 0.5–1 mm long, 0.2–0.3 mm wide, with an ill-defined thalline margin; epithecium black, white-pruinose; proper exciple absent; hymenium 100–125(–150) µm tall; ascospores 8 per ascus, 2-seriate, (45–)60–75(–95) µm long, (7–)8–10 µm wide, (12–)16–21-locular.

Chemistry: norstictic acid.

Also examined: Queensland: 33 km SSW of Gympie, *H.T. Lumbsch 10992c*, Oct 1994 (ESS).

New South Wales: Dangar Falls, c. 2 km N of Dorrigo, *A.W. Archer G 196*, Apr 1998 (NSW); Dorrigo National Park, *D. Verdon 5140*, Jan 1983 (CANB); Kiwarrah State Forest, *J.A. Elix 3964*, Oct 1977 (CANB); Wang Wauk State Forest, O'Sullivans Gap Nature Reserve, *J.A. Elix 33844*, Aug 1993 (CANB).

Graphis circumfusa is characterised by the inconspicuous open lirellae, the absence of a carbonised proper exciple, the ill-defined thalline margin and the presence of norstictic acid. It resembles the chemically similar *G. wilsoniana* (q.v.) but that species has a laterally carbonised proper exciple and smaller ascospores.

Graphis crassilabra Müll. Arg. (Fig. 1f)

(Müller 1882: 526)

Type: Queensland: Toowoomba, *C.Hartmann 78* (holo G; iso MEL 515597).

Thallus off-white, thick, corticolous, surface smooth and somewhat shiny; apothecia lirelliform, black, inconspicuous, numerous, crowded, immersed in the thallus, straight, curved or sinuous, sometimes branched, lips closed, sometimes becoming slightly open, 1–2 mm long, 0.1–0.15 mm wide; proper exciple laterally or almost completely carbonised; hymenium 100–125 mm tall; ascospores 8 per ascus, (45–)50–65 µm long, 8–12 µm wide, (9–)10–14(–15)-locular.

Chemistry: stictic acid (major) and hypostictic acid (trace).

Also examined: Queensland: Goodna, *F.R.M. Wilson 51* (NSW); Sankeys Scrub, *F.R.M. Wilson s.n.* (NSW L5027), *F.R.M. Wilson 1534*, Aug 1889 (NSW); Three Mile Scrub, *F.R.M. Wilson s.n.* (NSW L5059); Brisbane, Peachys Scrub, *F.R.M. Wilson s.n.*, Aug 1896 (NSW L4994); Kuranda Range, *K. Kalb 21280*, Aug 1988 (herb. Kalb).

New South Wales: Gradys Creek, on edge of Border Ranges National Park, *J. Hafellner 16469*, Aug 1986 (GZU); Cherrytree State Forest, Mallanganee, c. 80 km ENE of Tenterfield, *A.W. Archer G 274*, Nov 1998 (NSW).

Graphis crassilabra is characterised by the inconspicous, black, immersed lirellae, the variably carbonised proper exciple and the presence of stictic acid. Externally. *G. crassilabra* resembles *G. imersella* (q.v.) and *G. propinqua* (q.v.) but is distinguished

from the former species , which also contains stictic acid , by the smaller ascospores in that species, and from the latter species by the green thallus and the absence of lichen compunds in that species.

Müller (1882) reported the proper exciple in *G. crassilabra* to be laterally carbonised ('perithecium basi deficiens') but lirellae with the proper exciple both laterally and almost completely carbonised were seen in both the holotype and the specimens cited above.

Graphis descissa Müll. Arg. (Fig. 1g)

(Müller 1895: 318)

Type: Queensland: sine loc., *C. Knight 339*, 1887 (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, conspicuous, numerous, immersed, curved or sinuous, often branched, lips closed, 1–4(–5) mm long, 0.15–0.3 mm wide, with a conspicuous, white, immersed thalline margin; proper exciple completely carbonised; hymenium 100–120 µm tall; ascospores 8 per ascus, 28–37(–40) µm long, 6–8 µm wide, 8–10(–11)-locular.

Chemistry: stictic acid.

Also examined: New South Wales: Myall River State Forest, *K. Kalb 17961*, Aug 1988 (herb. Kalb); Dangar Falls, c. 2 km N of Dorrigo, *A.W. Archer G 280*, Nov 1998 (NSW).

Graphis descissa is characterised by the conspicuous immersed lirellae, the completely carbonised proper exciple and the presence of stictic acid. The species somewhat resembles *G. crassilabra* (q.v.) but that species has larger ascospores. Müller (1895) compared his new species with *G. noumeana* Müll. Arg.: both species have conspicuous immersed lirellae but *G. noumeana* has larger ascospores (80–110 µm long) and contains no lichen compounds.

Graphis elixii A.W. Archer (Fig. 1h)

(Archer 1998: 16).

Type: New South Wales: Monga State Forest, along the Mongarlowe River, 5 km S of Monga, alt. 665 m, in rainforest on canopy of *Eucryphia moorei*, *J.A. Elix 11732*, Jan 1984 (holo CANB).

Thallus pale fawn, thin, corticolous, surface smooth and shiny; apothecia lirelliform, conspicuous, scattered, sessile, straight or slightly curved, unbranched, black, lips initially closed, then opening to form a slit, with a conspicious thalline margin, the lirellae 1–2 mm long, 0.3–0.4 mm wide; proper exciple laterally carbonised; hymenium hyaline, c. 100 µm tall; ascospores hyaline, rounded-oblong, 8 per ascus, 2-seriate, (16–)18–20 µm long, 8–10 µm wide, 4-locular.

Chemistry: psoromic acid.

Graphis elixii is characterised by the conspicuous lirellae, the small 4-locular ascospores and, in particular, the presence of psoromic acid. Psoromic acid is an uncommon compound in the Graphidaceae (Wirth & Hale 1978) and is known only from two species, viz. *Graphina columbina* (Tuck.) M. Wirth & Hale (Wirth & Hale 1978) and *Graphis alboscripta* Coppins & P. James (Coppins et al. 1992). Neither of these two species has carbonised exciples and in the *Graphina* species the ascospores are both transversely and longitudinally septate. *Graphis alboscripta* occurs in the high rainfall areas of western Scotland and appears to be endemic to that region.

Graphis elixii resembles *Graphis albonitens* Müll. Arg., (q.v.). Both of these species have laterally carbonised proper exciples and small, 4-locular ascospores but in *G. albonitens*

the lirellae are immersed in the thallus and are barely visible as a thin black line. In contrast, the lirellae in *G. elixii* are conspicuous and sessile, with thick thalline margins. Lichen compounds are absent from *G. albonitens* but *G. elixii* contains psoromic acid. *Graphis elixii* is so far known only from the type specimen.

Graphis emersa Müll. Arg. (Fig. 1i)

(Müller 1893a: 132)

Type: Queensland: Brisbane, *F.M. Bailey 217*, 1891 (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, numerous, conspicuous, straight or curved, unbranched, sessile, lips closed, lacking a thalline margin, 0.5–2.0 mm long, 0.2 mm wide; proper exciple completely carbonised; hymenium 100–150 µm tall; ascospores 8 per ascus, 2–3-seriate, (30–)35–40 µm long, 8–9 µm wide, 8–10(–11)-locular.

Chemistry: norstictic acid.

Also examined: Queensland: Gambubal State Forest, *J. Hafellner 16348*, Sep 1986 (GZU); Forest Glen, 8 km SE of Nambour, *D. Verdon 5212*, Jan 1983 (CANB); Brandy Creek Road, 12 km NE of Proserpine, *H. Streimann 37444*, June 1986 (B, CANB, US).

New South Wales: Marengo State Forest, *H. Streimann 6761*, Oct 1978 (CANB); Myall River State Forest, *K. Kalb 17946*, Aug 1988 (herb. Kalb).

Graphis emersa is characterised by the conspicuously sessile lirellae lacking a thalline margin, the completely carbonised proper exciple and the presence of norstictic acid.

The species is distinguished from the somewhat similar *G. desquamescens* (Fée) Zahlbr. by the subimmersed lirellae and the smaller, 6–8-locular, ascospores in that species, and from *G. anfractuosa* (Eschw.) Eschw. by the presence of norstictic acid, which is absent from *G. anfractuosa* .

Graphis epimelaeana Müll. Arg. (Fig. 1j)

(Müller 1895: 319).

Type: Queensland: sine loc. [Sankeys Scrub, Brisbane (Shirley 1889)], *F.M. Bailey 778*, 1891 (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, inconspicuous, scattered, immersed, curved, sometimes branched, lips initially closed, opening to reveal a greyish white epithecium, 1–2 mm long, 0.05–0.1 mm wide; proper exciple apically carbonised; hymenium 100–150 µm tall; ascospores 8 per ascus, 40–60 µm long, 10–12 µm wide, 10–12-locular.

Chemistry: no compounds found.

Also examined: Queensland: sine loc., *J.F. Shirley s.n.* (BRI [AQ 721287]).

Graphis epimelaena is characterised by the inconspicuous, immersed, open lirellae, the apically carbonised proper exciple and the absence of lichen compounds. The holotype is a specimen previously determined as *Graphis malacodes* Nyl. [*Phaeographis malacodes* (Nyl.) Zahlbr. (fide Filson 1996)] by J. Shirley (Shirley 1889).

Graphis epimelaena resembles *G. xanthospora* but is distinguished from that species by the open lirellae and the larger ascospores. The species is so far known only from the two specimens cited above.

Graphis glauca Müll. Arg. (Fig. 1k)

(Müller 1893b: 58)

Type: Victoria: Warburton, *F.R.M. Wilson 884*, Dec 1885 (holo G, iso NSW).

Thallus dull green, thin, corticolous, surface smooth and shiny; apothecia lirelliform, inconspicuous, immersed, indicated by a thin line between two lips, sometimes slightly open, slightly raised and paler than the thallus, straight, curved or sinuous, often branched, 1–3 mm long, 0.05–0.1 mm wide; proper exciple absent; hymenium c. 125 µm tall; ascospores 8 per ascus, imbricate 1-seriate, ellipsoid, 18–20 µm long, 8–10 µm wide, 4-locular.

Chemistry: no compounds found.

Also examined: Queensland: Goomburra State Forest, c. 50 km NW of Warwick, alt. 800 m, *H.T. Lumbsch 5691c*, Sep 1987 (ESS);

New South Wales: Royal National Park, *F.R.M. Wilson 1562*, Oct 1888 (NSW).

Graphis glauca is characterised by the green thallus, the inconspicuous, immersed lirellae, 4-locular ascospores and the absence of lichen compounds.

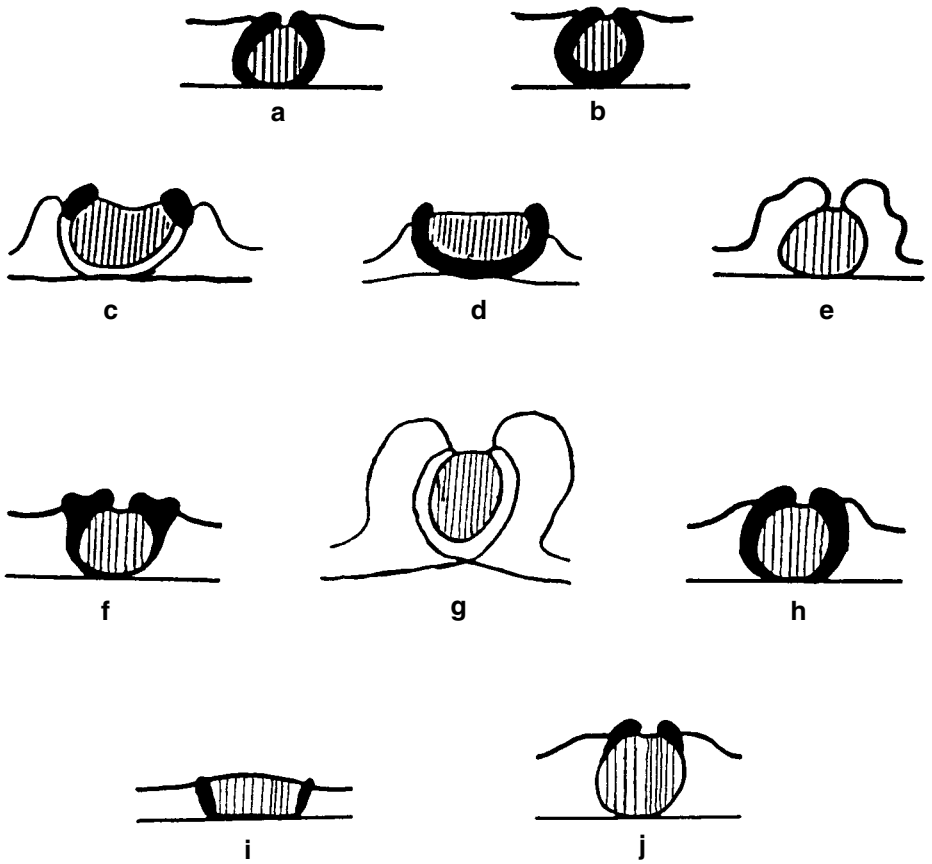

Fig. 2. Diagrammatic cross sections of lirellae (not to scale). **a**, *Graphis immersella*; **b**, *G. propinqua*; **c**, *G. sayeri*; **d**, *G. semiaperta*; **e**, *G. subcontexta*; **f**, *G. subtenella*; **g**, *G. vermifera*; **h**, *G. vinosa*; **i**, *G. wilsoniana*; **j**, *G. xanthospora*.

Graphis immersella Müll. Arg. (Fig. 2a, 4c)

(Müller 1895: 319)

Type: Queensland: sine loc.[Cairns (Shirley 1896)], *J.F. Shirley 1793*, 1893 (lecto G, here selected).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, inconspicuous, immersed, level with the thallus surface, straight, curved or sinuous, sometimes branched, lips closed, 1–2 mm long, (0.05–)0.1–0.15 mm wide; proper exciple laterally carbonised; hymenium 75–100 µm tall; ascospores 8 per ascus, 24–35(–40) µm long, 6–8 µm wide, 8–10(–11)-locular.

Chemistry: stictic acid.

Also examined: Queensland: Balfour Range, 29 km SE of Nanango, *H. Streimann 9320*, Aug 1979 (CANB, NICH); Bunya Mountains, 12 km NNE of Mount Mowbullan, *K. Kalb 18999*, Aug. 1988 (herb. Kalb); Bellenden Ker, *J. Shirley* (BRI [AQ 721281]).

Graphis immersella is characterised by inconspicuous immersed lirellae, the laterally carbonised proper exciple and the presence of stictic acid. Müller (1895) cited two syntypes in the protologue, *Bailey 1818* and *Shirley 1793*. The ascospores in both specimens are similar in size and number of locules but are slightly smaller than those quoted by Müller, viz. 40–45 µm long, c. 9 µm wide and 12-locular. The Shirley specimen is the larger of the two and is here selected as lectotype. The chemistry reported above is based on that of the lectotype and the specimens cited above, as the Bailey specimen was too small for chemical examination.

An unnamed, morphologically similar species from Queensland and the Northern Territory contains norstictic acid.

Graphis innata C. Knight see **Graphis circumfusa** Stirt.

Graphis laevigata Müll. Arg. see **Graphina laevigata** (Müll. Arg.) A.W. Archer

Graphis propinqua Müll. Arg. (Fig. 2b)

(Müller 1882: 502)

Type: Queensland: Toowoomba, *C. Hartmann 77* (holo G; iso MEL 515603).

Thallus pale greyish-green, thin, corticolous, surface smooth and somewhat shiny; apothecia lirelliform, black, conspicuous, numerous, immersed, lips closed, curved, sinuous, and often branched, 0.5–2.0 mm long, 0.1–0.15 mm wide; proper exciple completely, or rarely almost completely, carbonised; hymenium 100–150 µm tall; ascospores 8 per ascus, (43–)55–65 µm long, 8–11 µm wide, 13–15(–16)-locular.

Chemistry: no compounds found.

Also examined: Queensland: D'Aguilar Range, W of Mount Glorious township, *J. Hafellner 16923*, Aug 1986 (GZU).

New South Wales: Conglomerate State Forest, Waihou Road, 25 km NNW of Coffs Harbour, *A.W. Archer G193*, April 1998 (NSW); Dorrigo National Park, 40 km WSW of Coffs Harbour, *A.W. Archer G222*, April 1998 (NSW).

Graphis propinqua is characterised by the pale green thallus with conspicuous thin black immersed lirellae, the completely carbonised proper exciple and the absence of lichen compounds. The species closely resembles *G. leptogramma* Nyl., described from New Caledonia (Nylander 1868); both species have thin, black, immersed lirellae in a green thallus but *G. leptogramma* has a laterally carbonised exciple and contains stictic acid.

Graphis robustior Müll. Arg. see **Graphis subcontexta** Nyl.

Graphis sayeri Müll. Arg. (Fig. 2c)

(Müller 1887a: 401).

Type: Queensland: Trinity Bay [Cairns], *W.A. Sayer s.n.* (holo G).

Thallus pale greenish-grey, thin, corticolous, surface smooth and dull; apothecia lirelliform, inconspicuous, immersed, numerous, crowded, visible as a thin black line, straight, curved or sinuous, sometimes branched,1–3(–5) mm long, (0.15–)0.2–0.3 mm wide, lips closed; proper exciple apically, or rarely slightly laterally, carbonised; hymenium 90–100 µm tall; ascospores 8 per ascus, (30–)38–50(–55) µm long, (6–)8–10 µm wide, (9–)10–12-locular.

Chemistry: no compounds found.

Also examined: Queensland: Bellenden Ker, *F.R.M. Wilson 876,* no date (NSW); Brisbane, Three Mile Scrub, *F.R.M. Wilson 1545,* 1889 (NSW); Goodna, *F.R.M. Wilson 2010*, no date (NSW), *F.R.M. Wilson 49,* no date (NSW); Pine Mountain State Forest, 24 km SSW of Calliope, *J.A. Elix 34793*, Aug 1993 (CANB).

Graphis sayeri is characterised by immersed black lirellae, the apically carbonised proper exciple and the absence of lichen compounds. It is distinguished from *G. epimelaena* and *G. xanthospora*, both of which have apically carbonised proper exciples, by the open lirellae in *G. epimelaena* and the smaller ascospores in *G. xanthospora*. *Graphis sayerii* was also reported from Ambon [Indonesia] (Müller 1893c).

Graphis semiaperta Müll. Arg. (Fig. 2d)

(Müller 1891b: 397).

Type: Queensland: Brisbane, *F.M. Bailey 488*, 1889 (holo G).

Thallus off-white to pale grey, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, conspicuous, numerous, scattered, straight or curved, rarely branched, sessile with a thin evanescent thalline margin, 0.7–3 mm long, 0.15–0.25(–0.3) mm wide, lips initially closed, becoming open; proper exciple completely carbonised; epithecium black, epruinose; hymenium 75–100 µm tall; ascospores 8 per ascus, 20–29(–34) µm long, 6–8 µm wide, (5–)6–8-locular.

Chemistry: norstictic acid.

Also examined: Queensland: sine loc., *J.F. Shirley* (BRI [AQ 721279]); New England Highway, 20 km SW of Yarraman, *J. Hafellner 18647*, Sep 1986 (GZU).

New South Wales: Currowan State Forest, 12 km W of Nelligen, *J.A. Elix 3607*, July 1977 (CANB); Blue Mountains, Glenbrook, by side of Euroka Creek, *A.W. Archer G 160*, Mar 1998 (NSW); Chaelundi Mountain, 37 km N of Ebor, *D. Verdon 3902*, Oct 1978 (CANB); Stroud–Gloucester Road, 37 km S of Gloucester, *H. Streimann 43921*, Apr 1990 (CANB); Currawon State Forest, 14 km NW of Batemans Bay, *H. Streimann 27686*, May 1983 (CANB).

Victoria: Fernshaw at Watts River, NE of Healesville, *J. Hafellner 18393*, July 1986 (GZU).

Tasmania: 5 km NNE of St Marys, *J.A. Curnow 2455*, Nov 1988 (CANB).

Graphis semiaperta is characterised by black open lirellae with a completely carbonised proper exciple and the presence of norstictic acid. The species is thus distinguished from the somewhat similar species *G. librata* C. Knight, which has closed lirellae and an incompletely carbonised exciple. Reported substrates include *Acacia*, *Banksia*, *Breynia*, *Callicoma*, *Ficus*, *Persoonia* and *Pomaderris*.

Graphis subcontexta Nyl. (Fig. 2e)

(Nylander 1868: 79).

Type: New Caledonia: Lifu (Loyalty) Island, *Thiébaut s.n.*, 1864 (lecto H–NYL 7700, here selected).

Graphis robustior Müll. Arg.

(Müller 1891b: 398).

Type: Queensland: Brisbane, *F.M. Bailey 492*, 1889 (holo G).

Thallus olive-green to brownish green, thick, corticolous, surface smooth, and shiny; apothecia lirelliform, conspicuous, numerous, crowded, curved and sinuous, rarely branched, off-white to reddish brown, 4–10 mm long, (0.3–)0.4–0.8(–1.0) mm wide,

at first partly immersed, finally becoming sessile, lips closed or sometimes slightly open, sometimes slightly sulcate; proper exciple reddish brown, uncarbonised or slightly apically carbonised, open at the base or sometimes almost closed; hymenium 100–125(–150) µm tall; ascospores 8 per ascus, 1-seriate, rounded oblong, hyaline, (13–)15–21 µm long, 6–8(–9) µm wide, 4-locular.

Chemistry: no compounds found.

Also examined: Northern Territory: Litchfield Park, Curtain Falls, 38 km WSW of Batchelor, *J.A. Elix 27581*, July 1991 (CANB).

Queensland: Peachys Scrub [Brisbane], *F.R.M.* Wilson, no date (NSW L5075); Upper Coomera [near Southport], *F.R.M. Wilson 1530*, no date (NSW); Three Mile Scrub, *J.F.* Shirley (BRI [AQ721278]); Daintree National Park, Emmagen Creek, c. 5 km N of Cape Tribulation, *H.T. Lumbsch 11161g*, Aug 1996 (ESS), *H.T.Lumbsch 11161b* (ESS); Crediton State Forest, 20 km SSW of Finch Hatton, *J.A. Elix 21056*, July 1986 (CANB); Wilson Beach, 17 km SE of Proserpine, *H. Streimann 37606*, June 1986 (CANB).

New Zealand: sine loc., *C. Knight 41*, 1867 (H–NYL 7701).

Graphis subcontexta is characterised by the large, conspicuous sessile lirellae, small 4-locular ascospores and the absence of lichen compounds

The appearance of the lirellae is variable as the colour of the lirellae depends on the degree of exposure of the reddish brown proper exciple. When concealed by the thalline margin the lirellae appear off-white but with a less well-developed thalline margin the reddish brown proper exciple becomes more conspicuous and the lirellae appear reddish brown (cf. *Lumbsch 11161g*). The species occurs in Australia (Northern Territory and Queensland) and in New Caledonia and New Zealand.

In the protologue Nylander referred to specimens collected by Vieillard, Déplanche and Thiébaut. H–NYL 7700 is the only specimen collected by Thiébaut which is annotated with spore dimensions by Nylander and is chosen as lectotype. The remaining specimens examined from H–NYL, viz. 7702, 7703, 7704, 7705 and 7707, are too small to select as a lectotype. H–NYL 7701 is from New Zealand (*vide supra*) and H-NYL 7706 appears to be from Tahiti but the label is unclear.

Graphis subtenella Müll. Arg. (Fig. 2f)

(Müller 1887a: 400)

Type: Queensland: Mulgrave River, NE Australia, *W.A. Sayer s.n.* (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, inconspicuous, thin, initially immersed, becoming subimmersed to sessile with a thin thalline margin, curved and sinuous, often branched, sometimes in substellate

clusters, lips closed, sulcate, 1–3(–4) mm long, 0.05–0.15 mm wide; proper exciple apically to laterally carbonised; hymenium 50–100 µm tall; ascospores 8 per ascus, 21–30(–34) µm long, (5–)6–7 µm wide, 8–10-locular.

Chemistry: no compounds found.

Also examined: Queensland: Wooroonooran National Park, Babinda Boulders, *H.T. Lumbsch 11152c*, July 1996 (ESS); Charleys Creek, 18 km NNE of Proserpine, *J.A. Elix 21012*, May 1986 (CANB); North Wallaman logging area, 36 km WNW of Ingham, *H. Streimann 28790*, June 1984 (CANB).

New South Wales: 4 km E of Robertson, *J.A. Elix 8899*, Sep 1980 (CANB); Budawang Range, 14 km SE of Nerriga, *D. Verdon 2562*, July 1976 (CANB); Mount Boss State Forest, *D. Verdon 4056*, Oct 1978 (CANB); Hyland State Forest, 30 km NW of Dorrigo, *D. Verdon 3866*, Oct 1978 (CANB);

Graphis subtenella is characterised by inconspicuous, branched, black, sulcate lirellae, small ascospores and the absence of lichen compounds. Reported substrates include *Doryphora* and *Nothofagus*.

Graphis subtenella is distinguished from the morphologically similar *G. rimulosa* (Mont.) Trevis. (which also occurs in Australia) by the incompletely carbonised proper exciple. An unnamed species from Queensland, somewhat similar to *G. subtenella*, contains stictic acid.

Graphis vermifera Müll. Arg. (Fig. 2g)

(Müller 1887a: 401).

Type: Queensland: Trinity Bay [Cairns], *W.A. Sayer s.n.* (holo G).

Thallus off-white to pale olive-green, thin, corticolous, surface smooth and dull; apothecia lirelliform, conspicuous, off-white, sessile, straight, curved or sinuous, very rarely branched, lips closed, with a thalline margin, 1–6(–10) mm long, 0.3–0.5(–0.6) mm wide; proper exciple brown to orange brown, complete or rarely just open at the base, uncarbonised; hymenium 125–175 µm tall; ascospores 8 per ascus, (65–)81–95(–105) µm long, 10–11 µm wide, (15–)18–22(–24)-locular.

Chemistry: stictic acid.

Also examined: Queensland: Upper Coomera [near Southport], *F.R.M. Wilson 2013*, no date (NSW); Russell River National Park , c. 8 km NE of Babinda, *H.T. Lumbsch 11138n*, July 1996 (ESS); Wooroonooran National Park, Babinda Boulders, *H.T. Lumbsch 11152d*, July 1996 (ESS); Gordonvale Road, c. 10 km E of Cairns, *H.T. Lumbsch 11158h* July 1996 (ESS); Rainbow Beach, c. 50 km W of Gympie, H.T. Lumbsch *10995l*, Oct 1994 (ESS); Windsor Tableland, 38 km NW of Mossman, *H. Streimann 29703* p.p., June 1984 (CANB).

New South Wales: Richmond River, Big Scrub, *F.R.M. Wilson s.n.*, no date (NSW).

Graphis vermifera is characterised by conspicuous white lirellae on a pale green thallus, large, multilocular ascospores and the presence of stictic acid. The species resembles *Graphina repleta* (q.v.) but is distinguished from that species by the nonsulcate lirellae and the transversely septate ascospores. The type specimen is now very poor and fragmentary. Müller (1887a) compared his new species with *G. nematodes* Leighton, from Ceylon (Leighton 1869) but that species has a completely carbonised proper exciple and the spores are reported to be 6-locular.

Graphis vinosa Müll. Arg. (Fig. 2h)

(Müller 1895: 318).

Type: Queensland: Thursday Island, *C. Knight 341*, 1887 (lecto G, here selected).

Thallus off-white to pale fawn, corticolous, thin, surface smooth and dull; apothecia lirelliform, black, inconspicuous, thin, numerous, scattered, straight, curved or sinuous, sometimes branched, semi-immersed to sessile, lips smooth, closed, becoming slightly open, 0.5–4 mm long, 0.1–0.15(–0.3) mm wide, with a conspicuous thalline margin; proper exciple laterally carbonised; hymenium 100–125 µm tall; ascospores 8 per ascus, 40–50 µm long, (6–)8–10 µm wide. (10–)12–14-locular.

Chemistry: norstictic acid.

Also examined: Northern Territory: Melville Island, Conder Point, *H. Streimann 42480*, Apr 1989 (CANB); Lee Point, 16 km NNE of Darwin, *H. Streimann 8789*, Dec 1984 (CANB); 6 km SE of Darwin, *H.T. Lumbsch 8877*, July 1991 (ESS); Rapid Creek, 8 km NNE of Darwin, *J.A. Elix 22599*, May 1988 (CANB); Howard Springs, 22 km W of Darwin, *H. Streimann 8733* p.p., Dec 1984 (CANB).

Queensland: Bunya Mountains, near Maidenwell, *J. Hafellner 19344*, Aug 1986 (GZU); Forest Beach, 16 km SE of Ingham, *H. Streimann 28839*, June 1984 (CANB).

Graphis vinosa is characterised by inconspicuous black lirellae with conspicuous thalline margins, laterally carbonised proper exciples and the presence of norstictic acid. Müller reported the ascospores in his new species to be 38–45 µm long and 8–10-locular but the ascospores seen in the lectotype were 40–50 µm long and never less than 10-locular, with the majority being 12–14-locular.

The epithet 'vinosa' was based on the appearance of the lower hymenium, 'lamina inferne', which Müller described as 'purplish red or pale carmine or coppery violet'. This coloration was not visible in the holotype when examined and may have been due to a pigment from the substrate. The substrates of some recently examined *Graphis* specimens from Queensland showed them to be reddish-violet just below the lichen thallus.

The protologue refers to several of Knight's specimens (*Knight 10* p.p., *146*, *149* p.p., *287* p.p., *329* p.p., *337* and *341*) and the best of these, *Knight 341*, is here selected as lectotype.

Graphis wilsoniana Müll. Arg. (Fig. 2i)

(Müller 1893b: 57).

Type: Victoria: Lakes Entrance, *F.R.M. Wilson 1495*, Mar 1889 (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull with patches of pale orange-brown soralia; apothecia lirelliform, inconspicuous, black with a white pruinose epithecium, open, immersed, scattered or rarely clustered, irregular in shape, rarely simple and linear, often branched, sometimes substellate, 1–3 mm long, 0.2–0.3 mm wide, clusters to 4 × 2 mm; proper exciple thin, laterally carbonised; hymenium 125–150 µm tall; ascospores 8 per ascus, 45–50(–54) µm long, (6–)8–9 µm wide, (9–)10–16-locular.

Chemistry: norstictic acid.

Graphis wilsoniana is characterised by the open, immersed lirellae, the laterally carbonised proper exciple and the presence of norstictic acid. It is distinguished from the somewhat similar *G. circumfusa* Stirton (q.v.) by the presence of a laterally carbonised proper exciple and smaller ascospores.

Graphis wilsoniana is the type species for *Graphis*, Section *Phanerodiscus* Müll. Arg. characterised by a thin laterally carbonised proper exciple, a flat, widely open disc and with ascospores more than 4-locular (Müller, 1893b). The species is, so far, known only from the type specimen.

Graphis xanthospora Müll. Arg. (Fig. 2j)

(Müller 1895: 320)

Type: Queensland: Trinity Bay [Cairns], *W.A. Sayer*, *s.n.*, 1894 (holo G).

Thallus off-white, corticolous, thin, surface smooth and dull; apothecia lirelliform, black, inconspicuous, immersed, numerous, crowded, curved and sinuous, sometimes branched, 1–2(–3) mm long, 0.15–0.25 mm wide, with a conspicuous thalline margin, lips closed; proper exciple apically carbonised; hymenium 80–125 µm tall; ascospores 8 per ascus, 30–40 µm long, 8–10 µm wide, 8–10-locular.

Chemistry: no compounds found.

Also examined: Queensland: Bartle Frere, Curtain Fig Tree, *H.T. Lumbsch 5424g*, Aug 1987 (ESS); W of Palm Cove, 25 km N of Cairns, *K. Kalb 19968*, Aug 1988 (herb. Kalb).

Graphis xanthospora is characterised by inconspicuous black immersed lirellae, the apically carbonised proper exciple and the absence of lichen compounds. A similar unnamed species from Queensland has smaller ascospores and contains stictic acid.

Müller's epithet was based on the yellow ascospores present in the holotype when examined by him. A recent examination of the holotype showed only old shrivelled, pale yellow brown ascospores and it is possible that Müller was misled by the appearance of these ascospores. Ascospores in the genus *Graphis* are well-known to discolour and become shrunken and misshapen with age. The recent specimens cited above are morphologically and chemically identical with the holotype but contained hyaline ascospores.

Graphis xanthospora is distinguished from *G. epimelaena* and *G. sayeri*, both of which have apically carbonised proper exciples, by the black lirellae and the smaller ascospores. All three taxa lack lichen compounds. *Graphis xanthospora* was also reported from Paraguay (Redinger 1935) but Redinger reported his specimen to react K+ yellow-orange ('luteo-aurantia'), suggesting the presence of norstictic acid, and it is possible that his specimen was misidentified.

Graphina species

Graphina brachyspora Müll. Arg. see **Graphina pertenella** (Stirt.) Shirley

Graphina gyridia (Stirt.) Zahlbr (Fig. 3a)

(Zahlbruckner 1923: 412)

Graphis gyridia Stirt.

(Stirton 1881: 77)

Type: Victoria: Gippsland, Waterloo, *H. Paton s.n.* (lecto BM, *fide* Rogers 1982).

Thallus pale grey, thin, evanescent, corticolous, surface smooth and slightly shiny; apothecia lirelliform, conspicuous, appearing as pale dull yellow patches on the thallus, numerous, scattered, sessile, straight, curved or sinuous, sometimes branched, lips closed, with a pale thalline margin, 1–4 mm long, c. 0.3 mm wide; proper exciple lacking, hymenium 50–60 µm tall; ascospores 8 per ascus, hyaline, 18–25 µm long, 6–8 µm wide, 6–9 × 2-locular [fide Stirton 1881].

Chemistry: stictic acid [fide Nakanishi, 1973, in sched.].

Graphina gyridia is characterised by the pale scattered lirellae, the absence of a proper exciple and the presence of stictic acid. The species is so far known only from the type specimen.

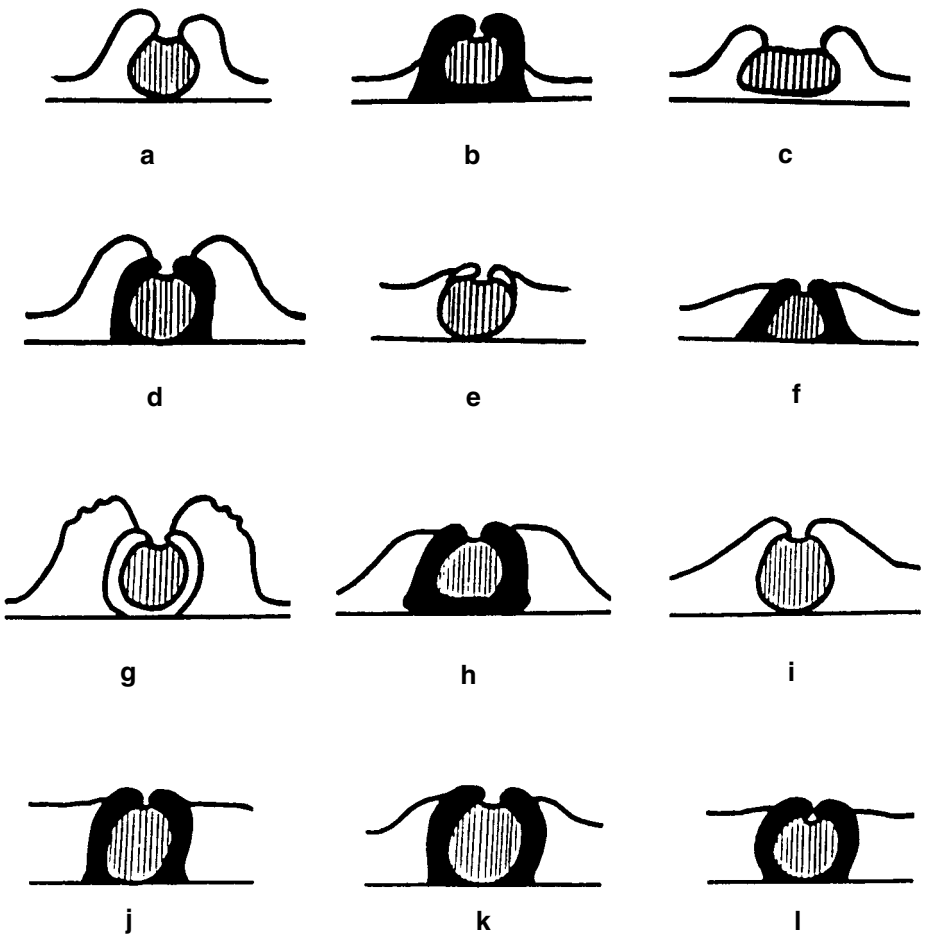

Fig. 3. Diagrammatic cross sections of lirellae (not to scale). **a**, *Graphina gyridia*; **b**, *G. hartmanniana*; **c**, *G. laevigata*; **d**, *G. palmicola*; **e**, *G. pertenella*; **f**, *G. polyclades*; **g**, *G. repleta*; **h**, *G. saxicola*; **i**, *G. subaggregans*; **j**, *G. subtartarea*; **k**, *G. subvelata*; **l**, *G. tenuirima*.

Graphina hartmanniana Müll. Arg. (Fig. 3b)

(Müller 1882: 503)

Type: Queensland: Toowoomba, *C. Hartmann 75* (holo G; iso MEL 515669).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, sessile, numerous, short and simple, straight or slightly curved, unbranched, lacking a thalline margin, lips closed, 0.5–1 mm long, 0.15–0.25 mm wide; proper exciple completely carbonised; hymenium 100–125 µm tall; ascospores 8 per ascus, imbricate, 1-seriate, narrowly ellipsoid, 19–25 µm long, 6–8(–11) µm wide, 6–8 × 2-locular.

Chemistry: no compounds found.

Graphina hartmanniana is characterised by the small black lirellae, the small ascospores and the absence of lichen compounds. The species is so far known only from the type specimen.

Graphina laevigata *(Müll. Arg.) A.W. Archer*, **comb. nov.** Figure 3c, 4d

Graphis laevigata Müll. Arg., *Nuovo Giorn. Bot. Ital.* 23: 398 (1891).

Type: Queensland: Brisbane, *F.M. Bailey 484*, 1889 (holo G; iso G).

Thallus pale olive-green, corticolous, thin, surface smooth and dull; apothecia lirelliform, white, sessile, conspicuous, curved and sinuous, sometimes branched, subimmersed, lips initially closed, becoming open, 1–3 mm long, 0.15–0.2 mm wide, with a conspicuous thalline margin; epithecium reddish brown; proper exciple uncarbonised; hymenium 60–75 µm tall; ascospores 8 per ascus, 10–13 µm long, 5–6 µm wide, 4 × 2-locular.

Chemistry: protocetraric acid.

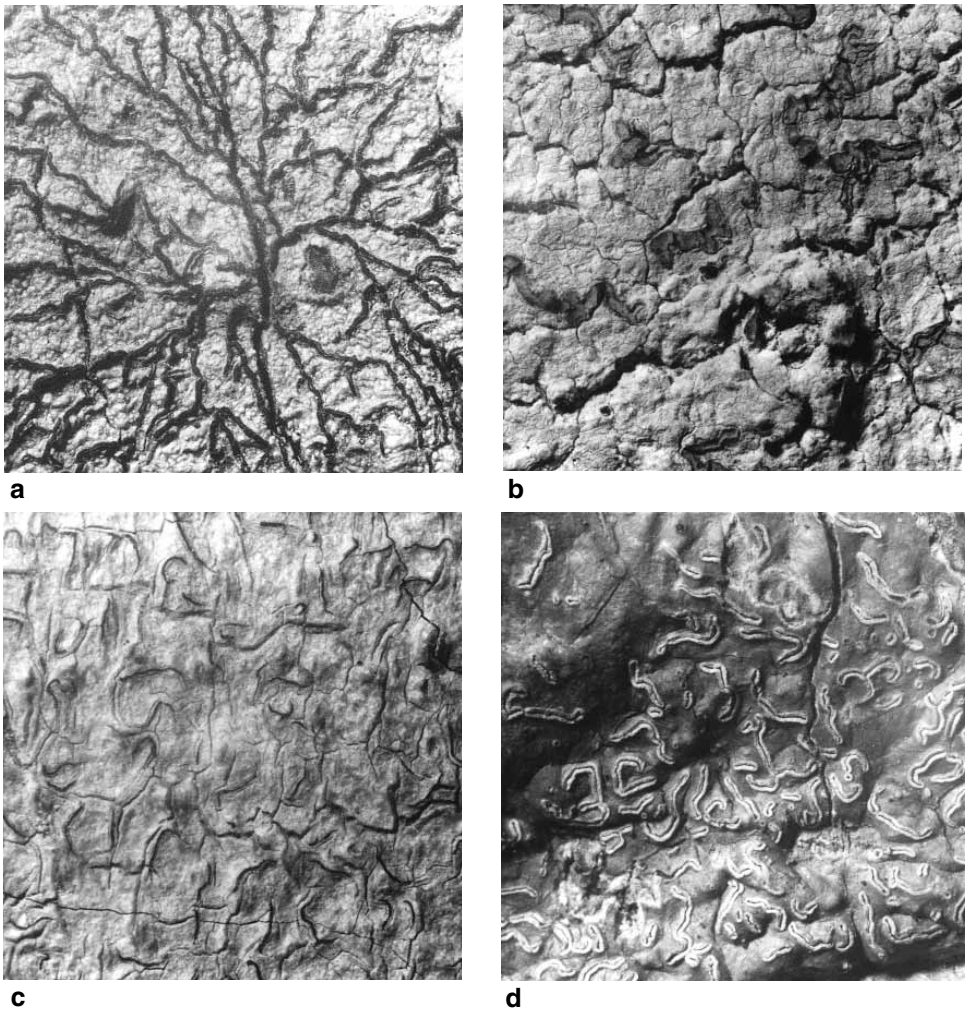

Fig. 4. a, *Graphis centrifuga* Räsänen, holotype (H) showing much-branched lirellae. **b**, *Graphis circumfusa* Stirt., isotype (BRI) showing open, immersed lirellae. **c**, *Graphis immersella* Müll. Arg., holotype (G) showing closed, immersed lirellae. **d**, *Graphina laevigata* (Müll. Arg.) A.W. Archer, holotype (G) showing conspicuous thalline margin. All × 6.4.

Also examined: Queensland: Sankeys Scrub [Brisbane], *J. Shirley* (BRI [AQ721283]); Charleys Creek, 18 km NNE of Proserpine, *H. Streimann 37609*, June 1986 (CANB).

Vanuatu: sine loc., *F.R.M Wilson s.n.*, 1895 (NSW).

Graphina laevigata is characterised by conspicuous, sessile white lirellae, opening to reveal a reddish brown epithecium, small, muriform ascospores and the presence of protocetraric acid. The only acospores seen in the holotype were immature and in the ascus, matching the description in the protologue 'c. 13 µm × 5 µm, 4 locular' (Müller 1891b). No ascospores were seen in the isotype or in the other older specimen from Queensland. However, the recent specimen from Queensland and the older specimen from Vanuatu contained mature ascospores which were muriform. The species has therefore been transferred to the genus *Graphina*.

Müller (1880) separated the genus *Graphina* from the genus *Graphis* on the basis of ascospore septation. Ascospores in the genus *Graphis* have only transverse septation whereas in the genus *Graphina* the ascospores have both transverse and longitudinal septation, giving the acospores a muriform appearance. This difference is less well-defined with smaller ascospores (Wirth & Hale 1978) and Müller saw only immature ascospores without the later longitudinal septation.

Graphina palmicola Müll. Arg. (Fig. 3d)

(Müller 1887a: 402)

Type: Queensland: Trinity Bay [Cairns], *W.A. Sayer s.n.* (holo G; iso MEL 515674).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, numerous, subimmersed, with slightly raised thalline margin, straight, curved or sinuous, rarely branched, lips closed, 1–3(–5) mm long, 0.5–0.6 mm wide; proper exciple laterally carbonised, sometimes with the base almost closed; hymenium (125–) 150–200 µm tall; ascospores 8 per ascus, ellipsoid, hyaline, 100–130(–145) µm long, (25–)33–38 µm wide, densely muriform.

Chemistry: norstictic acid.

Also examined: Queensland: Bellenden Ker Range, Bartle Frere, Mulgrave River, *H.T. Lumbsch 5407b*, Aug 1987 (ESS); Mount Stuart, 10 km S of Towsville, *H. Streimann 31322*, July 1984 (CANB, H, US); Forty Mile Scrub, 53 km E of Mount Surprise, *H. Streimann 46738*, Dec 1990 (CANB).

Graphina palmicola is characterised by the subimmersed black lirellae, the laterally carbonised proper exciple and the presence of norstictic acid. It resembles *G. subtartarea* (described from the same locality) but the lirellae in that species are fully immersed and the ascospores are smaller, 80–100 µm long. When the two species are seen side by side, the lirellae in *G. palmicola* are readily seen to be larger and more conspicuous.

Graphina pertenella (Stirt.) Shirley (Fig. 3e)

(Shirley 1889: 208)

Graphis pertenella Stirt.

(Stirton 1881: 72)

Type: Queensland: Brisbane, *F. Bailey 79* (holo BRI, Bailey book, p.28, [AQ 720192]; iso BRI).

Graphina brachyspora Müll. Arg.

(Müller 1883: 79)

Type: Queensland: Rockhampton, *A.Thozet 47* (holo G).

Thallus pale brownish green to pale olive green, thick, cracked, corticolous, surface smooth and dull; apothecia lirelliform, dark reddish brown, immersed, numerous, scattered in irregular clusters, straight, curved or sinuous, sometimes branched, with thin white thalline margin, lips closed, becoming slightly open, 0.5–1(–2) mm long, c. 0.2 mm wide; proper exciple uncarbonised, apices brown; hymenium 70–80 µm tall. ascospores 8 per ascus, irregularly 1-seriate, ellipsoid, hyaline, 9–14(–16) µm long, 5–7 µm wide, 4(–6) × 1–2-locular.

Chemistry: protocetraric acid.

Also examined: Queensland: Mount Fox, 43 km SW of Ingham, *H. Streimann 37110*, June 1986 (CANB), *H. Streimann 37111*, June 1986 (CANB, US); Kearneys Falls, 15 km S of Gordonvale, *H. Streimann 46557*, Dec 1990 (CANB); Cow Bay, 26 km NNE of Mossman, *H. Streimann 45973*, Dec 1990 (CANB).

Graphina pertenella is characterised by the immersed brown lirellae, the small ascospores and the presence of protocetraric acid. The lirellae are visible as thin dark brown lines with white margins which may become slightly raised, in contrast to the conspicuous white thalline margins present in the chemically similar *Graphina laevigata* (q.v.).

Graphina brachyspora is a later name for *Graphina pertenella*. Müller (1883) had almost recognised this synonymy when he suggested that *G. pertenella* was an immature specimen of *G. brachyspora*.

Graphina polyclades (Kremp.) Müll. Ar (Fig. 3f)

(Müller 1882: 502)

Graphis polyclades Kremp.

(Krempelhuber 1880: 341)

Type: New South Wales: Richmond River, *C.H. Fawcett s.n.* (holo M).

Thallus pale olive-green, thin, corticolous, surface smooth and dull; apothecia lirelliform, inconspicuous, black, lips closed, scattered, immersed, curved or sinuous, sometimes branched and forming substellate clusters, 2–6 mm long, 0.25–0.4 mm wide, with a slightly raised thalline margin; proper exciple laterally carbonised; hymenium 125–150 µm tall; ascospores 8 per ascus, hyaline, 37–50 µm long, 12–13 µm wide, 10–12(–13) × 2–3-locular.

Chemistry: stictic acid.

Also examined: Queensland: sine loc. [label unclear], *F.R.M Wilson s.n.* (NSW L5060); Wooroonooran National Park, Josephine Falls, montane rainforest, *H.T. Lumbsch 11154a*, July 1996 (ESS).

Graphina polyclades is characterised by the green thallus, the immersed black lirellae and the presence of stictic acid. The species somewhat resembles the chemically similar *Graphina fissofurcata* (Leight.) Müll. Arg. (Leighton 1869), which also occurs in Australia, but that species has conspicuous sessile lirellae and larger ascospores, (60–)70–90(–100) µm long and is both corticolous and saxicolous in Australia.

Graphina repleta (Stirt.) Shirley (Fig. 3g)

(Shirley 1889: 208)

Graphis repleta Stirt.

(Stirton 1881: 73)

Type**:** Queensland: Brisbane, *F. Bailey 226* (holo BRI [AQ 720194]; iso BRI).

Thallus pale fawn, thin, corticolous, surface smooth and shiny; apothecia lirelliform, white, conspicuous, numerous, scattered, sessile, lips closed, sulcate, curved or sinuous, often branched, 1–5(–8) mm long, 0.4–0.6 mm wide; proper exciple uncarbonised, reddish brown, complete (sometimes ill-defined); hymenium 150–180 µm tall; ascospores 8 per ascus, ellipsoid, hyaline, 54–75 µm long, 9–12(–18) µm wide, muriform [10–17 × 2–4-locular (fide Stirton1881)].

Chemistry: no compounds found (in var. *repleta*).

Also examined: Queensland: Eungella National Park, *H.T. Lumbsch 11057b p.p.*, July 1996 (ESS); Big Tableland, 26 km S of Cooktown, *H. Streimann 30894*, July 1984 (CANB); Alma Gap, 20 km NW of Cardwell, *H. Streimann 28738*, June 1984 (CANB).

New South Wales: Mount Nardi, 28 km N of Lismore, *A.W. Archer G 281*, Nov 1998 (NSW).

Graphina repleta is characterised by the conspicuous, large off-white, slightly sulcate lirellae, the red-brown exciple and the absence of lichen compounds. The species resembles *Graphis vermifera* (q.v.) but is distinguished from that species by the smaller muriform ascospores and the grooved lirellae. There are two additional varieties:

Graphina repleta var. **macrospora** *A.W. Archer*, **var. nov.**

Sicut *Graphina repleta* var. *repleta* sed ascosporis majoribus et acidum sticticum continens.

Type: New South Wales: Evans Head, S side of Evans River, 29°08'S, 152°24'30''E, alt. c. 5 m, on *Acronychia imperforata* F. Muell., *A.W. Archer G 271*, Nov 1998 (holo: NSW; iso: BRI, CANB).

Graphis repleta var. *macrospora* is morphologically dentical to var. *repleta* but the ascospores are 1 per ascus, (80–)100–125(–150) µm long, (20–)25–37 µm wide, muriform and, in addition, stictic acid is present.

Chemistry: stictic acid.

Also examined: Queensland: Tinaroo Falls Road, 12 km N of Atherton, on *Casuarina*, *H. Streimann 29777*, June 1984 (CANB); E of Tingara Lookout, SE of Noosa Heads, *J. Hafellner 16856*, July 1986 (GZU).

New South Wales: Broken Head Nature Reserve, 8 km S of Byron Bay, *A.W. Archer G 273*, Nov 1998 (NSW).

The variety was conspicuous and frequent at the type locality.

Graphina repleta var. **stictica** *A.W. Archer*, **var. nov.**

Sicut *Graphina repleta* var. *repleta* sed acidum sticticum continens.

Type: Queensland: Tully Falls Road, 8 km SE of Ravenshoe, 17°40'S, 145°31'E, alt. 540 m, *J.A. Elix 16774*, June 1984 (holo: CANB).

Graphis repleta var. *stictica* is identical to var. *repleta* but the variety contains stictic acid.

Chemistry: stictic acid.

Also examined: Wooroonooran National Park, *H.T. Lumbsch 11114b* , July 1996 (ESS); Cooroo Logging Area, 16 km WNW of Innisfail, *J.A. Elix 16688, 16691*, June 1984 (CANB).

Graphina repleta var. *repleta*, var. *macrospora* and var. *stictica* are characterised by large, conspicuous, white, sulcate lirellae. Var. *macrospora* is differentiated from var. *repleta* by the monosporous asci with larger ascospores, and the presence of stictic acid, while var. *stictica* differs in containing stictic acid.

Graphina saxicola Müll. Arg. (Fig. 3h)

(Müller 1887a: 401)

Type: Queensland: Thursday Island, *C. Hartmann s.n*. (holo G).

Thallus off-white to pale grey, thick, saxicolous, surface smooth and dull; apothecia lirelliform, black, numerous, scattered, sessile to subimmersed, with a conspicuous thalline margin, lips closed, 1–5 mm long, 0.3–0.4 mm wide; proper exciple completely carbonised; ascospores 8 per ascus, 40–55 µm long, 17–20 µm wide, 8–16 × 3–5-locular [fide Müller 1887a].

Chemistry: norstictic acid.

Graphina saxicola is characterised by the substrate preference, the completely carbonised proper exciple and the presence of norstictic acid. The species resembles *Graphina dispersa* Redinger, described from Brazil, but that species has smaller ascospores, 20–24 µm long and c. 10 µm wide (Redinger 1933). *Graphina saxicola* is so far known only from the type specimen. A somewhat similar unnamed saxicolous species from Queensland has larger ascospores and contains stictic acid.

Graphina subaggregans Müll. Arg. (Fig. 3i)

(Müller 1893b: 58)

Type: Victoria: Lakes Entrance, *F.R.M. Wilson 1524* (lecto G (here selected); isolecto NSW); residual syntype: Maffra, *F.R.M. Wilson 883* (NSW).

Thallus off-white, thin to evanescent, corticolous, surface smooth and dull; apothecia lirelliform, inconspicuous, white, immersed, lips slightly open, 1–3 mm long, 0.25–0.4(–0.5) mm wide, disc white pruinose; proper exciple uncarbonised, inconspicuous, colourless or weakly brown at the apices; ascospores 8 per ascus, 16–20 µm long, × 6–8 µm wide, 6–8 × 2-locular [fide Müller 1893a].

Chemistry: norstictic acid.

Graphina subaggregans is characterised by the inconspicuous lirellae, the uncarbonised proper exciple and the presence of norstictic acid. The species is so far known only from the syntypes.

In the protologue Müller referred to two syntypes, *Wilson 883* and *Wilson 1524*. As specimens of *Wilson 1524* are in both G and NSW (Filson 1986: 87), this specimen is selected as lectotype.

Graphina subtartarea Müll. Arg (Fig. 3j)

(Müller 1887a: 402)

Type: Queensland: Trinity Bay [Cairns], *W.A. Sayer s.n*. (holo G).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, inconspicuous, black, immersed, straight, curved or sinuous, sometimes branched, numerous, scattered, lips closed, 1–4 mm long, 0.15–0.25 mm wide; proper exciple laterally carbonised; hymenium 125–150 µm tall; ascospores 1 per ascus, ellipsoid, hyaline, 80–100 µm long, 18–28 µm wide, densely muriform.

Chemistry: norstictic acid.

Also examined: Queensland: Mount Archer Environmental Park, 7 km NE of Rockhampton, *J.A. Elix 34544*, Aug 1993 (CANB).

Graphina subtartarea is characterised by the immersed black lirellae, the laterally carbonised proper exciple and the presence of norstictic acid. The species resembles

G. palmicola but the lirellae are fully immersed and less conspicuous than those of *G. palmicola*, and the ascospores are smaller in *G. subtartarea*. Both species contain norstictic acid and were described from the same locality.

Graphina subvelata (Stirt.) Zahlbr. (Fig. 3k)

(Zahlbruckner 1923: 428)

Graphis subvelata Stirt.

(Stirton 1899: 488).

Type: Queensland: sine loc., *F.M. Bailey s.n.* (lecto BM, fide Rogers 1982).

Thallus off-white, thin, corticolous, slightly cracked, surface smooth and dull; apothecia lirelliform, black, conspicuous, numerous, immersed, lips closed, curved or sinuous, rarely (if at all) branched, 1–4 mm long, 0.1–0.2 mm wide; proper exciple laterally carbonised; hymenium 100–125(–150) µm tall; ascospores 8 per ascus, 2-seriate, hyaline, 35–45 µm long, 8–11(–12) µm wide, 8–11 × 2–3(–4)-locular.

Chemistry: no compounds found.

Also examined: Northern Territory: Doctors Gully, 2 km NW of Darwin, *H. Streimann 8761*, Dec 1984 (CANB).

Queensland: Kuranda Range, SE of Kuranda, in tropical rainforest, *K. Kalb 19914*, Aug 1988 (herb. Kalb).

Graphina subvelata is characterised by the laterally carbonised proper exciple, the immersed lirellae and the absence of lichen compounds. Superficially, the species resembles *Graphis descissa* Müll. Arg. but that species contains stictic acid and has a completely carbonised proper exciple and *Graphis*-like ascospores. The species is also reported from New Zealand (Hayward 1977).

Graphina tenuirima Shirley (Fig. 3l)

(Shirley 1892: 34).

Type: Queensland: Gladfield, near Warwick, *C.J. Gwyther s.n.* (holo BRI [AQ 721313]).

Thallus off-white, thin, corticolous, surface smooth and dull; apothecia lirelliform, black, thin, numerous, immersed, straight, curved or sinuous, sometimes branched, lips closed, 1–3(–4) mm long, 0.1 mm wide; proper exciple laterally carbonised; hymenium 60–100 µm tall; ascospores 8 per ascus, imbricate 2-seriate, hyaline, 19–24(–28) µm long, 7–9 µm wide, 5–6 × 2(–3)-locular.

Chemistry: no compounds found.

Also examined: Queensland: Bunya Mountains, 56 km NE of Dalby, on edge of subtropical rainforest, *J. Hafellner 16738, 16758*, Sep 1986 (herb. Hafellner).

New South Wales: Cherrytree State Forest, Mallanganee, c. 80 km ENE of Tenterfield, *A.W. Archer G 315*, Nov 1998 (NSW).

Graphina tenuirima is characterised by the thin, immersed black lirellae, the laterally carbonised proper exciple, the small ascospores and the absence of lichen compounds.

The species resembles *G. subvelata* but the ascospores in that species are 35–45 µm long.

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