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Studies on the lichen genus *Sticta* (Schreber) Ach.: II. Typification of taxa from Swartz's Prodromus of 1788

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Synopsis. Of the 18 lichens described from Jamaica by Swartz in his *Prodromus* (1788), three taxa are referable to the genus *Sticta*, viz. *Lichen damaecornis, L. laciniatus* and *L. tomentosus*, although Swartz's *L. laciniatus* is a later homonym of *L. laciniatus* Hudson (1762) and is illegitimate. *Lichen damaecornis* and *L. tomentosus* are typified from authentic Swartz material and detailed descriptions and taxonomic notes are given. Swartz material distributed as *L .laciniatus* comprises two distinct taxa which are newly described here as *Sticta laciniosa* and *S. swartzii*.

INTRODUCTION

Sticta is a widely distributed lichen genus of some 60 species with a preponderance of taxa found in tropical or subtropical areas, especially the Caribbean, Central America and the tropical parts of South America, and the palaeotropics from Africa and the Indian Ocean Islands to the Pacific. Apart from the cosmopolitan taxa *S. fuliginosa* (isidiate) and *S. limbata* (sorediate), found on all major land areas, and the widespread palaeotropical species *S. sublimbata* and *S. wiegelii*, species of *Sticta* tend to have rather restricted distributions with both tropical and temperate regions having well-defined endemic taxa, for example New Zealand (Galloway, 1985), East Africa (Swinscow & Krog, 1988), Juan Fernandez and southern South America (Galloway, 1994). Species of *Sticta* and *Lobaria* (unlike *Pseudocyphellaria*) are particularly strongly represented in the neotropics in comparison with numbers of taxa in cool temperate parts of South America (Galloway & Arvidsson, 1990; Galloway, 1994). This reflects a basic biogeographical distinction between these three important Southern Hemisphere genera with *Pseudocyphellaria* having pronounced austral affinities (Galloway, 1987, 1988*a*, 1992*b*) while both *Sticta* and *Lobaria* appear to be predominantly tropical groups (Galloway & Arvidsson, 1990). Species of *Sticta* are now recognized as being important nitrogen producers in both tropical and temperate forest ecosystems (Green et al., 1980; Galloway, 1988*a*, 1992*a*, 1992*b*, 1994). Nitrogen is fixed by cyanobacteria present either as primary photobionts or as internal cephalodia (James & Henssen, 1976). The taxonomy of *Sticta* is still very confused, especially in tropical regions where speciation in the genus is most marked. A number of early names in the genus, for example *Sticta damaecornis*, have been widely used in the tropics, when it is now known that several entities are involved. In order to clarify correct use of names in *Sticta*, the present paper is one in a series attempting to define the limits of taxa described in the late eighteenth century and early nineteenth century.

The Swedish botanist Olof Peter Swartz (1760–1818) was a student of Linnaeus's son, Carl Linnaeus, completing his studies in medicine and natural history at the University of Uppsala in 1783. Twenty-two years old, and furnished with ample private means, he was keen to travel to distant parts to study natural history in the tradition of the elder Linnaeus's 'Linnaean apostles' (Stafleu, 1971). Swartz decided on the West Indies as a suitable area for study, following in the footsteps of Sir Hans Sloane, Charles Plumier, Patrick Browne and Nicolaus Joseph Jacquin (Stearn, 1980). Choosing the island of Jamaica, he embarked from Sweden on 5 August 1783, and landed at Montego Bay in Jamaica on 5 January 1784 after some time botanizing at Boston, Massachusetts. During his time in Jamaica he collected widely from the interior of the island and reached the highest summits in the Blue Mountains (Stearn, 1980). On his return home in 1786 he spent some time in London working on the arrangement and naming of his West Indian collections with the help of Sir Joseph Banks's herbarium and library and with the assistance of Jonas Dryander, Banks's Swedish librarian. The first results of Swartz's West Indian botanical collections appeared in his book *Nova genera et species plantarum seu Prodromus* (Swartz, 1788), a slim but nomenclaturally very important work (Stearn, 1980; Nicolson & Jarvis, 1990).

Some of the earliest names now recognized in *Sticta* appear in Swartz's *Prodromus* where he described 18 new taxa in the collective genus *Lichen* (see Galloway, 1981, 1988*b*), of which *L. damaecornis* and *L. tomentosus* are referable to *Sticta* as *S. damaecornis* (Sw.) Ach. and *S. tomentosa* (Sw.) Ach. Subsequently, these taxa and the illegitimate *Sticta laciniata* (Sw.) Ach., were widely, and often incorrectly, reported in the literature on tropical lichens. In an attempt to clarify the confusion which exists in the literature relating to present distributions of these taxa, they are typified on authentic Swartz material from Jamaica, descriptions are given and bibliographic and taxonomic notes are supplied for each. Original Swartz material distributed as *Lichen laciniatus* Sw. comprises two distinct taxa; one with a green algal photobiont which is newly described here as *Sticta laciniosa* D.J.Galloway, and one with a cyanobacterial photobiont, which is newly described as *S. swartzii* D.J.Galloway.

Authentic Swartz material from Jamaica and reported in the *Prodromus* was studied from the following herbaria: BM, BM-ACH, G, GB, L, PC-MONTAGNE, SBT, UPS, UPS-ACH, UPS-THUNBERG. More recent material from

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Jamaica and from neotropical and palaeotropical regions was studied from BM collections.

Scanning electron microscopy was performed on air-dried material coated with gold-palladium on aluminium stubs, using an Hitachi S-800 microscope. Thin-layer chromatography of acetone extracts was carried out according to standardized methods (Culberson, 1972; White & James, 1985).

SYSTEMATIC TREATMENT

1. **Sticta damaecornis** Ach., *Meth. Lich.*: 276 (1803). *Lichen damaecornis* Sw., *Prodr.*: 146 (1788). *Platisma cornudamae* Hoffm., *Descr. Adumbr. pl. lich.* **1:** 103, tab. XXIV, figs 1–7 (1790). *Parmelia damaecornis* (Sw.) Eschw. in Martius, *Fl. Bras.* **1:** 213 (1833). *Lobaria damaecornis* (Sw.) Trevisan, *Lichenotheca veneta* exs. 75 (1869). Type: Jamaica, sine loco, *Swartz* (SBT – lectotype selected here).

Figs 1, 2.

Sticta damaecornis f. *elongato-laciniata* Tuck. in Stizenb., *Flora, Jena* **81:** 121 (1895). [Wright, *Lichenes Cubae* No. 59]; nom. nud.

Thallus 4–8(–10) cm diam., possibly larger, irregularly spreading, loosely attached, margins free, ± ascending. *Lobes* rather narrow, (1.5–)2–4(–7) mm wide, ± regularly dichotomously branching, divergent at apices, discrete, con-

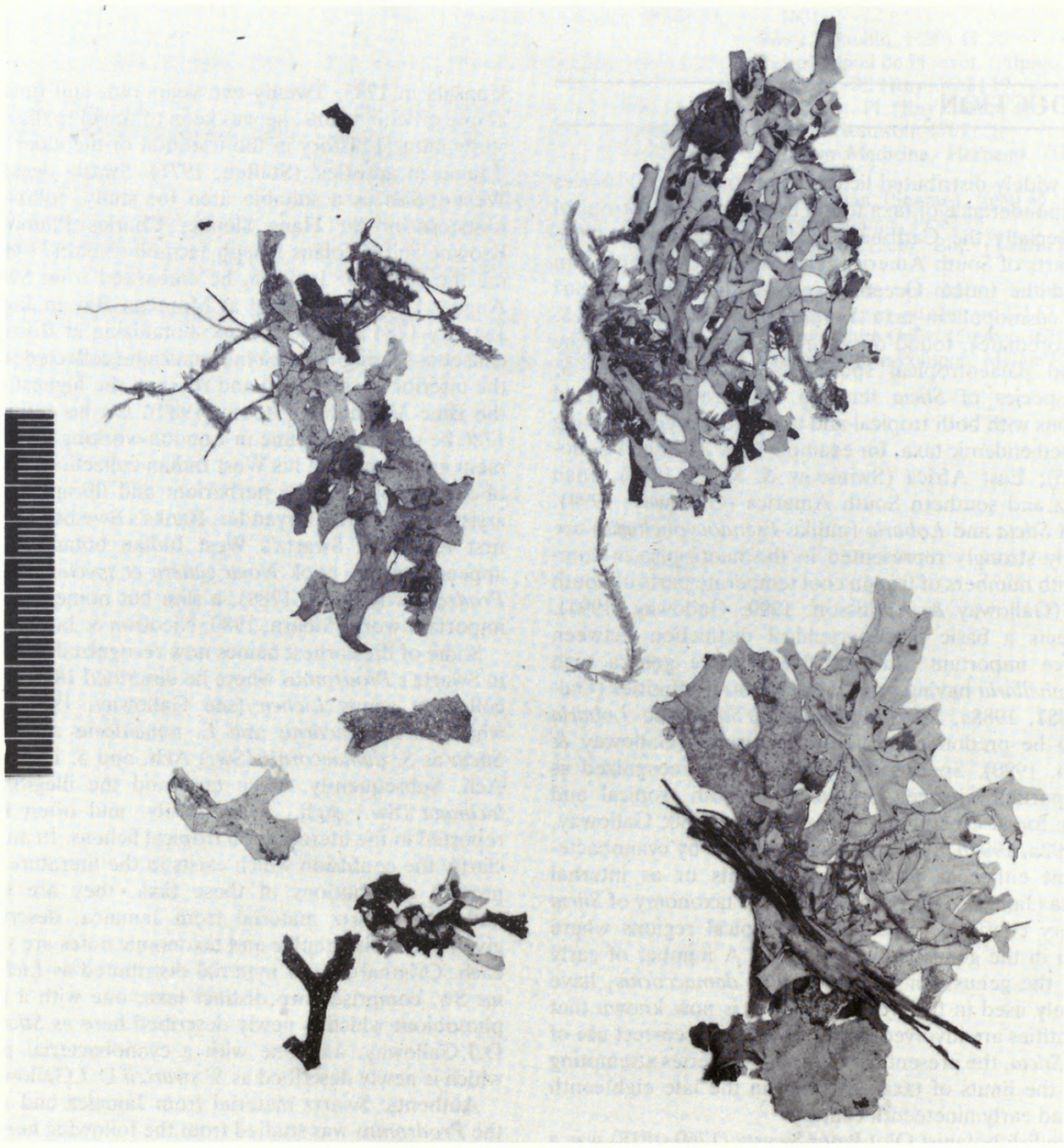

Fig. 1 *Lichen damaecornis* Sw. Lectotype (SBT). Scale in mm.

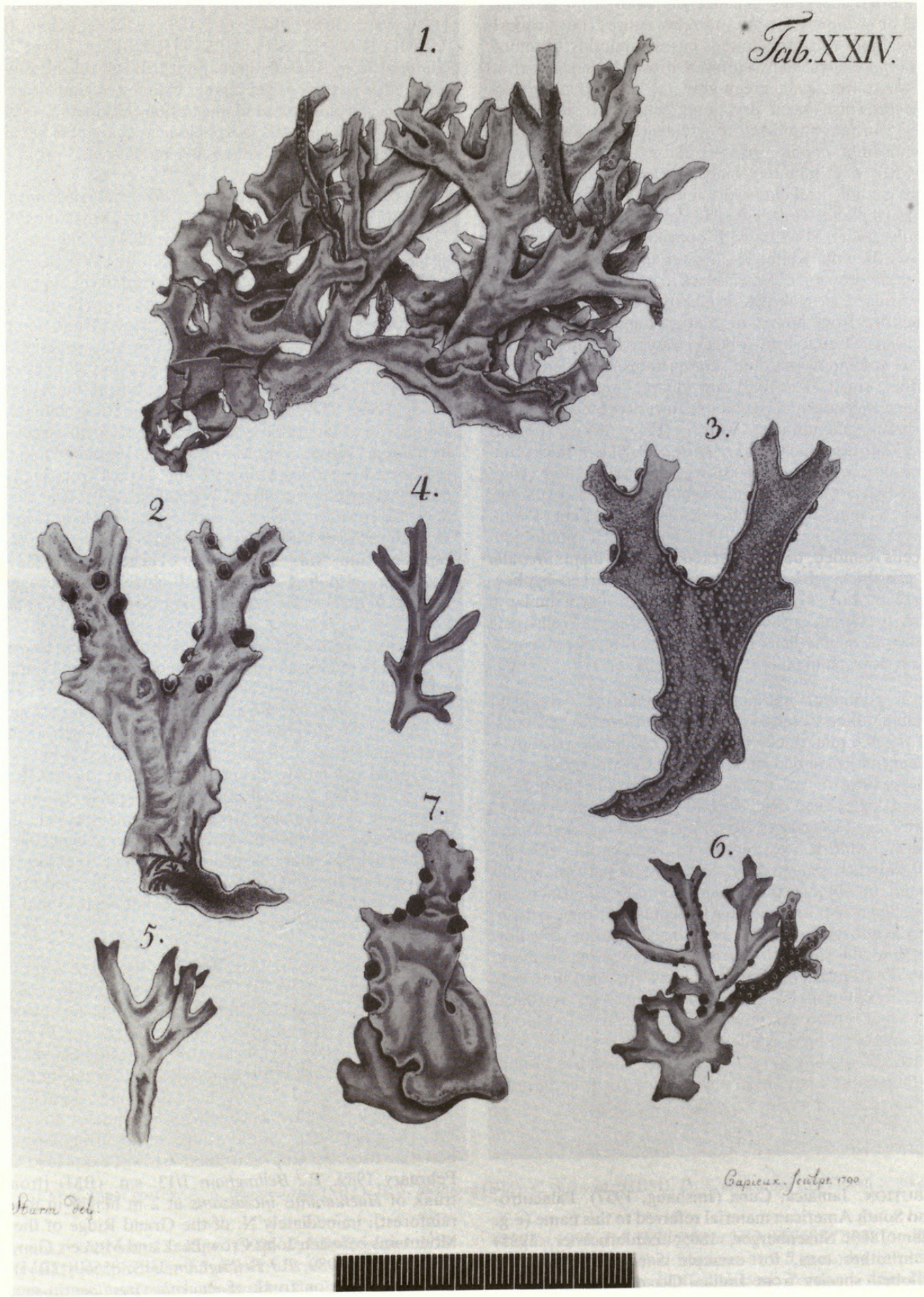

Fig. 2 Hoffmann's 1794 illustration of *Platisma cornudamae*. Scale in mm.

tiguous to somewhat entangled centrally, plane to distinctly convex, often markedly canaliculate below, apices blunt, rounded or shallowly furcate. *Margins* entire, conspicuously thickened and ridged below, sinuses smoothly rounded. *Upper surface* olivaceous, suffused brown or red-brown at apices when wet, pale green-grey to olivaceous or buff, suffused brownish when dry, matt, somewhat coriaceous, minutely punctate-impressed to irregularly dimpled in parts to ± uniformly smooth, pliable, flabby when wet, rather brittle when dry, minutely maculate (x 10 lens), maculae visible as a faint, irregular white marbling of upper surface. Isidia, phyllidia, pseudocyphellae, and soredia absent, ± continuous under SEM or with occasional, scattered pores (Fig. 3A). *Medulla* white, K–. *Lower surface* white or pale tan to dark brown or brown-black, smooth to irregularly wrinkled-ridged, ± glabrous or glabrous only near apices to ± tomentose from apices to centre, tomentum sparse to moderate, pale buff to brown-black, silky to felted-entangled. *Cyphellae* common, scattered, conspicuous, rounded, regular, rather small, 0.3(–0.5) mm diam., margins sharply defined, conspicuously raised above lower cortex and tomentum, basal membrane white (Fig. 4A). *Thallus* 120–200(–240) μm thick. *Upper cortex* 20–30 μm thick, outermost 8–10 μm pale yellow-brown, of small, closely compacted cells 2–5 μm diam., inner zone colourless, of larger, thin-walled, round to irregular cells 6–8.5 μm diam. *Photobiont layer* dense, continuous, 25–35 μm thick, photobiont green, cells rounded, densely packed, to 4 μm diam. *Medulla* 55–145 μm thick, of loosely interwoven colourless hyphae, 4–5 μm diam. *Lower cortex* 20–30 μm thick, closely similar in structure to upper cortex, outermost layer of cells pale red-brown. *Tomental hairs* pale red-brown to yellow-brown, to 5.5 μm diam., and 60–170 μm long (Fig. 5A).

Apothecia common, marginal or submarginal, rounded, 0.5–1.5 mm diam., subpedicellate, constricted at base, pedicel 0.2–0.6 mm thick, disc matt, epruinose, shallowly concave at first, soon becoming plane to subconvex, disc pale to dark red-brown or ± blackened, margins persistent, roughened, paler than disc, exciple below disc pale buff to dark brownish, roughened to areolate-scabrid, sometimes with silky whitish to red-brown tomentum. *Exciple* 112–190 μm thick, pale to dark red-brown, of parallel, radiating, round to oblong, thick-walled cells 8.5–15 μm diam. *Hypothecium* 55–90 μm thick dark greenish- or olive-brown, turning olive-black in K and suffusing a distinctive yellow pigment into thecium and surrounding mounting medium. *Thecium* 60–70 μm tall, pale yellow-brown, becoming pale yellowish to pale pinkish in K; *epithecium* 14–20 μm thick, dark brown or red-brown, intensely granular, pale red-brown in K; paraphyses simple, 2.5–3 μm thick, apices swollen. *Asci* cylindrical 70–82(–88) × 14–17(–20) μm. Ascospores ellipsoid with pointed ends, pale olive-brown to ± colourless, 1–3-septate, 25–30.5 × 5.5–8.5 μm.

CHEMISTRY. Nil.

DISTRIBUTION. Jamaica, Cuba (Imshaug, 1957). Palaeotropical and South American material referred to this name (e.g. Nylander, 1860; Stizenberger, 1895; Zahlbruckner, 1925) belong in other taxa, for example *Sticta dichotoma* for narrow-lobed species from Indian Ocean islands, and *S. ainoae* (Galloway & Pickering, 1990) for collections from temperate, southern South America.

TYPIFICATION. Original (syntype) Swartz material of *Lichen damaecornis* is found in the following herbaria: BM-ACH (Galloway, 1988*b*), BM, G, GB, H-ACH (Vainio, 1915), PC-MONTAGNE, SBT, UPS- THUNBERG [sheet 26188]. Material from Swartz's herbarium (SBT sheet 40, Fig. 1) is selected as lectotype. This agrees with the original description and the early fine coloured illustration (Hoffmann, 1794: tab. 24, fig. 7) showing the morphological characters which correctly define this West Indian species (Fig. 2).

OBSERVATIONS. Early accounts of *Sticta damaecornis* (Hoffmann, 1794; Acharius, 1799, 1803, 1810, 1814) follow Swartz (1788, 1811) in giving the West Indies as habitat for the species, and Acharius (1814) included two varieties, *wiegelii* and *canariensis*, which are today referred to the species *Sticta wiegelii* (Acharius) Vainio and *S. canariensis* (Flörke) Delise. The former occurs widely in both tropical and temperate habitats (Galloway, 1994), the latter in Macaronesia, Spain, Portugal, France, Great Britain, Ireland and Norway (Purvis et al., 1992). Hooker (1822) recorded it from the neotropics, while Delise (1825) cited it from America, Jamaica and Réunion and described a similar though distinct species, *S. dichotoma* Delise, from Mauritius and Réunion. Fée (1837) recognized *S. damaecornis* as being distinct from Delise's *S. dichotoma* while in contrast, Nylander (1860), who recorded *S. damaecornis* as a widespread tropical species, recognized several varieties viz., var. *sinuosa*, var. *macrophylla*, var. *caperata* and var. *dichotoma*. Tuckerman (1882) like Nylander, also had a wide and obviously heterogeneous concept of the species, including in it Swartz's *Lichen laciniatus*.

A more restricted distribution for *S. damaecornis* is accepted here (see above) with other tropical and temperate taxa being referred to other taxa (see Galloway & Pickering, 1990). *Sticta damaecornis* is characterized by rather narrow, ± regularly dichotmously branching lobes which are divergent at the apices, noticeably thickened-ridged at the margins below and commonly distinctly canaliculate below. It has a white medulla; a green photobiont; sparse to moderate tomentum on the lower surface which may be pale buff to brown-black; conspicuous, scattered, small cyphellae with sharply defined margins projecting above the tomentum; apothecia are marginal or submarginal, the disc red-brown to black, the exciple roughened to areolate-scabrid and sometimes whitish tomentose.

SPECIMENS EXAMINED. **Jamaica:** sine loco, *Mr Wiles* (BM); Ibid., Hart, June 1886 (BM); Mt Diablo, *H.N. Ridley* (BM); steep ridge on flanks of Blue Mountains in headwaters of Mabess River, 1460 m, 16 December 1988, *P.J.Bellingham* 1/13: 863600 (BM) [epiphytic at *c.* 1 m on stem of *Smilax balbisiana* under tall forest canopy]; Grand Ridge of the Blue Mountains E. of John Crow Peak, 1600 m, 8 January 1989, *P.J.Bellingham* 1/13: 856600 (BM) [on a fallen rotten branch Mull Ridge forest]; Grand Ridge of the Blue Mountains between Morce's Gap and John Crow Peak, 1600 m, 10 February 1989, *P.J.Bellingham* 1/13: s.n. (BM) [from the trunk of *Haenianthus incrassatus* at 2 m height in montane rainforest]; immediately N. of the Grand Ridge of the Blue Mountains between John Crow Peak and Morce's Gap, 1580 m, 23 March 1989, *P.J.Bellingham* 1/13: 856601 (BM) [epiphytic at 1.5 m on trunk of *Eugenia virgultosa* in montane rainforest]; steep ridge flanks at headwaters of Mabess River, NW of Belle Vue Peak on the Grand Ridge of the Blue

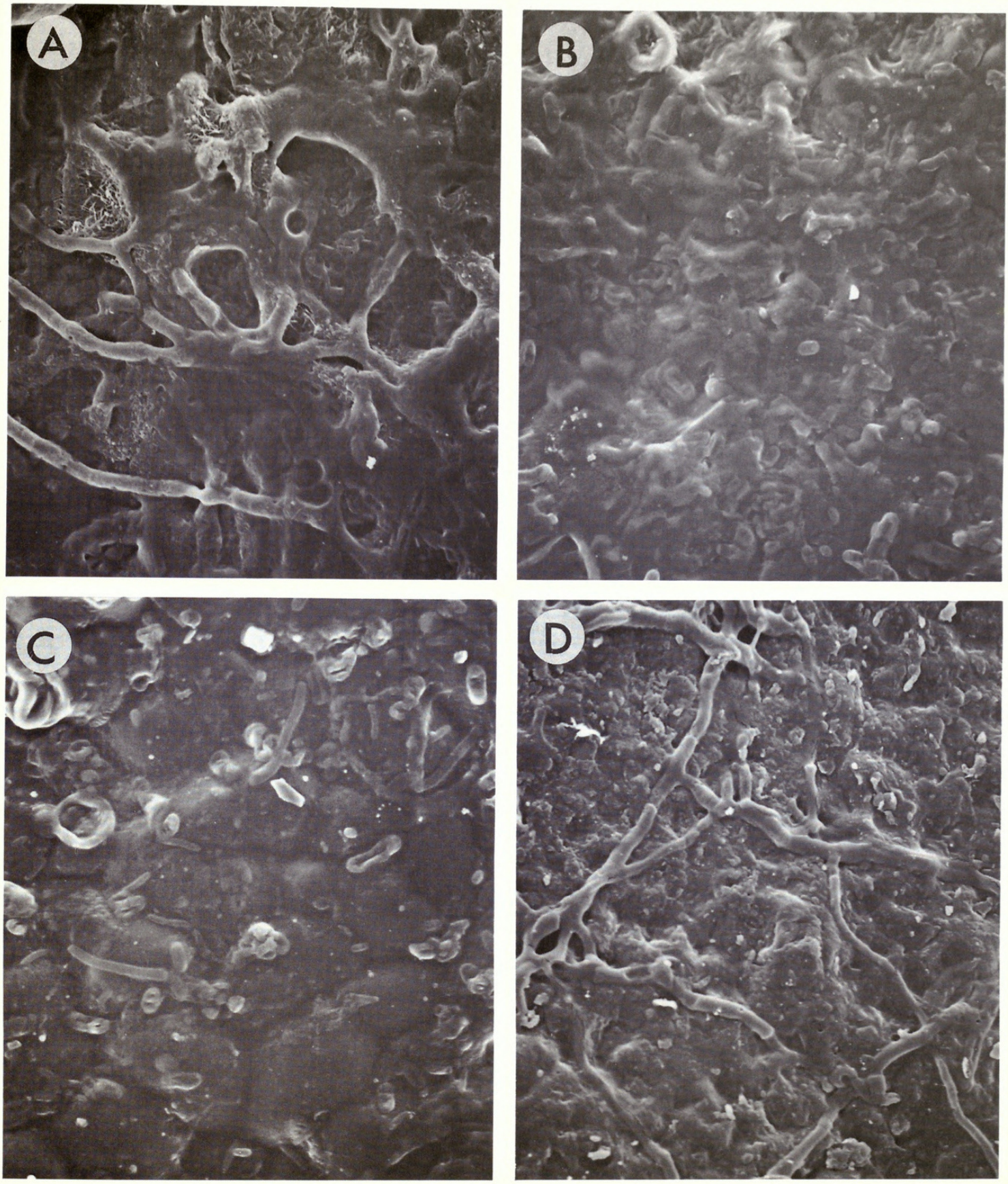

Fig. 3 SEM of upper cortex. A. *S. damaecornis* (SBT). B. *S. laciniosa* (BM). C. *S. swartzii* (BM). D. *S. tomentosa* (SBT). All × 2000.

Mountains, 1710 m, 13 June 1990, *P.J.Bellingham* 1/13: 867597 (BM) [epiphytic at 0.3 m on trunk of *Clethra occidentalis* in montane rainforest]; steep ridge flanks at headwaters of Mabess River N. of the Grand Ridge of the Blue Mountains between Morce's Gap and John Crow Peak, 1440 m, 23 August 1990, *P.J.Bellingham* 1/13: 857602 (BM) [on the stem of a large *Marcgravia brownei* at 0.5 m under tall montane rainforest on steep, bluffed slopes]; Portland, near Hardwar Gap, near the Portland-St Andrew Line, 17–27 December 1968, *W.L. & C.F. Culberson* 13,299 [A. Vezda, *Lich.Sel-*

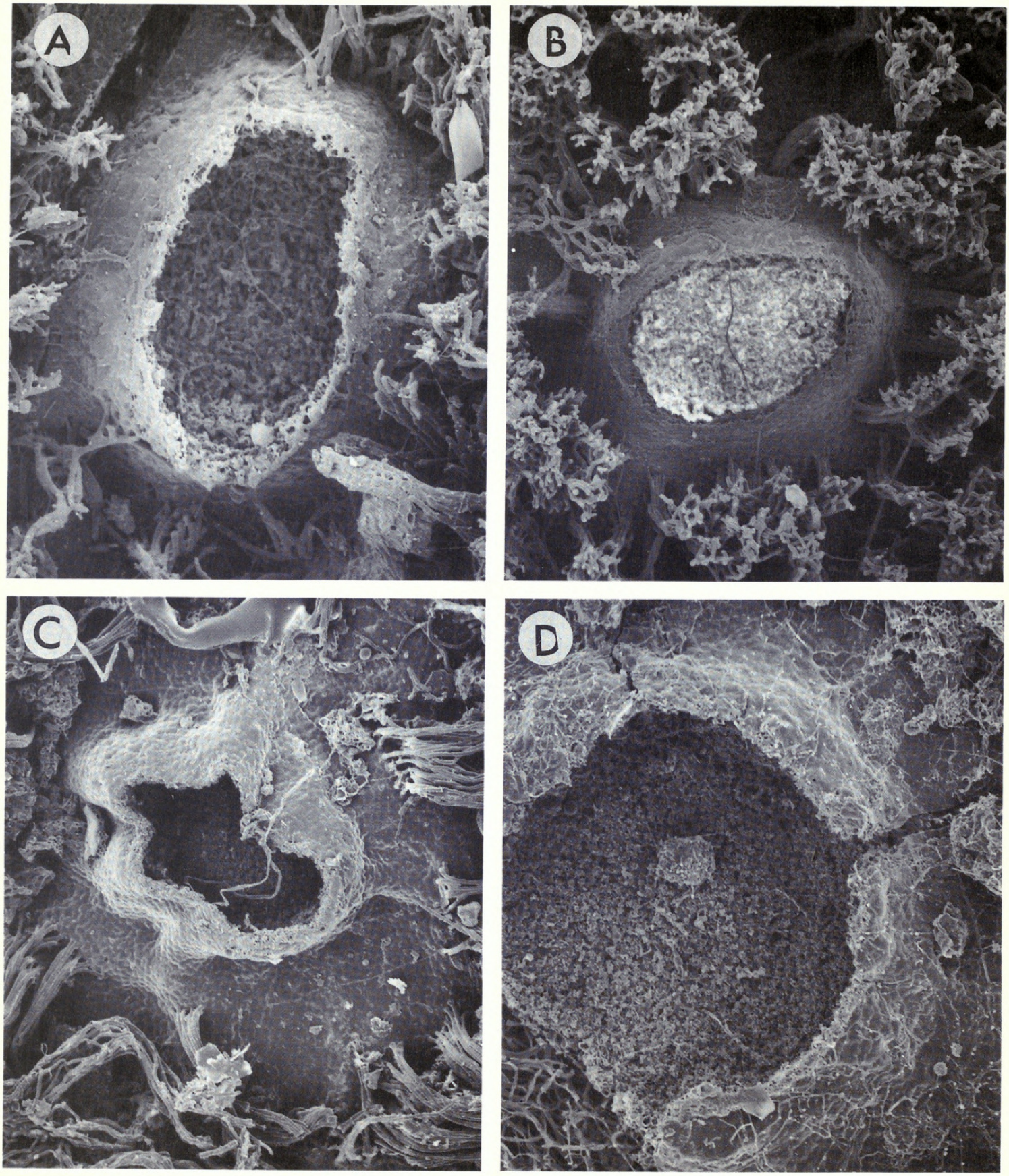

Fig. 4 SEM of cyphellae. A. *S. damaecornis* (SBT) × 150. B. *S. laciniosa* (BM) × 250. C. *S. swartzii* (BM) × 250. D. *S. tomentosa* (SBT) × 150.

.*Exs.* 863] (BM); Portland, Abraham's Ridge, 2000–3000 ft, 17 December 1973, *B.D. Morley & C. Whitefoord* 588 (BM). **Cuba:** sine loco, *Wright* 59, 60, 61 [*Lichenes Cubae*] (BM); Sierra Mae stra, cerca Pico Bayamesa, S. del poblado Pino del Agua, 1440 m, 1 December 1978, *T. Pocs* 9067 (BM); Sierra Maestra, Estribo de Turquino, 1600–1700 m, 20 April 1979, *T. Pocs* 9092 (BM); Sierra Maestra, 1300 m, 20 April 1979, *T. Pocs* 9087 (BM); Sierra de la Gran Piedra, Pico

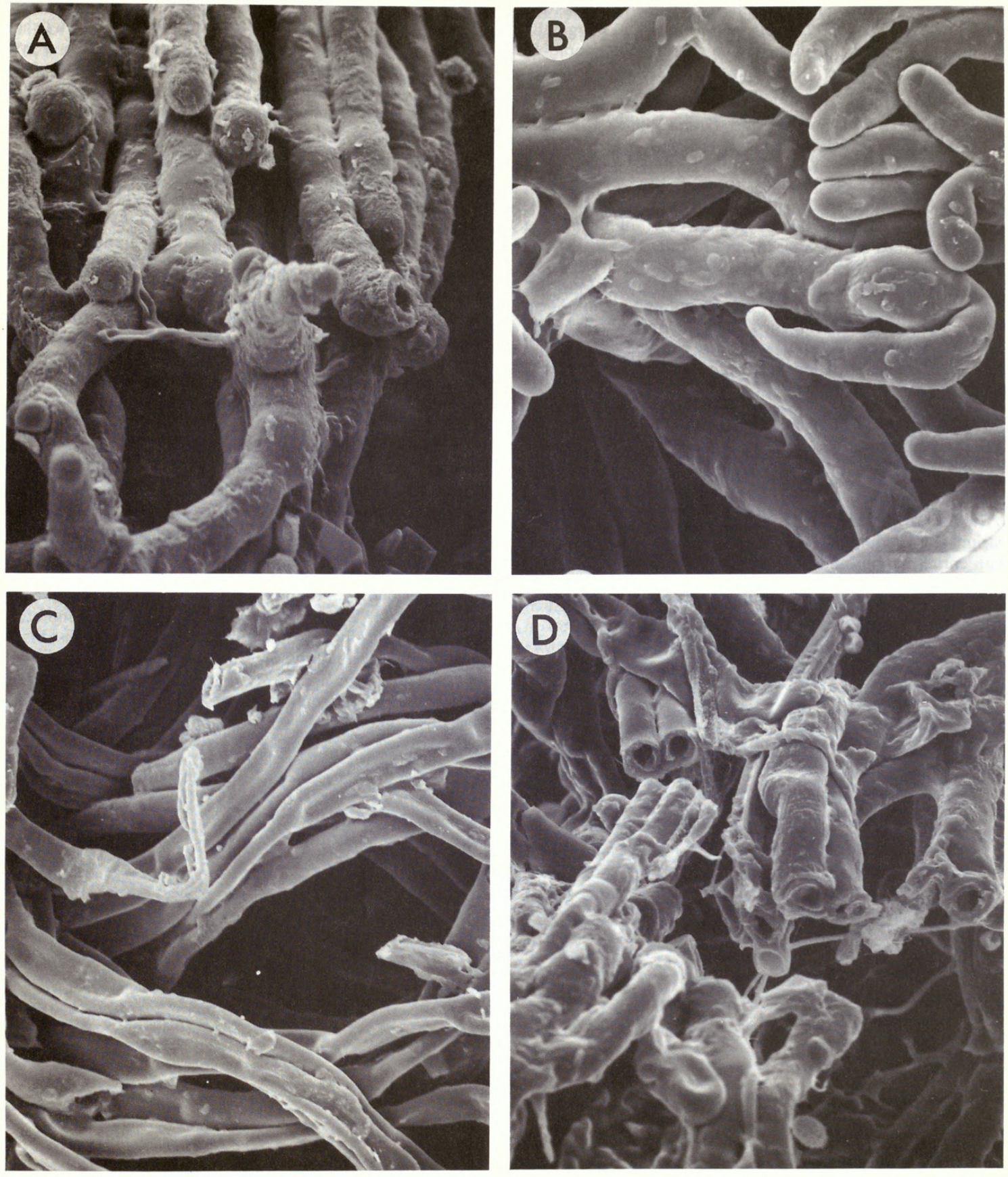

Fig. 5 SEM of tomental hairs. A. *S. damaecornis* (SBT) × 2000. B. *S. laciniosa* (BM) × 2000. C. *S. swartzii* (BM) × 1500. D. *S. tomentosa* (SBT) × 2000.

Mogota, 900–1000 m, 26 May 1979, *T. Pocs* 9123 [A. Vezda, *Lich. Sel. Exs.* 1680] (BM).

2. **Sticta laciniosa** D.J.Galloway, **sp. nov.**

Thallus viridis vel olivaceous foliaceus, laciniosus 5–8(–15) cm latus, lacinii irregulariter divisa subdichotomae vel truncatae, (2–)5–15(–30) mm latae, margis integerrimis, supra laevigatae non faveolatae; medulla niveis vel dilute stramineis,

K + rubra; subtus dense tomentosus, cyphellis numerosis profunde excavatis; apothecia 0.5–3(–6) mm lata, marginalia et aliquando supra lacinias, excipulo scabrido; sporae 8: nae, dilute olivaceus, 1–3-septatae, (22–)25–33(–36) × 5.5–8.5 μm.

Typus: Jamaica, Parish of Portland, Grand Ridge of the Blue Mountains between John Crow Peak and Morce's Gap, 18°05′N 76°39′W, *c.* 1610 m, on the trunk of a *Lyonia octandra* (Sw.) Griseb., (Ericaceae) at 0.5 m height in montane rainforest, 2 April 1989, *P.J. Bellingham* (BM-holotype). Fig.6.

Lichen laciniatus Sw., *Prodr.*: 147 (1788) nom. illegit. (Art. 64.1) [Note 1]. *Platisma laciniatum* (Sw.) Hoffm., *Descript. Adumbr. pl. lich.* **3:** 14 (1801). nomen sed non planta. *Sticta laciniata* (Sw.) Ach., *Meth. Lich.*: 279 (1803). *Lobaria laciniata* (Sw.) Trevisan, *Lichenotheca veneta* exs. 75 (1869). [Note 2]. Type: Jamaica, sine loco, *Swartz* (SBT-lectotype selected here).

NOTE 1. *Sticta laciniata* Ach.

Lichen laciniatus (Swartz, 1788) on which Acharius's *Sticta laciniata* is based is a later homonym of *Lichen laciniatus* Hudson (Hudson, 1762: 449) and is accordingly illegitimate (Art. 64.1). Material of *Lichen laciniatus* in Swartz's herbarium (SBT) comprises two taxa, a green photobiont species with entire margins and a K+ red medullary reaction, which is here described as *Sticta laciniosa*, and a cyanobacterial photobiont species, with delicately phyllidiate margins which is described below as *S. swartzii*. Material of this latter taxon was discussed and figured by Hoffmann (1801) as *Platysma laciniata* (Sw.) Hoffm., based on the illegitimate *L. laciniatus* Sw.

NOTE 2. *Lobaria laciniata* (Sw.) Trevisan

Hudson's *Lichen laciniatus* (Hudson, 1762: 449) is an earlier, but largely forgotten, name for Scopoli's *Lichen amplissimus* (Scopoli, 1772: 386), the basionym for the well-known lichen *Lobaria amplissima* (Scop.) Forssell, and is cited as a synonym of *Lobaria amplissima* in several treatments (e.g. Crombie, 1894; Zahlbruckner, 1925). Vainio (1899) recognized this when he made the combination *Lobaria laciniata* (Hudson) Vainio, but failed to recognize that his new combination was a later homonym of *Lobaria laciniata* (Sw.) Trevisan (Trevisan, 1869) and therefore illegitimate. Thus, Hudson's *Lichen laciniatus* becomes unavailable for use in *Lobaria* and does not take precedence over *Lobaria amplissima*.

Thallus irregularly spreading, 5–8(–15) cm diam., loosely to closely attached from margins to centre. *Lobes* broadly laciniate, subdichotomously to irregularly branched, branches ± discrete and somewhat truncate at margins, becoming subimbricate centrally (2–)5–15(–30) mm wide, thick, coriaceous. *Margins* entire, unevenly sinuate or ± truncate, slightly thickened below, occasionally to ± commonly furnished with projecting, short black tufts of tomentum. *Upper surface* lettuce green to olive green, occasionally suffused brownish at margins when wet, pale olivaceous or pale glaucous-greyish or yellowish or ± brownish in parts when dry, mainly plane or subconvex to minutely, irregularly and shallowly pitted or wrinkled, not faveolate or punctate-impressed, matt, without isidia, maculae, phyllidia, pseudocyphellae or soredia, ± continuous under SEM, rarely with occasional, scattered pores (Fig. 3B). *Medulla* whitish to pale yellowish, K+ red. *Lower surface* smooth or minutely wrinkled especially at margins, pale brown at margins, black centrally or black and shining from margins to centre in older lobes, glabrous in a narrow, marginal zone, ± uniformly densely tomentose from margins to centre, except for young lobe tips, tomentum dark brown to black, thick, entangled, shaggy or woolly. *Cyphellae* common, scattered, round or

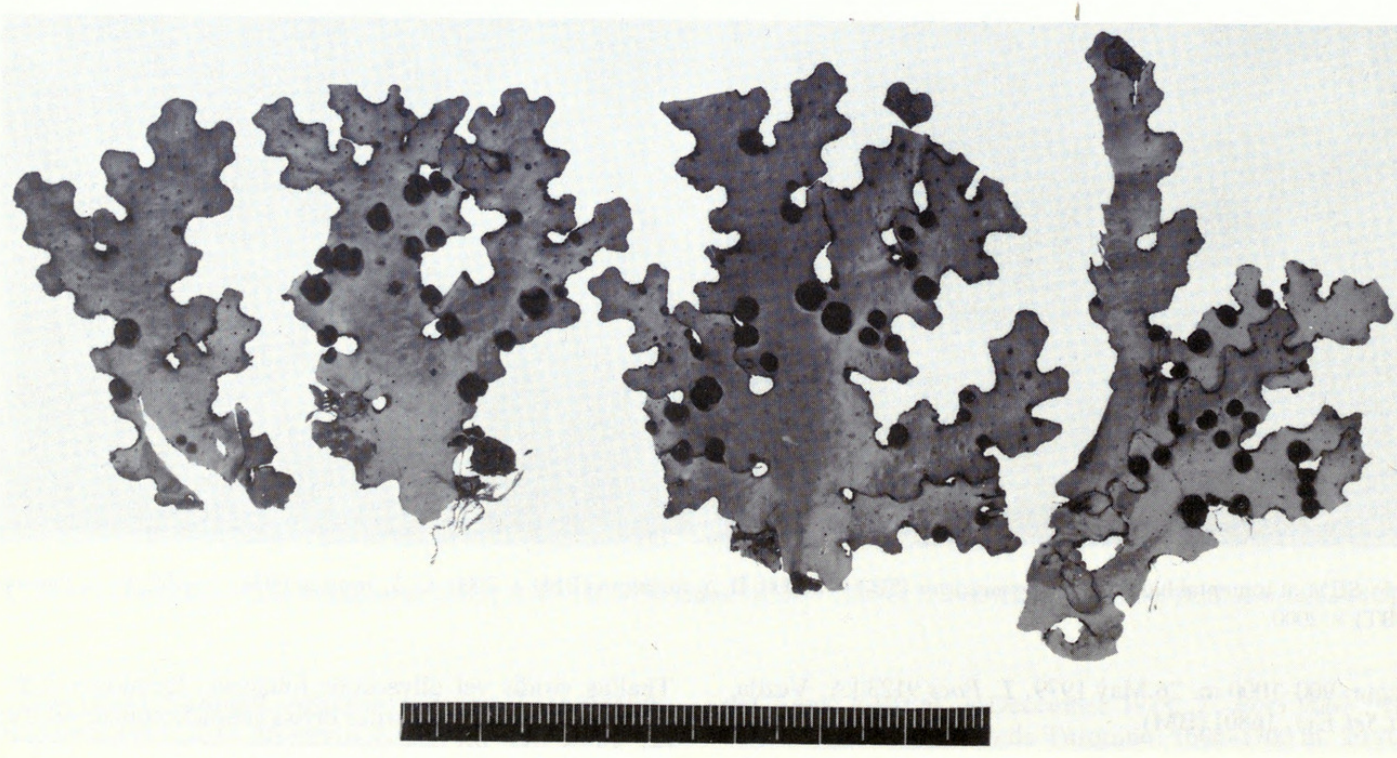

Fig. 6 *Sticta laciniosa*. Holotype (BM). Scale in mm.

subirregular, 0.1–0.5(–1.2) mm diam., deeply excavate, often sunk in dark tomentum, margins thin, sharply defined (Fig. 4B), concolorous with lower cortex, pit membrane yellowish to pale ochre. *Thallus* 200–450(–550) μm thick. *Upper cortex* 40–55 μm thick, colourless, of round to irregular ± isodiametric cells, 2.5–8.5 μm diam. *Photobiont layer* 40–55 μm thick, photobiont green, cells rounded, 3.5–5.5 μm diam. *Medulla* 150–300 μm thick, colourless in upper parts, pale red-brown near lower cortex, hyphae loosely interwoven to 5.5 μm diam. *Lower cortex* 40–65 μm thick, dark red-brown, cells round to irregular, thick-walled, 2.5–11 μm diam. *Tomental hairs* 5–8.5 μm diam., dark red-brown to 180 μm long, in clustered fascicles (Fig. 5B).

Apothecia prominent, mainly marginal and submarginal, occasionally laminal, 0.5–3(–6) mm diam., subpedicellate, round to subirregular, concave at first becoming plane or subconvex at maturity, disc orange-brown to dark red-brown, rarely ± blackened, glossy especially when young, epruinose, smooth to matt and minutely roughened-papillate at maturity. *Proper exciple* swollen, conspicuous, persistent, ± obscuring disc when young, slightly darker than disc, conspicuously verrucose-areolate, margins slightly raised above surface of disc, without projecting marginal hairs. *Exciple* 150–230 μm thick, pale red-brown in outer parts, ± colourless internally, of parallel, radiating, round to irregular thick-walled cells 8–22 μm diam. *Hypothecium* 50–65 μm thick, densely interwoven, olive brownish to red-brown, unchanged in K. *Thecium* 160–200 μm tall, pale yellow-brown to dark brown; epithecium 14–20 μm thick, dark brownish to red-brown, unchanged in K; paraphyses simple, 2–3 μm thick, apices swollen to 5 μm diam. *Asci* cylindrical to clavate-cylindrical (80–)88–106 × 16–19.5 μm. *Ascospores* elongate-ellipsoid, apices pointed, pale olive-brown, 1–3-septate, (22–)25–33(–36) × 5.5–8.5 μm. *Pycnidia* common,

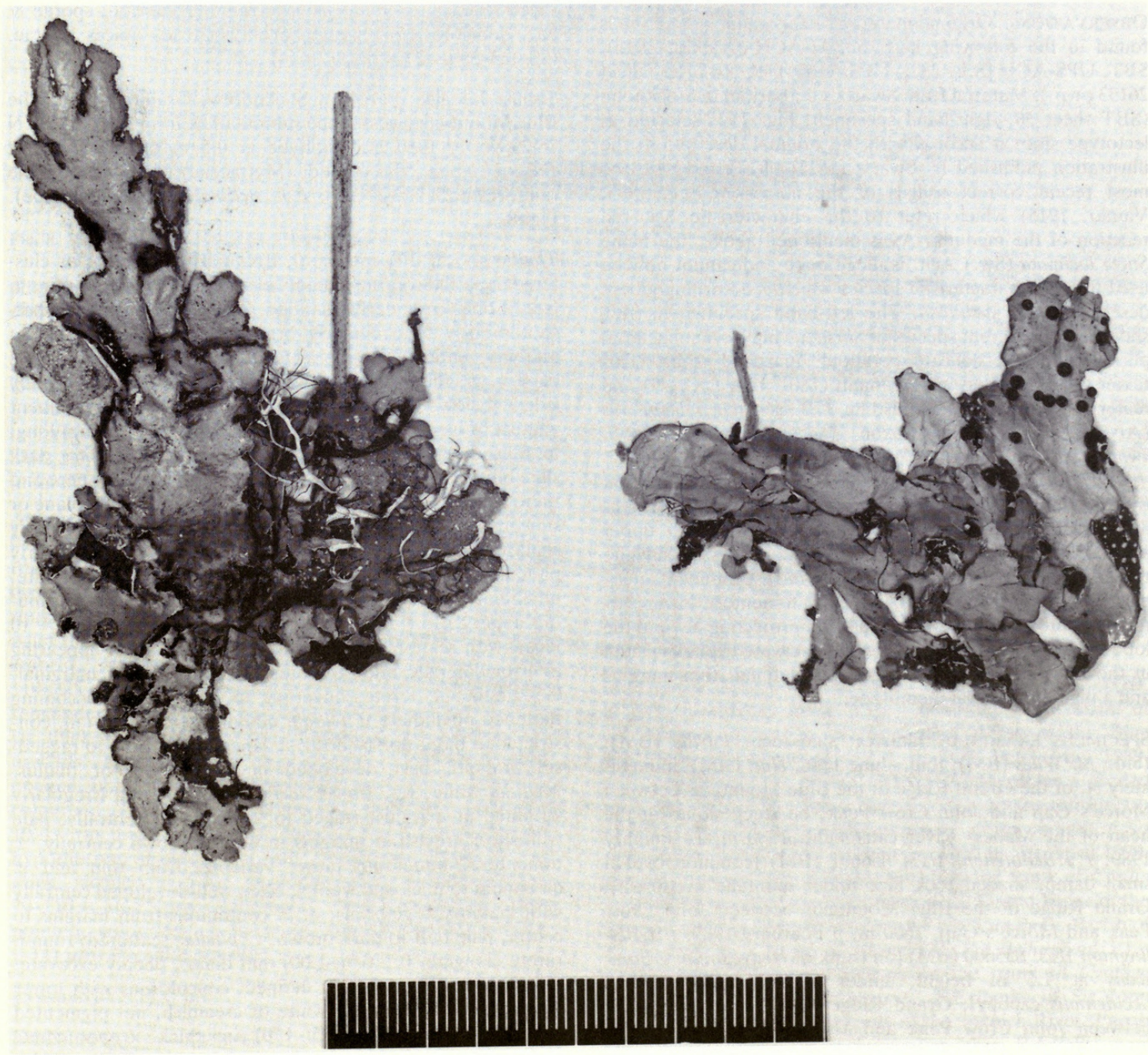

Fig. 7 *Lichen laciniatus* Sw. Lectotype, right-hand specimen (SBT); left-hand specimen is *S.swartzii*. Scale in mm.

scattered, often crowded, ostiole punctate, 0.1 mm diam., dark brown-black, often with noticeably swollen margin concolorous with thallus.

CHEMISTRY. Medulla K+ red: containing a complex mixture of terpenoids, pigments and other lichen substances separated by TLC. The presence of acetone-soluble secondary compounds is extremely unusual in species of *Sticta*, although gyrophoric acid, congyrophoric acid and an unidentified, fast-running compound (Rf class 7) are known from the Asian species *S. nylanderiana* Zahlbr., *S. platyphylloides* Nyl. (lacking gyrophoric acid) and *S. praetextata* (Räsänen) Awasthi (Joshi & Awasthi, 1982; Chen, 1993). The above chemical pattern in *S. laciniosa* is presently under investigation.

DISTRIBUTION. Jamaica (all records seen except one); also in Colombia (one nineteenth century collection only, no recently collected material was seen).

OBSERVATIONS. Original material of *Lichen laciniatus* Sw. is found in the following herbaria: H-ACH (Vainio, 1915), SBT, UPS-ACH [S.L. 232], UPS, UPS-THUNBERG (sheet 26193 pr.p.). Material from Swartz's herbarium in Stockholm (SBT sheet 38, right-hand specimen, Fig. 7) is selected as lectotype since it accords with the original description, the illustration published by Swartz (1811: pl. 7) and with the most recent correct usages of the name (Malme, 1899; Vainio, 1915) which refer to the characteristic K+ red reaction of the medulla. As is mentioned above, the name *Sticta laciniata* (Sw.) Ach. is illegitimate and cannot now be used for this characteristic species which is accordingly here described as *S. laciniosa*. The left-hand specimen in SBT sheet 38 is a different species of *Sticta* having a cyanobacterial photobiont, and delicate coralloid, marginal isidia. This taxon was illustrated in Hoffmann (1801: tab. LXV, 3) and material of it is present also in GB as *Lichen laciniatus* (Arvidsson, 1989). This taxon is described below as *S. swartzii*.

Sticta laciniosa is characterized by laciniate, somewhat truncate lobes rather variable in width with entire margins and having a green photobiont, a mainly smooth upper surface which is not faveolate or punctate impressed, a white to very pale yellowish medulla (K + red), prominent, marginal and laminal ascomata, a thickly tomentose lower surface, the brown-black tomentum often projecting beyond the lobe margins, and scattered, deeply excavate cyphellae sunk in the tomentum and having sharply defined, thin margins and a pigmented basal membrane.

SPECIMENS EXAMINED. **Jamaica:** sine loco, *Purdie* (BM); Ibid., *Mr Wiles* (BM); Ibid., June 1886, *Hart* (BM); immediately N. of the Grand Ridge of the Blue Mountains between Morce's Gap and John Crow Peak, on steep slopes at the head of the Mabess River catchment, 1580 m, 14 January 1989, *P.J.Bellingham* 1/13: 856601 (BM) [common over a small damp, shaded rock face under montane rainforest]; Grand Ridge of the Blue Mountains between John Crow Peak and Morce's Gap, 1600 m, 3 February 1989, *P.J.Bellingham* 1/13: 855600 (BM) [on trunk of *Hedyosmum arborescens* at 1.5 m height, under predominantly *Clethra occidentalis* canopy]; Grand Ridge of the Blue Mountains between John Crow Peak and Morce's Gap, 1600 m, 10 February 1989, *P.J.Bellingham* 1/13: s.n. (BM) [from trunk of *Haenianthus incrassatus* at 1 m height, in montane rainforest; from trunk of *Hedyosmum arborescens* at 2 m height, in montane rainforest]; Grand Ridge of the Blue Mountains between John Crow Peak and Morce's Gap, 1610 m, 2 April 1989, *P.J.Bellingham* 1/13: 854602 (BM) [on trunk of *Lyonia octandra* at 0.5 m height in montane rainforest]; immediately S. of the summit of Blue Mountain Peak, 2240 m, 4 September 1990, *P.J.Bellingham* 1/18: 945549 (BM) [on trunk of *Vaccinium meridionale* at 1 m height in elfin forest. **Colombia:** [as N. Granada] sine loco, *Mrs Blagbourne* (BM).

3. **Sticta swartzii** D.J.Galloway, **sp. nov.**

Thallus cinereus foliaceus, laciniosus, 4–7.5(–10) cm latus; lacinii irregulariter divisa, 2–5(–10) mm latae, margis isidiatis vel phyllidiatis vel ciliatis; supra nitida, laevigatae vel faveolatae; medulla niveis K–; photobion Nostocaceis; subtus tomentosus, margine glabrae, cyphellae profunde excavatae; apothecia 0.5–1.0(–1.5) mm lata, marginalia et aliquando supra lacinias, excipulo pallido, minute scabrido; sporae 8: nae, incolores, 1–3-septatae, ellipsoideae, apices acutae, (28–)33–36 (–42) × 8.5–12(–14) μm.

Typus: Jamaica, Parish of St Andrew, Grand Ridge of the Blue Mountains, west of the summit of St John Peak, 18°05′N 76°39′W, *c.* 1910 m, epiphytic at 0.5 m on the trunk of *Eugenia alpina* (Sw.) Willd. (Myrtaceae) in upper montane rainforest, 29 April 1990, *P.J. Bellingham* (BM-holotype). Fig. 8.

Thallus 4–7.5(–10) cm diam., irregularly spreading or clustered in partial rosettes, loosely attached centrally, margins ± free. Lobes irregularly laciniate, 2–5(–10) mm wide, subdichotomously to irregularly branched, ± free, discrete at margins, entangled- imbricate centrally, rather thin and papery, fragile. *Margins* slightly thickened and delicately ridged below, entire in parts and then with ± prominent whitish to black or brown projecting cilia, 0.2–0.5 mm long, to ragged, lacerate-isidiate-phyllidiate. *Upper surface* dark slate blue or blue-black when wet, pale to dark grey, here and there suffused red-brown or brown when dry, mainly plane or subconvex, matt or shining, smooth in places or irregularly shallowly ridged, occasionally dimpled to ± regularly punctate-impressed towards margins, isidiate, maculate, phyllidiate, without soredia or pseudocyphellae, ± continuous under SEM (Fig. 3C). *Maculae* minute, white, (use × 10 lens), with scattered larger photobiont-free areas appearing as irregular pale buff to whitish blotches. *Isidia* marginal, 0.5–2 mm tall, terete, fingerlike to ± coralloid, becoming flattened-phyllidiate. *Phyllidia* marginal, 0.5-2 mm tall, constricted at base, dorsiventral, ± lanceolate at first to ragged-subcoralloid, best developed in older parts of thallus. *Medulla* white, K–. *Lower surface* minutely and irregularly wrinkled at margins, ridged to ± faveolate centrally, pale whitish or greyish at margins to buff or brown centrally, ± tomentose, tomentum rather variable, from thin and ± arachnoid to thick and woolly, often well-developed centrally with margins ± glabrous, or ± continuous from margins to centre, pale buff to dark brown. *Cyphellae* scattered, round, rarely elongate, 0.1–0.5(–1.00) mm diam., deeply excavate, margins very thin, sharply defined, concolorous with lower surface, basal membrane white or creamish, not pigmented (Fig. 4C). *Thallus* 55–135(–170) μm thick. *Upper cortex* 20–30(–35) μm thick, colourless, of 3–4 rows of round to irregular, thick-walled cells, 5.5–16 μm diam., cells close to

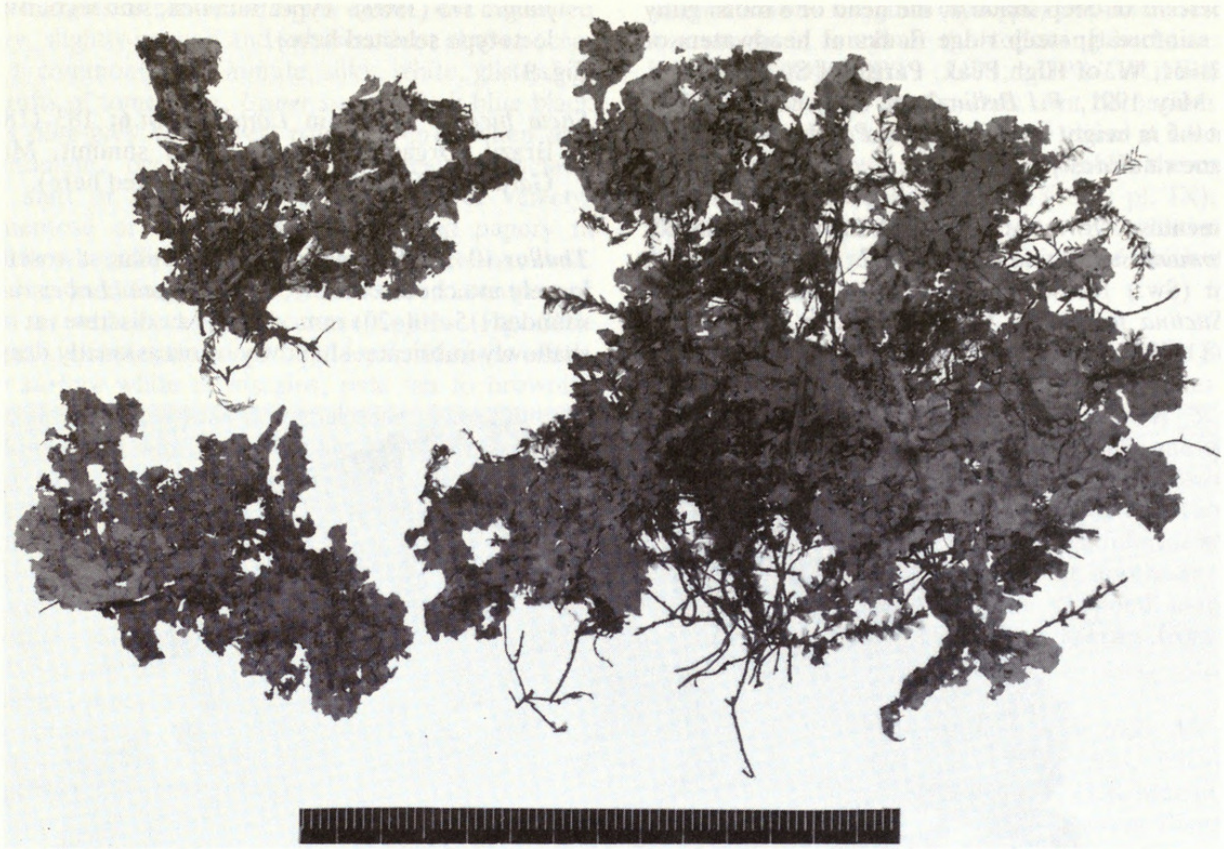

Fig. 8 *Sticta swartzii*. Holotype (BM). Scale in mm.

photobiont layer much larger than cells of outermost layer. *Photobiont layer* 20–45 μm thick, dense, continuous, photobiont ?*Nostoc*, cells rounded, 5.5–9 μm diam., clustered in packets. *Medulla* 35–70 μm thick, almost lacking in young lobes, hyphae colourless, loosely interwoven, 3–5 μm diam. *Lower cortex* 14–25 μm thick, colourless, 1–2 rows of round to irregular, thick-walled cells 5.5–22 μm diam. Tomental hairs 5.5–8.5 μm diam., colourless, to 170 μm long, single or in fascicles (Fig. 5C).

Apothecia rather rare, marginal or submarginal, 0.5–1.0(–1.5) mm diam., subpedicellate, constricted at base, round, very shallowly concave at first soon becoming plane, disc red-brown to dark brown, epruinose, matt, slightly roughened. *Proper exciple* pale pinkish brown, markedly paler than disc, ± translucent when wet, minutely corrugate-scabrid, without projecting marginal hairs. *Exciple* 110–225 μm thick, pale red-brown in outermost 15–20 μm, remainder colourless, of parallel, radiating, round to irregular, thick-walled cells, 11–28 μm diam., largest diameter cells towards hypothecium. *Hypothecium* 55–115 μm thick, opaque, upper 20–35 μm red-brown, paler in K, remainder colourless. *Thecium* 135–170 μm tall, colourless; *epithecium* 10–17 μm thick, red-brown, paler in K, ± contiguous with hypothecium at margins of fruit; paraphyses simple, 2–3 μm thick, swollen to 5 μm at apices. *Asci* clavate-cylindrical 70–110 × 16–25 μm. *Ascospores* elongate-ellipsoid, apices pointed, colourless, 1–3-septate, (28–)30–36(–42) × 8.5–12 (–14) μm. *Pycnidia* not seen.

CHEMISTRY. TLC nil.

DISTRIBUTION. Jamaica.

OBSERVATIONS. Original Swartz material from Jamaica having a cyanobacterial photobiont, delicate marginal coralloid isidia and a K– medulla and labelled *Lichen laciniatus* is found in the following herbaria: GB, UPS-THUNBERG (sheet 26193 pr.p.). This taxon was also illustrated in Hoffmann (1801: tab. LXV, 3). As indicated above (see under discussion of *S. laciniosa*) this is a good independent taxon which is here described as *S. swartzii*.

Sticta swartzii is characterized by rather narrow, irregularly laciniate, thin, papery lobes with coralloid isidiate to phyllidiate margins and often fine, projecting cilia. It has a shining upper surface which is irregularly punctate-impressed; a white medulla which is K–; occasional, small, marginal or submarginal apothecia with prominent pale, glabrous margins; and a variably tomentose lower surface with scattered, round, deeply excavate cyphellae with a white or creamish basal membrane.

SPECIMENS EXAMINED. **Jamaica:** sine loco, *Swartz* (GB, UPS-THUNBERG 26193 pr.p.); headwaters catchment of the Mabess River, N. of the Grand Ridge of the Blue Mountains, Parish of Portland, *c.* 1480 m, 1 May 1989, *P.J.Bellingham* 1/13: 858601 (BM) [Occasional on a shaded rock face (shale) on a steep ridge under montane rainforest]; Grand Ridge of the Blue Mountains W. of the summit of Sir John Peak, Parish of St Andrew, *c.* 1910 m, 29 April 1990, *P.J. Bellingham* 1/13: 877603 (BM) [On the trunk of *Cyrilla racemiflora* in upper montane rainforest]; Grand Ridge of the Blue Mountains immediately W. of Belle Vue Peak, Parish of St Andrew, *c.* 1740 m, 12 May 1990, *P.J.Bellingham* 1/13: 867597 (BM) [Epiphytic at 1 m on the trunk of *Cyathea pubescens* in montane rainforest]; NE flanks of Sir John Peak, at a small headwater gully of the Spanish River, Parish of Portland, *c.* 1840 m, 9 September 1990, *P.J.Bellingham* 1/13: 88160 (BM) [Epiphytic at 1 m height on the trunk of a

Cyathea pubescens in deep shade at the head of a moist gully in montane rainforest]; steep ridge flanks at headwaters of the Green River, W. of High Peak, Parish of St Thomas, *c.* 1780 m, 18 May 1991, *P.J.Bellingham* 1/13: 885594 (BM) [Epiphytic at 0.5 m height on the trunk of *Podocarpus urbanii* in tall montane rainforest].

4. **Sticta tomentosa** (Sw.) Ach., *Meth. Lich.*: 279 (1803). *Lichen tomentosus* Sw., *Prodr.*: 147 (1788). *Lobaria tomentosa* (Sw.) Räuschel, *Nomenclat. Bot.* ed **3:** 330 (1797). *Stictina tomentosa* (Sw.) Nyl., *Syn. meth. lich.* **1**(2): 343 (1860). *Dystictina tomentosa* (Sw.) Clem., *Gen. fung.*: 175 (1909). Type: Jamaica, sine loco, *Swartz* (SBT-lectotype selected here).
Fig. 9.

Sticta bicolor Taylor in *Lond. J.Bot.***6:** 183 (1847). Type: Brazil, Organ Mountains, [near summit, March 1841], *Gardner* 1001 (BM- lectotype selected here).

Thallus 10–50(–85) mm diam., orbicular, ± rosette-forming, loosely attached centrally, margins free. *Lobes* rather broad, rounded, 5–10(–20) mm diam., ± discrete at margins or shallowly imbricate, shallowly or occasionally deeply incised,

Fig. 9 *Lichen tomentosus* Sw. Lectotype (SBT). Scale in mm.

rarely from margins to centre. *Margins* entire, not thickened below, wavy, slightly crisped and subascendent above, occasionally to ± commonly with minute, silky, white, glistening, projecting tufts of tomentum. *Upper surface* dark blue-black or glaucous blue-grey when wet, pale blue-grey when dry, smooth, undulate, occasionally but erratically punctate-impressed, matt or rarely glossy in parts, never velvety-pilose, tomentose or scabrid, rather thin and papery in texture, brittle when dry, flabby, pliable when wet, maculate, without isidia, pseudocyphellae or soredia, ± continuous under SEM or with occasional scattered pores (Fig. 3D). *Maculae* white, minute, scattered (x 10 lens). *Medulla* white, K–. *Lower surface* white at margins, pale tan to brownish centrally, ± glabrous in a wide marginal zone, matt, minutely wrinkled, tomentum white, rarely pale brownish centrally, silky, sparse to ± densely felted. *Cyphellae* common, scattered, round to subirregular, 0.1–0.8(–1.5) mm diam., margins very narrow, sharply defined, rising abruptly and ± vertically from lower surface (Fig. 4D), central cavity white, deeply concave. *Thallus* 140–225 μm thick. *Upper cortex* 14–20 μm thick, colourless, of two layers of thick-walled cells, wall 2.5–3 μm thick, uppermost layer of smaller cells 2.5–5 μm diam., inner cells larger, 8.5–12 μm diam. Photobiont layer continuous, 40–55 μm thick, photobiont cyanobacterial ?*Nostoc*, cells in clusters in a colourless gelatinous matrix, cells 3–5.5 μm diam. *Medulla* 70–130 μm thick, of loosely woven, colourless hyphae to 4 μm diam. *Lower cortex* a single layer of thick-walled, rectangular, colourless cells, 14–20 μm tall and 8–11 μm thick, wall to 3 μm thick. *Tomental hairs* colourless, single or in clusters, to 4 μm diam., 35–135 μm long (Fig. 5D).

Apothecia common, richly developed and often clustered at margins, rare or absent centrally, rounded, sessile, constricted at base to very shortly pedicellate, insertion of disc showing a marked concavity on lower surface, 0.1–1.5(–2) mm diam., disc plane to subconvex, matt, pale to dark red-brown when dry, epruinose, pale brown, ± opaque when wet. *Proper exciple* persistent when dry, excluded when wet, white to pale buff or creamish, smooth to minutely crenulate with occasional projecting silky white hairs at margins of disc, especially noticeable in young fruits. *Exciple* 55–125 μm thick, outermost 30 μm dilute yellow-brown, remainder colourless, of round to irregular, ± isodiametric cells 8–22 μm diam. *Hypothecium* 40–55 μm thick, densely interwoven, upper 22–28 μm pale red-brown, remainder colourless, unchanged in K. *Thecium* 80–90 μm tall, colourless; *epithecium* 5–9(–13) μm thick, pale olive-brown to red-brown, unchanged in K; paraphyses distinctly septate, constricted at septa and appearing long-moniliform, 3.5–8 μm diam., swollen and tinged olive-brown at apices. *Asci* cylindrical, (72–)80–92 × 11–17 μm. *Ascospores* colourless, long-ellipsoid, apices pointed, straight or curved, 3-septate, 27.5–33.5(– 36) × 5.5–8.5 μm.

CHEMISTRY. Nil.

DISTRIBUTION. Neotropics and palaeotropics. Jamaica (Imshaug, 1957), Mexico (Imshaug, 1956*b*), Panama (Imshaug 1956*a*), Colombia, Venezuela, Peru, Brazil (Malme, 1934). East Africa including Kenya, Tanzania, Uganda (Swinscow & Krog, 1988), St Helena (Leighton, 1871), South Africa, Madagascar, Hawaii (Magnusson & Zahlbruckner, 1943; Magnusson, 1956).

TYPIFICATION. Original (syntype) Swartz material of *Lichen tomentosus* is found in the following herbaria: G, GB, L [910,213–1824], SBT, UPS, UPS-THUNBERG [sheet 26202]. Material from Swartz's own herbarium (SBT sheet 44) is selected as lectotype (Fig. 9) since it accords with the original description and closely resembles the coloured illustration later provided by Swartz (1811: pl. IX). Material in BM-ACH labelled *Sticta tomentosa* by Acharius (Galloway, 1988*b)* is a mixture of two taxa neither of which appears to be *Sticta tomentosa*.

OBSERVATIONS. In commenting on his species *Sticta bicolor*, Thomas Taylor (1847) gives the following notes which are a good description of the morphology of *S. tomentosa*; '. . .Thallus 4 inches wide, lobes scarcely one quarter of an inch broad, the central parts of an ash-grey, the extreme of a chestnut brown, but little deepened by moisture. The thick dark grey scabrous pubescence of the inferior surface of the thallus reappears on the backs of the apothecia. The smooth surface of the thallus and the crowded marginal sessile apothecia readily distinguish this species from *S. sylvatica* Ach.'.

SPECIMENS EXAMINED. **Jamaica:** sine loco, *Mr Wiles* (BM); sine loco, on branches and twigs of trees, Feb.–March 1905, *Miss C.E. Cummings* [*Lich. Exs.*, G.K.Merrill 193] (BM); headwaters of catchment of the Mabess River, N. of the Grand Ridge of the Blue Mountains, 1340 m, 8 May 1989, *P.J.Bellingham* 1/13: 860602 (BM) [from trunk of *Myrcianthes fragrans* on a rock bluff in montane rainforest]; steep slopes at the headwaters of the Mabess River N. of the Grand Ridge of the Blue Mountains between Morce's Gap and John Crow Peak, 1420 m, 5 July 1990, *P.J.Bellingham* 1/13: 859601 (BM) [Epiphytic at 0.5 m height on stems of *Picea weddellii* in a steep rubbly channel at the edge of an old landslide]; steep ridge at headwaters of Mabess River, N. of the Grand Ridge of the Blue Mountains between Morce's Gap and John Crow Peak, 1440 m, 23 August 1990, *P.J.Bellingham* 1/13: 857602 (BM). **Mexico:** La Cima, 3050 m, 14 July 1908, *C.G.Pringle* S 19,184 (BM); Amecameca, 14 September 1908, *C.G.Pringle* S 19,225 (BM); Hills Patzcuaro, November 1891, *C.G.Pringle* S 22,511 (BM). **Panama:** Chiriqui, between Los Planes de Hornito and Fortuna Lake. Trail to Zarzo, 1200 m, 8 March 1985, *R.Hampshire & C.Whitefoord* 335 (BM). **Colombia:** Rio Magdalena, *Mr J. Weir* (BM); Cali-Dagua Road, after Bitaco turning, 1000 m, 17 December 1967, *R.M. Garrett* 36 (BM); sine loco., ex Herb. Lindig 2521 (BM). **Venezuela:** Sierra de Sto Domingo, 1 August 1958, *R.W.G. Dennis* 1935b (BM). **Peru:** In declivibus Andium peruvianarum. pr. Sachapata, Sept. 1854, *W.Lechler* 3124 (BM). **Brazil:** Organ Mountains, *Gardner* (BM); sine loco, *Mr Weir* 61 (BM). **St Helena:** High Peak National Forest, 600 m, 17 December 1986, *A.B.Barlow* (BM). **Tanzania:** Arusha Distr., Mt Meru, south side, 2000 m, February 1974, *T.D.V. Swinscow* T16/5 (BM). **Kenya:** Meru Distr., Mt Kenya, east side, Themwe, 2100 m, February 1974, *T.D.V. Swinscow* 3K 16/8 (BM); Mt Kenya, 2 km NW of Irangi Forest Station, 2000 m, February 1974, *T.D.V. Swinscow* K48/15 (BM); Mt Kenya, near Castle Forest Station, 1900 m, February 1974, *T.D.V. Swinscow* K 49/6 (BM). **Uganda:** Kigezi District, Kinkizi County, 1600 m, December 1971, *T.D.V. Swinscow* 3U 56/4 (BM). **South Africa:** Cape Province [Kaffraria], Barziya (?), *Rev. R. Baur* (BM). **Madagascar:** sine loco, *Barron* (BM). **Hawaii:** Mauii, Puu Kukui, Mount Kaulawelewele, 295 m, 25 April 1970,

A.C. Jermy s.n. (BM) [on soft sandstones or as epiphytes in *Metrosideros* rainforest with *Pomantia arborea* as a dominant shrub].

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REFERENCES

Acharius, E. 1799. *Lichenographiae sueciae prodromus*. Lincopiae.
—— 1803. *Methodus*. Stockholm.
—— 1810. *Lichenographia universalis*. Göttingen.
—— 1814. *Synopsis methodica lichenum*. Lund.
Arvidsson, L. 1989. Lichen material by O.P. Swartz in the herbarium at Göteborg. *Graphis Scripta* **2:** 164–167.
Chen, J.-B. 1993. Chemical notes on three species of *Sticta* from China. *Lichenologist* **25:** 454–458.
Crombie, J.M. 1894. *A monograph of lichens found in Britain*. London.
Culberson, C.F. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromat.* **72:** 113–125.
Delise, D.F. 1825. Histoire des lichens: genre *Sticta*. *Mém. Soc. linn. Normandie* **2:** 1–167.
Fée, A.L.A. 1837. *Essai sur les cryptogames des écorces exotiques officinales. Deuxième parte*. Paris.
Galloway, D.J. 1981. Erik Acharius, Olof Swartz and the evolution of generic concepts in lichenology. *In* Wheeler, A. & Price, J.H. (Eds), *History in the service of systematics. Soc. Hist. nat. Hist. Spec. Pub.* **1:** 119–127.
—— 1985. *Flora of New Zealand lichens*. Wellington.
—— 1987. Austral lichen genera: some biogeographical problems. *Bibl. Lichenol.* **25:** 385–399.
—— 1988*a*. Studies in *Pseudocyphellaria* (lichens) I. The New Zealand species. *Bull.Br.Mus.nat.Hist.* (Bot.) **17:** 1–267.
—— 1988*b*. Erik Acharius and his influence on English lichenology. *Bull. Br. Mus. nat. Hist.* (Bot.) **18**(2): 149–194.
—— 1992*a*. Lichens of Laguna San Rafael, Parque Nacional 'Laguna San Rafael', southern Chile: indicators of environmental change. *Glob. Ecol. Biogeogr. Lett.* **2:** 37–45.
—— 1992*b*. Studies in *Pseudocyphellaria* (lichens) III. The South American species. *Bibl. Lichenol.* **46:** 1–275.
—— 1994. Studies on the lichen genus *Sticta* (Schreber) Ach.: I. Southern South American species. *Lichenologist* **26:** 000–000.
—— **& Arvidsson. L.** 1990. Studies in *Pseudocyphellaria* (lichens) II. Ecuadorean species. *Lichenologist* **22:** 103–135.
—— **& Pickering, J.** 1990. *Sticta ainoae*, a new species from cool temperate South America. *Bibl. Lichenol.* **38:** 91–97.
Green, T.G.A., Horstmann, J., Bonnett, H., Wilkins, A.L. & Silvester, W.B. 1980. Nitrogen fixation by members of the Stictaceae (Lichenes) of New Zealand. *New Phytol.* **84:** 339–348.
Hoffmann, G.F. 1791–1801. *Descriptio et adumbratio plantarum e classe cryptogamica Linnaei quae lichenes dicuntur*. **1, 3**. Lipsiae.
Hooker, W.J. 1822. Lichenes. *In* Kunth, C.S. (Ed.), *Synopsis plantarum, quas, in itinere ad plagam aequinoctialem orbis novi, collegerunt Al. de Humboldt et Am. Bonpland*. **1:** 7–65. Paris.
Hudson, W. 1762. *Flora anglica*. London.
Imshaug, H.A. 1956*a*. Catalogue of Central American lichens. *Bryologist* **59:** 69–114.
—— 1956*b*. Catalogue of Mexican lichens. *Revue bryol. lichén.* **25:** 321–385.
—— 1957. Catalogue of West Indian lichens. *Bull.Inst. Jamaica Sci. Ser.* **6:** 1–153.
James, P.W. & Henssen, A. 1976. The morphological and taxonomic significance of cephalodia. *In* Brown, D.H., Hawksworth, D.L. & Bailey, R.H. (Eds), *Lichenology: progress and problems*: 22–77. London.
Joshi, M. & Awasthi, D.D. 1982. The lichen family Stictaceae in India and Nepal. *Biol. Mem.* **7:** 165–190.
Leighton, W.A. 1871. Notes on the lichens of the island of Saint Helena. *Trans. Linn. Soc. Lond.* **27:** 155–158.
Magnusson, A.H. 1956. A catalogue of the Hawaiian lichens. *Ark. Bot.* II, **3:** 223–402.
—— **& Zahlbruckner. A.** 1943. Hawaiian lichens. I. The families Verrucariaceae to Peltigeraceae. *Ark. Bot.* **31A**(1): 1–96.
Malme, G.O.A. 1899. Beiträge zur Stictaceen-flora Feuerlands und Patagoniens. *Bih. K. svenska Vetensk.-Akad. Handl.* **25**(3/6): 1–39.
—— 1934. Die Stictaceen der ersten Regnellschen Expedition. *Ark. Bot.* **26A**(14): 1–18.
Nicolson, D.H. & Jarvis, C.E. 1990. Solander's manuscript *Florula Indiae Occidentalis* and Swartz's *Prodromus*. *Taxon* **39:** 615–623.
Nylander, W. 1860. *Synopsis methodica lichenum*. **1**(2): 141–430. Paris.
Purvis, O.W., Coppins, B.J., Hawksworth, D.L., James, P.W. & Moore, D.M. 1992. *The lichen flora of Great Britain and Ireland*. London.
Scopoli, J.A. 1772. *Flora Carniolica* 2nd ed. **2**. Wien.
Stafleu, F. 1971. *Linnaeus and the Linneans. The spreading of their ideas in systematic botany, 1735–1789. Regnum. veg.* **79:** 1–386.
Stearn, W.T. 1980. Swartz's contributions to West Indian botany. *Taxon* **29:** 1–13.
Stizenberger, E. 1895. Die Grübchenflechten (*Stictei*) und ihre geographische Verbreitung. *Flora, Jena* **81:** 88–150.
Swartz, O. 1788. *Nova genera & species plantarum seu Prodromus*. Holmiae.
—— 1811. *Lichenes americani*. Norimbergae.
Swinscow, T.D.V. & Krog, H. 1988. *Macrolichens of East Africa*. London.
Taylor, T. 1847. New lichens, principally from the herbarium of Sir William J. Hooker. *Lond. J. Bot.* **6:** 148–197.
Trevisan, V. 1869. Lichenotheca Veneta exs. 75 *Lobaria pulmonaria*. Bassano.
Tuckerman, E. 1882. *A synopsis of the North American lichens: Part 1*. Boston.
Vainio, E.A. 1899. Lichenes in Caucaso et in Peninsula Taurica annis 1884–1885 ab. H. Lojka et M. a Déchy collecti. *Termés-zetr. Füz.* **22:** 269–343.
—— 1915. Additamenta ad lichenographiam Antillarum illustrandam. *Ann. Acad. Sci. Fenn.* A **6**(7): 1–226.
White, F.J. & James, P.W. 1985. A new guide to microchemical techniques for the identification of lichen substances. *Bull. Br. Lichen. Soc.* **57** (suppl.): 1–41.
Zahlbruckner, A. 1925. *Catalogus lichenum universalis* **3:** 326–407. Leipzig.

Galloway, David J. 1994. "Studies on the lichen genus Sticta (Schreber) Ach.: II. Typification of taxa from Swartz's Prodromus of 1788." *Bulletin of the Natural History Museum. Botany series* 24(1), 35–48.

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