

New Species of *Graphis*, *Phaeographina* and *Sarcographa* (Ascomycotina, Graphidaceae) from Vanuatu

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Abstract Four new species of the lichen family Graphidaceae are described from Vanuatu: *Graphis brevicarpa* M.Nakan., Kashiw. & K.H.Moon, *Phaeographina albogranulifera* M.Nakan., Kashiw. & K.H.Moon, *P. vanuatuensis* M.Nakan., Kashiw. & K.H.Moon and *Sarcographa macrohydrina* M.Nakan., Kashiw. & K.H.Moon. They are all corticolous and so far known only from Vanuatu.

Key words: *Graphis*, *Phaeographina*, *Sarcographa*, lichen, Vanuatu

The genera *Graphis* and *Graphina* are crustose lichens in the family Graphidaceae. Although they are widely distributed in the world, especially in tropical and subtropical areas, only four taxa, *Graphina mendax* (Nyl.) Müll.Arg., *G. pallido-ochracea* (Kremp.) Zahlbr., *Graphis longula* Kremp. and *G. assimilis* f. *ochracea* Räsänen have been reported from Vanuatu (Archer 2001a, 2001b & 2001c, Elix & McCarthy 1998, Räsänen 1949).

During their lichenological investigation of Vanuatu in October 2000, under the Collection Building and Natural History Studies in Asia and the Pacific Rim Project supported by the National Science Museum, Tokyo, Kashiwadani and Moon made an extensive collection of lichens. As a result of the taxonomic studies of specimens belonging to the Graphidaceae, four new species were found and these are described in the present paper.

Materials and Methods

The present study is based on 92 specimens of the family Graphidaceae collected in 2000 by

Kashiwadani and Moon from the islands of Espiritu Santo, Efate and Tanna. Specimens reported in the present paper are kept in the herbarium of the National Science Museum, Tokyo (TNS). Chemical substances were studied by means of thin-layer chromatography (Culberson & Johnson 1982) and HPLC. Sections of apothecia and thalli were cut by hand-razor and mounted in lactophenol cotton-blue solution.

Species

1) *Graphis brevicarpa* M.Nakan., Kashiw. & K.H.Moon, sp. nov. (Figs. 1a, 2a & 3a)

Similis *Graphi tenellulae* sed labio margine thallis bene superatis usque ad apicem et sporis minoribus et 5–6 loculis differt.

Thallus corticolous, continuous, smooth, whitish-gray, subnitid. Apothecia prominent, simple or sparingly branched, up to 1(–1.5) mm long; labia nearly completely covered with a thalline margin, convergent; exciple dimidiate, carbonized laterally, 30–40 μ m thick; hymenium 40–60 μ m high, containing numerous oily droplets. Spores colorless, asci 6–8 spored;

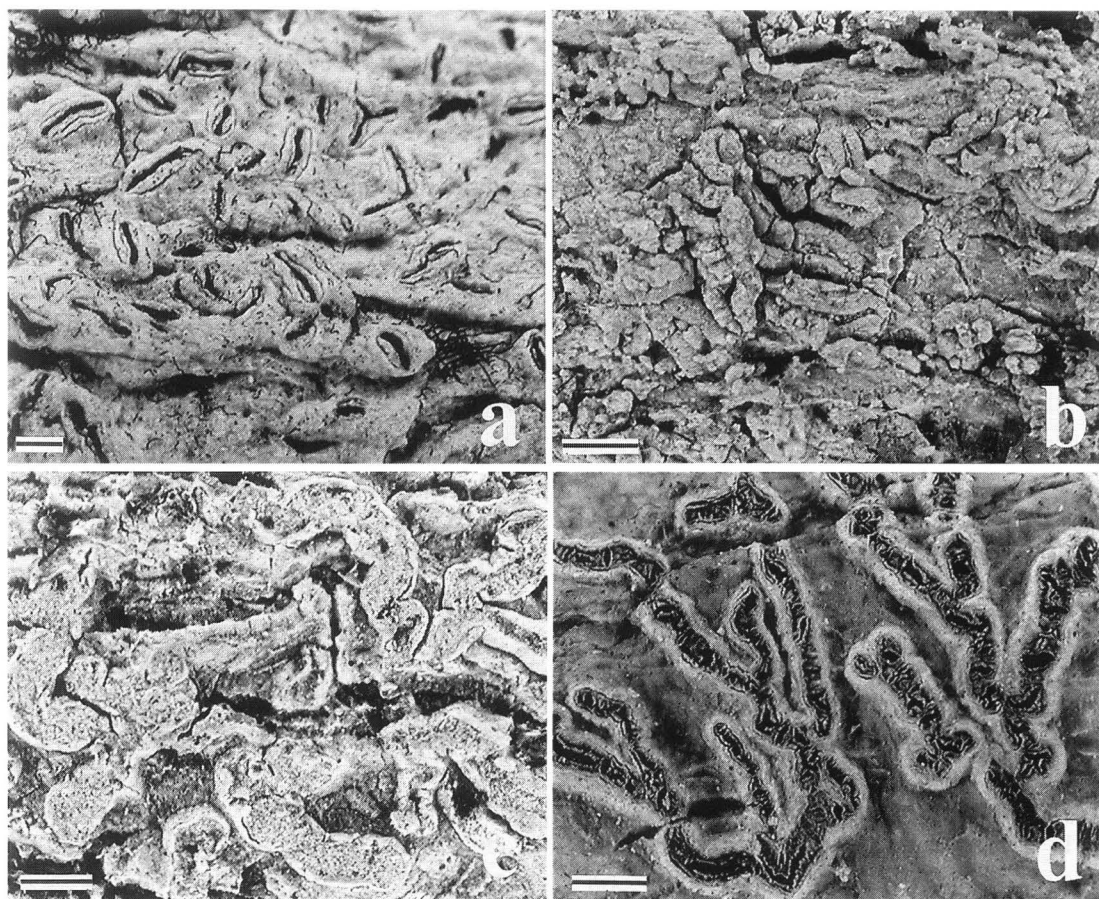


Fig. 1. a, *Graphis brevicarpa* M.Nakan., Kashiw. & K.H.Moon, holotype (TNS); b, *Phaeographina albogranulifera* M.Nakan., Kashiw. & K.H.Moon, holotype (TNS); c, *Phaeographina vanuatuensis* M.Nakan., Kashiw. & K.H.Moon, holotype (TNS); d, *Sarcographa macrohydrina* M.Nakan., Kashiw. & K.H.Moon, holotype (TNS), scale bar=1 mm.

spores ellipsoid, with 4–5 transverse septa, $17\text{--}20 \times 6\text{--}7\text{ }\mu\text{m}$.

Type collection: Vanuatu. Prov. Sanma. Espiritu Santo: Ca 7 km SW of Luganville. On bark of *Garga floribunda*, elevation c. 15 m, October 26, 2000, H. Kashiwadani 43246–holotype in TNS.

Chemistry: norstictic acid

Graphis brevicarpa is unique in having ascocarps covered with thallus up to the top of the labia, the exciple carbonized laterally, the small spores with 4–5 septa and the presence of norstictic acid.

G. brevicarpa can be readily distinguished from *G. longula* Kremp., the only species of

Graphis reported from Vanuatu (Type collection: Brazil, Glaziou 5497–holotype in M!), by the smaller spores and by the presence of norstictic acid; *G. longula* has larger spores with 10–17 locules and $(40\text{--})75\text{--}90\text{ }\mu\text{m}$ in length, and produces no chemical substance. *G. brevicarpa* resembles *G. tenellula* Vain., a species reported from St. Domingo and the Philippines (Type collection: Prope La Cumbra, St. Domingo, C. Raukiaer 490–holotype in TUR!), since they have similar ascocarps and produce norstictic acid. However, it can be distinguished from the latter by the ascocarps covered with the thalline margin up to the top, and by the small ascospores

(17–20 μm in length) with 4–5 septa (*G. tenellula* has larger spores with 8–10 septa and 33–35 μm in length.). It might be confused *G. setschwanensis* Zahlbr. (Type collection: China, Setschwan, 2700 m alt., Handel-Mazetti 567–holotype in W!), which has the ascocarps covered with powdery thalloid layers, larger spores (up to 35 μm in length) and completely lacks chemical substances.

The new species is known only from the type collection.

2) *Phaeographina albogranulifera* M.Nakan., Kashiw. & K.H.Moon, sp. nov. (Figs. 1b, 2b & 3b)

Similis *Phaeographinae torquatae* sed thallus rimosis isidiis et sporis minoribus differt. Acidum norsticticum et acidum protocetraricum continentibus.

Thallus corticolous, continuous, smooth, whitish-gray, isidiate; isidia simple or furcate with fluffy surfaces. Apothecia prominent, simple or sparingly branched, straight to flexuous, up to 2 mm long, to 0.5 mm wide; labia thickly covered with a thalline margin, convergent; disc almost closed, to 0.1 mm wide, heavily pruinose

with white pruina; exciple thin, not carbonized; hymenium 120–140 μm high. Asci 1-spored; ascospores pale brown, muriform, 90–140 $\times$ 30–50 μm .

Type collection: Vanuatu. Prov. Sanma. Espiritu Santo: Butmas. On bark; elevation c. 520 m, October 24, 2000, H. Kashwiadani 43209–holotype in TNS.

Chemistry: norstictic acid and protocetraric acid.

Phaeographina albogranulifera resembles *P. torquata* Müll.Arg., a species reported from Viet Nam, which differs in having smaller spores 35–40 μm in length and containing no lichen substances. In external appearance it resembles *Graphina soozana* Zahlbr., but can be readily distinguished from the latter by the brown spores and by the presence of protocetraric acid.

P. albogranulifera is known only from the type locality.

3) *Phaeographina vanuatuensis* M.Nakan., Kashiw. & K.H.Moon, sp. nov. (Figs. 1c, 2c & 3c)

Similis *Phaeographinae albogranuliferae* sed discis latioribus et thallus isidiis destitutis differt.

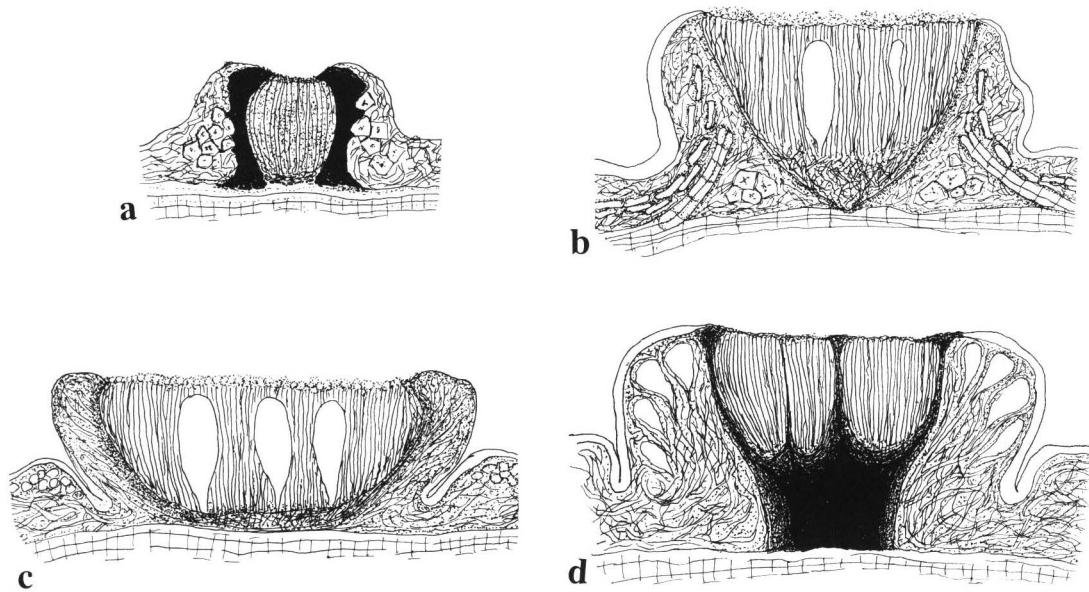


Fig. 2. Cross-section of apothecia. a, *Graphis brevicarpa*; b, *Phaeographina albogranulifera*; c, *P. vanuatuensis*; d, *Sarcographa macrohydrina*; scale bar = 100 μm .

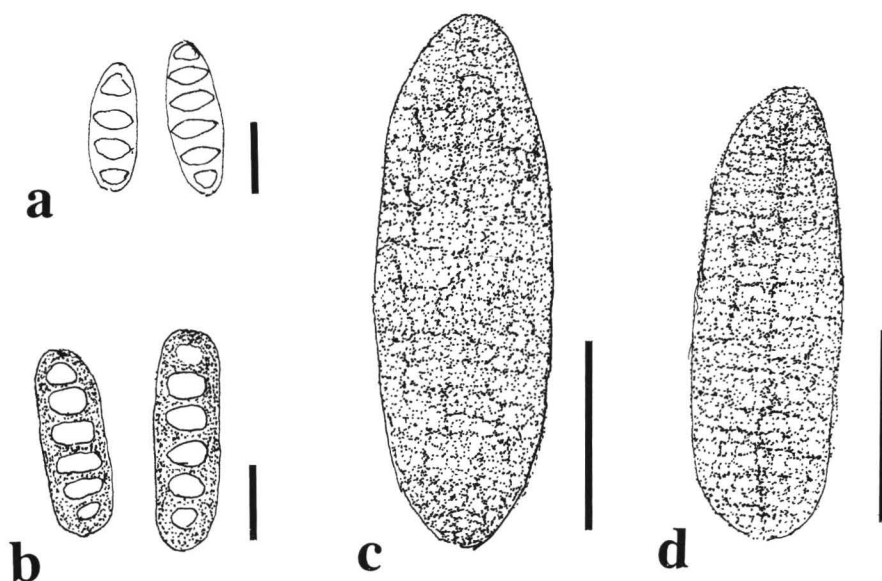


Fig. 3. Ascospores. a, *Graphis brevicarpa*; b, *Phaeographina albogranulifera*; c, *P. vanuatuensis*; d, *Sarcographa macrohydrina*; scale bar=100 μ m (a, b); scale bar=50 μ m (c, d).

Acidum sticticum continentibus..

Thallus corticolous, continuous, smooth, whitish-gray, without isidia or soredia. Apothecia prominent, simple or sparingly branched, flexuous, up to 2 mm long, to 0.4–0.5 mm wide; labia thick, covered with a thalline margin up to the top, divergent; disc open, covered with yellowish-white pruina, 0.2–0.4 mm wide; exciple thin, non-carbonized; hymenium 115–125 μ m high. Asci 1-spored; spores pale brown, muriform, 75–95(–100) $\times$ 25–30 μ m.

Type collection: Vanuatu. Prov. Sanma. Espiritu Santo: Butmas. On bark of *Citrus* sp.; elevation c. 520 m, October 24, 2000, K. H. Moon 5563–holotype in TNS.

Chemistry: stictic acid.

Phaeographina vanuatuensis resembles *P. albogranulifera* in having non-carbonized ascocarps with solitary and large muriform spores. However, it can be distinguished from the latter by the ascocarps with broader discs and smaller ascospores. In addition it lacks norstictic acid and protocetraric acid which are constant chemical constituents in the latter species. It might be confused with *P. caesioradiens* (Leight.) Redinger,

a species widely distributed in the southern Hemisphere, which differs in having smaller spores (35 $\times$ 18 μ m in size) and by the absence of chemical ingredients.

P. vanuatuensis is so far known only from narrow areas of Espiritu Santo. However, it is rather common on bark of *Citrus* around the type locality.

Other specimen examined. Vanuatu. Prov. Sanma. Espiritu Santo: Butmas. On bark of *Citrus* sp.; elevation c. 500 m, October 24, 2000, H. Kashiwadani 43216 (TNS).

4) *Sarcographa macrohydrina* M.Nakan., Kashiw. & K.H.Moon, sp. nov. (Figs. 1d, 2d & 3d)

Similis *Sarcographae hydrinae* sed stromatibus prominentibus, bene sessilibus et lirelliformibus differt. *Acidum sticticum* continentibus.

Thallus corticolous, continuous, smooth, warty, subnitid. Stromata prominent, conspicuously sessile, lirelliform, sparingly branched, to 8 mm long and to 0.5 mm wide; exciples pale brown laterally, dark brown to black, thick and completely closed at the base; disc plane to

slightly concave, dark brown to black, conspicuously cracked, thinly pruinose; hymenium 125–140 μm high. Asci 8-spored; ascospores dark brown with 6-locules, 25–32 $\times$ 7–8 μm .

Holotype. Vanuatu. Prov. Sanma. Espiritu Santo: Butmas. On bark of *Citrus* sp.; elevation c. 520 m, October 24, 2000, K. H. Moon 5556? holotype in TNS.

Chemistry: stictic acid.

Sarcographa macrohydrina has unique ascocarps with heavily cracked discs and can be easily distinguished from allied species of *Sarcographa*. It might be confused with *S. hydrina* (Vain.) Zahlbr. (Type collection: Philippine, Palawan, Merrill-9051, TUR!) and *S. protracta* (Kremp.) Zahlbr. (Type collection: Pulo Pinang, O. Beccari 242, M!), species reported from tropical areas in Asia, because they all have apothecia with discs divided by cracks, and ascospores of similar size. However, it can be distinguished from *S. hydrina* by the robust and elongated lirelliform stromata and from *S. protracta* by the robust and elongated lirelliform stromata; furthermore, the ascocarps of the latter two species are assemblages of punctiform apothecia of uneven width and are never lirelliform.

Specimens examined. Vanuatu. Prov. Sanma. Espiritu Santo: Butmas. On bark of *Citrus* sp.; elevation c. 520 m, October 24, 2000, H. Kashiwadani 43210 & 43212 (TNS); the same locality, on bark of *Citrus* sp., elevation 400 m, H. Kashiwadani 43433 (TNS).

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References

- Archer, A. W., 2001a. The lichen genera *Phaeographis* and *Phaeographina* (Graphidaceae) in Australia 2: *Phaeographina*—new reports and new species. *Telopea*, **9**(2): 329–344.
- Archer, A. W., 2001b. The lichen genus *Graphina* (Graphidaceae) in Australia: new reports and new species. *Mycotaxon*, **77**: 153–180.
- Archer, A. W., 2001c. New taxa and new reports in the lichen family Graphidaceae (Ascomycotina) from Australia. *Mycotaxon*, **80**: 367–374.
- Culberson, C. F. and A. Johnson, 1982. Substitution of methyl *tert*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *J. Chromat.*, **238**: 483–487.
- Elix, J. A. and P. M. McCarthy, 1998. Catalogue of the lichens of the smaller Pacific Islands. *Bibliotheca Lichenologica*, **70**: 1–361.
- Räsänen, V., 1949. Lichens novi V. *Annal. Bot. Soc. Zool. Bot. Fenn. 'Vanamo'*, **3**: 178–188.

