

A reassessment of the genera *Chromatochlamys* and *Thelenella*, and a new species of *Strigula* from the British Isles

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Abstract: *Strigula confusa* Fryday, Coppins & Common is described from the western British Isles, where it grows over bryophytes on mildly basic rocks. The concept of the genus *Thelenella* is expanded to include *Chromatochlamys* and the following new combinations are made: *Thelenella larbalestieri* (A. L. Sm.) Coppins & Fryday, *Thelenella muscorum* var. *octospora* (Nyl.) Coppins & Fryday, *Thelenella vezdae* (H. Mayrhofer & Poelt) Coppins & Fryday. *Thelenella sordidula* (Th. Fr.) H. Mayrhofer is reported for the first time from Europe (Svalbard).

Key words: *Aspidothelium*, pyrenolichens, *Strigulaceae*, *Thelenellaceae*

Introduction

The recent revival of interest in the lichen vegetation of high-altitude areas of the British Isles has resulted in numerous puzzling species being discovered (Gilbert *et al.* 1988; Gilbert & Coppins 1992; Fryday & Coppins 1996; Fryday 1996, 1997, 2000, 2002, in preparation). Among these is a species that was originally identified as *Chromatochlamys muscorum* var. *octospora* (Nyl.) H. Mayrhofer & Poelt (e.g. Gilbert & Fryday 1996), but it was later realized that it was not this taxon and provisionally renamed *Chromatochlamys confusum* ad int. (Fryday 1996a). However, a more critical investigation has shown it to be referable to the genus *Strigula* Fr., and it is here described as *Strigula confusa*.

Our investigations have found the separation of *Chromatochlamys* Trevis. from *Thelenella* Nyl. to be untenable, and the appropriate new combinations are made.

Materials and Methods

Apothecial characteristics were examined by light microscopy on hand-cut sections mounted in water, 10% KOH (K) or 50% HNO₃ (N). The ascus structure was studied in 0.15% aqueous IKI, both without prior treatment and after pretreatment with 10% KOH. All ascospore measurements were made in 10% KOH. For photography, all sections were prebleached and stained in 0.15% aqueous IKI (0.15IKI) without prior treatment (Common 1991).

All specimens of the newly described species are in the first author's personal herbarium unless stated otherwise.

Additional comparative material examined:

Aspidothelium cinerascens Vain.—**Trinidad:** ridge west of 'Arima—Blanchisseuse Road' along Las Lapas Road (west of Morne Bleu), c. 2000 ft., Northern Range, 1963, *H. A. Imshaug* [31750] & *F. H. Imshaug* (MSC).

Aspidothelium fugiens (Müll. Arg.) R. Sant.—**St. Lucia:** Secondary rainforest, c. 1900 ft., road south of Piton Canarie, Quarter of Soufrière, 1963, *H. A. Imshaug* [29759D] & *F. H. Imshaug* (MSC); lower montane rain forest to montane thicket, Mt. la Combe, 1000–1442 ft., Barre de L'Isle Ridge, Quarters of Castries and Dennery, 1963, *H. A. Imshaug* [30061A, 30072A] & *F. H. Imshaug* (MSC); secondary rain forest, Des Bottes, c. 2000 ft, north-east of Soufrière, Quarter of Soufrière, 1963, *H. A. Imshaug* [30076F] & *F. H. Imshaug* (MSC).

Aspidothelium geminipara (Malme) R. Sant.—**Trinidad:** ridge west of 'Arima—Blanchisseuse Road' along Las Lapas Road (west of Morne Bleu), c. 2000 ft.,

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B. J. Coppins: Royal Botanic Garden, Edinburgh, EH3 5LR, UK.

Northern Range, 1963, *H. A. Imshaug* [31750] & *F. H. Imshaug* (MSC).

Thelenella fernandeziana (Zahlbr.) H. Mayrhofer.—**Chile:** *Juan Fernandez Islands:* Mas a Tierra, Puerto Ingles, rocky shore at landing place on south end of bay. Sea level, 1965, *H. A. Imshaug* 37879A (MSC); Santa Clara, El Morro del Spartán (=Morro de los Alelies), summit plateau, 10 m, 1965, *H. A. Imshaug* 38238C (MSC).

Thelenella modesta (Nyl) Nyl.—**Italy:** *Toscana:* Lucca prov., N of Bagni di Lucca, NNE of Tereglio, Coll della Prada, 1300 m, 1985, *Coppins* 12007 (E). [**France:**] La Bayette, près Fougères (MSC); 'sur le peuplier blanc', Redon (MSC). [**Switzerland:**] Voirons, (près Genève), sur *Fagus* 'Herbier Müller Arg., 1896' (MSC).

Thelenella muscorum var. *muscorum* (Fr.) Vain.—[selected] **Great Britain:** *Scotland:* V.C. 88, Mid-Perthshire: Killin, Finlarig, 27/58.34, 100 m, on *Fraxinus*, 14 viii 1989, *Fryday* s.n.(E); *ibid.*, Creag Bhuidh, 27/57.35, 250 m, on *Fraxinus*, 1990, *Fryday* 1018 (E).—**USA:** *Colorado:* Boulder Co., Lytle formation, Dakota group, c. 4 miles N of Boulder, T. 1 N., R. 71 W., Sec 1, 5800–6400 ft alt., 1961, *R. A. Anderson* S-20272 (MSC).

Thelenella inductula (Nyl.) H. Mayrhofer.—**Spain:** *Canary Islands:* El Hierro, Lod Lajiales, 1981, *C. Hernandez Padrón* 3605 (E).

Strigula johnsonii P. M. McCarthy—**New Zealand:** *South Island:* North Otago: Leith valley, below Morrisons Creek, on rounded volcanic stones in bank of flood-prone stream, 1993, *P. N. Johnson* 757 (CHR—holotype); Bethunes Gulley, below Mt Cargill, grid ref. 144/198837, alt 135 m, on shaded volcanic stones in bank of flood-prone incised stream, 1993, *P. N. Johnson* 732 (CHR).

Chromatochlamys and *Thelenella*

The genera *Chromatochlamys* and *Thelenella* have been the subject of modern taxonomic treatments by Mayrhofer & Poelt (1985) and Mayrhofer (1987). The two genera, along with *Julella* Fabre, forming the family *Thelenellaceae* H. Mayrhofer (1987) (Eriksson *et al.* 2003), although Harris (1995) considered *Julella* to be 'clearly a member of the *Arthopyreniaceae* and should be excluded from the *Thelenellaceae*'. Harris (1995) also expanded the concept of *Thelenella* by including within it the tropical genus *Aspidothelium* Vain., which was previously included in the *Aspidotheliaceae* Räsänen ex J. C. David & D. Hawksw. However, Santesson (1952) considered that *Aspidothelium* was related to *Clathroporina* Müll. Arg. in the *Trichotheliaceae* (Müll. Arg.) Bitter & F. Schill. but not to *Thelenella*,

and Eriksson & Hawksworth (1998) recommended not uniting the *Aspidotheliaceae* with the *Thelenellaceae* pending further studies. Lücking (1998) discussed the differences between *Thelenella* and *Aspidothelium* and also recommended that they should not be united because he found several differences, especially the type of ascospore septation, which he considered significant at the generic level. Although Farkas & Sipman (1997) followed Harris in uniting the two genera, most other authors have continued to recognize *Aspidothelium* as a distinct genus (e.g. McCarthy 1999; McCarthy *et al.* 2001; Sérusiaux & Lücking 2001; Sipman 1997). In addition, Mayrhofer (1987) reported thinly falcate, 9–15 × 0.6–1.2 µm conidia in *Thelenella*, whereas Santesson (1952) reported oblong, slightly curved, 3–4 × 1 µm conidia for *Aspidothelium cinerescens* Vain. (the type species of *Aspidothelium*). Consequently, we also prefer to keep the two genera separate.

Mayrhofer & Poelt (1985) distinguished *Chromatochlamys* from *Thelenella* by its periphysoids in the ostiole and a recessed ('Einbuchtung') ocular chamber in the ascus apex. Mayrhofer (1987) abandoned the first character, so that the two genera were then separated only on the presence or absence of an ocular chamber. Harris (1995) questioned this distinction as he observed an ocular chamber in several *Thelenella* species, especially in freshly collected material. Although he noted differences in the paraphysoids of *Thelenella* and *Chromatochlamys*, he questioned whether this was significant at the generic level. However, he declined to unite the two genera owing to the limited material of *Chromatochlamys* available to him. We confirm Harris's observations of an ocular chamber in the specimens of *Thelenella* species available to us (see Materials and Methods), including material of the type of the genus, *T. modesta*. Indeed, an ocular chamber ('cone-shaped dimple') is clearly illustrated for this species by Morgan-Jones & Swinscow (1965: fig. 2). Although the paraphysoids of *T. modesta* tend to be more branched than those of *C. muscorum* (the type species of

Chromatochlamys), we consider this to be of minor importance and not significant at the generic level. As we have ample material of *Chromatochlamys* for comparison we, accordingly, consider *Chromatochlamys* to be a synonym of *Thelenella* and make the necessary new combinations. The combination *T. muscorum* (Fr.) Vain. has already been made.

***Thelenella larbalestieri* (A. L. Sm.)
Coppins & Fryday comb. nov.**

Microglaena larbalestieri [*larbalestieri*] A. L. Sm., *J. Bot.* **49**: 42 (1911).—*Chromatochlamys larbalestieri* (A. L. Sm.) H. Mayrhofer & Poelt, *Herzogia* **7**: 27 (1985); type: Ireland, Connemara, Twelve Pins, 1876, *Larbalastier* (BM—holotype!).

There are four collections referred to *T. larbalestieri* in BM, two each from Ireland and Scotland. The two Irish records, which include the holotype, have a thickish, rimose, brown thallus and are apparently epiphytic on other lichens (*Verrucaria* sp., *Porpidia* sp.) whereas the two Scottish collections have a thin, white thallus and are growing directly on rock, one of which was not semi-inundated. One of the Scottish collections (*James* 1966) supported only a single perithecium and was not examined microscopically, but the ascospores of the other collection (*Swinscow* 1962) were similar in size and shape to those of *T. larbalestieri*.

Additional specimens examined. **Ireland:** V.C. H16, West Galway: Doughruagh Mountain near Kylemore, mica-schist rock in small stream at 1000 ft., 4 vii 1961, *T. D. V. Swinscow* (BM). **Great Britain:** Scotland: V.C. 97, Argyll Main: quartz-dolerite rock in stream in deciduous wood on north shore of Loch Moidart, 30 vi 1962, *T. D. V. Swinscow* (BM). V.C. 103, Mid Ebudes: Tobermory, Aros woods, 17/508, 546, on shaded damp rocks by path in wood, 3 vii 1966, *P.W. James* (BM).

***Thelenella muscorum* var. *octospora*
(Nyl.) Coppins & Fryday comb. nov.**

Verrucaria muscicola var. *octospora* Nyl., in *Ohlert, Schriften Königl. Phys.-Ökon. Ges. Königsberg* **11**: 43 (1870).—*Chromatochlamys muscorum* var. *octospora* (Nyl.) H. Mayrhofer & Poelt, *Herzogia* **7**: 37 (1985); type: Poland (Borussia), Neu Grabau (pr. Berent), supra *Nephroma laevis* & muscos, 1866, *Ohlert* (H-

NYL 1576—holotype). For further synonymy and citation of types see Mayrhofer & Poelt (1985: 37) and Mayrhofer (1987: 73).

Selected specimens examined. **Great Britain:** England: V.C. 70, Cumberland: Melmerby Low Scar, 35/6.3, 410–470 m, over mosses on limestone, 1979, *Coppins* 4265 (E). Scotland: V.C. 96, Easternness: Drumnadrochit, by Divach Burn, near Divach Lodge, 28/49.27, c. 200 m, 1976, *Coppins* 3810 (E); 11 km WSW of Inverness, South Clunes, 28/55.40, on *Hypnum* on *Salix*, 1984, *Coppins* 10551 (E).

***Thelenella vezdae* (H. Mayrhofer & Poelt)
Coppins & Fryday comb. nov.**

Chromatochlamys vezdae H. Mayrhofer & Poelt, *Herzogia* **7**: 39 (1985); type: Österreich, Steiermark, 1340–1400 m, 18 vi 1972, *P. Döbblers* s.n. (GZU—holotype!).

This species should be compared with *Thelenella sychnogonioides* (Zahlbr.) R.C. Harris (syn. *T. harrisii* H. Mayrhofer), which Mayrhofer (1987), erroneously, considered to be a synonym of *T. hassei* (Zahlbr.) H. Mayrhofer.

Additional specimens examined. **Austria:** Steiermark: Koralpe, Herzogberg E von Modriach, beim Gehöft Aiblwirt, c. 1250 m, Tannen-Fichtenwald, an einem Strunk, 1985, *Hafellner* 13176, (GZU); 10 km W Schwanberg, Weg Jägerwirt-Schwanberger Brendel Hütt, 1300–1600 m, GF 9256/1, 1991, *Poelt, Scutari & Obermayer* s.n. (GZU); Teigitschgarben, S Voitsberg, c. 2 km SW vom Kraftwerk Arnstein, c. 440 m, MTB 8956/4 Schluchtwald mit Silikatschrofen, auf einem Baumstrunk, 1994, *Mayrhofer & Unger* s.n. (GZU); Eisenerzer Alpen, im Talschluss des Graskogel Grabens, c. 1080 m, 47°27'20"N, 14°51'50"E, MTB 8555/1 Fichtenwald, an morschen Koniferenstümpfen, 1997, *A. Hafellner & J. Hafellner* 40979 (GZU).

As part of our investigations we examined a '*Chromatochlamys*' collection from Svalbard. This proved to be *Thelenella sordidula* (Th. Fr.) H. Mayrhofer, previously known only from Disko Island (Greenland) and Ellesmere Island (Canada). It is here reported for the first time from Europe.

Thelenella sordidula—**Svalbard:** Nordenskiöld Land: Adventdalen, Todalen, 78°10'N, 15°53'E, UTM WGS84: WG 200–205, 770–778, alt. 50–150 m, 21 viii 2002, *R. Haugan* 6821 (BG).

A further, apparently undescribed, species of *Thelenella* is also known to us from two

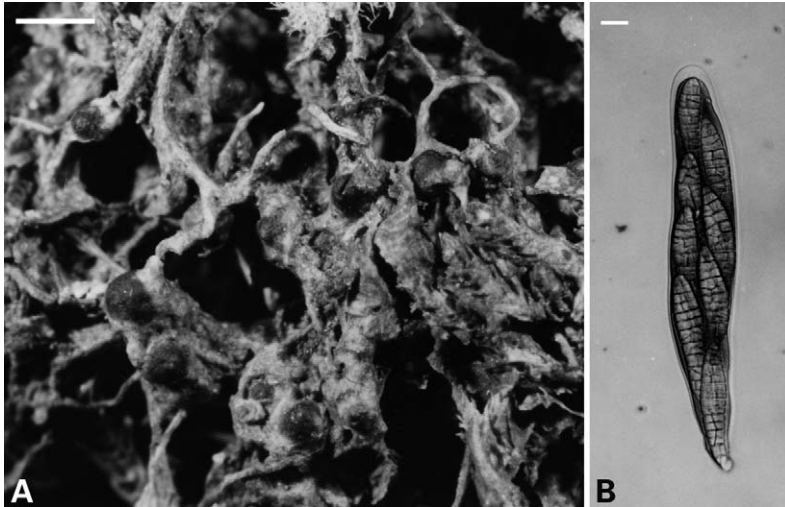


FIG. 1. *Strigula confusa* (Fryday 4676—holotype). A, thallus and perithecia; B, ascus and ascospores in 0.15% IKI, without pretreatment. Scales: A=0.5 mm, B=10 μ m.

collections from south-west England. It has a silvery thallus with a hint of grey-green, and 4-spored asci with ascospores mostly $36\text{--}55 \times 15\text{--}14 \mu\text{m}$. More material is required for a clearer understanding of its variation and relationships.

Thelenella sp. **Great Britain:** *England:* VC 3, South Devon: Pudscombe Cove, on sheltered, near vertical shale in valley, with *Leptogium teretiunculum*, 20/912.505, iv 2000, B. Benfield (E); *ibid.*, on Lower Devonian slate in quarry, 200 m from the sea-shore, 20/912.505, 10 viii 2000, B. Benfield (E).

Strigula Fr.

Strigula confusa Fryday, Coppins & Common sp. nov.

Thallus bryicola aut saxicola, tenuis, griseus. Algae ad *Trentepohliam* pertinentes. Perithecia atrobrunnea vel atra, $\frac{1}{2}$ vel $\frac{3}{4}$ immersa, 0.3–0.5 mm diam., involucrello nullo aut indistincto. Asci cylindrici vel anguste clavati, $140\text{--}160 \times 25\text{--}28 \mu\text{m}$. Ascospores $32.5\text{--}46.6\text{--}58.0 \times 11\text{--}13 \mu\text{m}$, elongato-ellipsoideae, hyaline, submuriformes vel muriformes.

Typus: Cambria, V.C. 49, Caernarvonshire [Caernarfon], Pass of Llanberis, Cwm Uchaf, 23/62 55, 825 m, over bryophytes on calcareous rock in damp, north-facing coire, 23 ix 1993, A. M. Fryday 4676 (E—holotypus).

(Fig. 1)

Thallus (Fig. 1A) grey, continuous, thin (c. $50 \mu\text{m}$ thick). *Photobiont* *Trentepohlia*; cells irregularly rounded and $10\text{--}15 \mu\text{m}$ diam., or elongate and up to $21 \times 12 \mu\text{m}$.

Perithecia (Fig. 1A) numerous, dark brown to black, globose in section, 0.3–0.5 mm diam., half to three-quarters immersed. *Excipulum* $70\text{--}80 \mu\text{m}$ thick, dark brown above, pale-brown or hyaline below; hyphal cells in upper excipulum rounded, angular or oblong, $4\text{--}10 \times 3\text{--}5 \mu\text{m}$, with dark brown pigment granules deposited on the cell walls. *Involucrellum* absent (or not well differentiated from the excipulum). *Paraphysoids* persistent, $2.0\text{--}2.5 \mu\text{m}$ wide, sparingly branched. *Asci* (Fig. 1B) cylindrical (to subclavate), $140\text{--}160 \times 25\text{--}28 \mu\text{m}$; outer wall c. $2 \mu\text{m}$ thick; apex with a distinct tholus and ocular chamber, I –; contents of ascus I+ red-brown; 6–8-spored. *Ascospores* (Fig. 1B) $32.5\text{--}46.6\text{--}58.0 \times 11\text{--}13 \mu\text{m}$, elongate-ellipsoid, hyaline, submuriform to muriform, with $12\text{--}14 \times 2\text{--}3$ septa.

Conidiomata pycnidia, dark brown to black, immersed in the thallus, $0.05\text{--}0.06$ mm diam. *Microconidia* short oblong-ellipsoid, $3.5\text{--}4.5 \times 1.0\text{--}1.2 \mu\text{m}$.

Chemistry. C –, KC –, K –, PD –, UV –. Not tested by TLC.

TABLE 1. Main differences between *Strigula confusa*, *Thelenella larbalestieri* and *T. muscorum* var. *octospora*

Character	<i>Strigula confusa</i>	<i>Thelenella larbalestieri</i>	<i>Thelenella muscorum</i> v. <i>octospora</i>
Ecology	over bryophytes on basic, montane rocks	semi-inundated, siliceous rocks in streams; possibly parasitic on other lichens	over bryophytes, usually on trees, rarely on basic rocks or soil
Thallus	grey, continuous	brown, cracked-rimose	white, very thin, membranous
Photobiont	<i>Trentepohlia</i>	trebouxioid	trebouxioid
Perithecia	black $\frac{1}{2}$ – $\frac{3}{4}$ immersed 0.3–0.5 mm diam. globose	black $\frac{3}{4}$ immersed 0.15–0.2 mm diam. flattened vertically	pale to dark brown $\frac{3}{4}$ – \pm completely immersed 0.2–0.3 mm diam. rounded to broadly pyriform
Exciple	upper $\frac{1}{2}$ – $\frac{3}{4}$ dark brown; pigment granular	rarely more than upper $\frac{1}{3}$ pigmented; pale brown; pigment homogeneous	pale brown above, colourless below; pigment homogeneous
Ascospores*	32.5–46.6–57.75 × 11–13 µm	44.1–56.8–68.6 × 13–15 µm	(50–)55–57.8–65 × 14.5–19 µm

*10 measured for each of *Strigula confusa*, *Thelenella larbalestieri*, and *T. muscorum* var. *octospora*.

Notes. The large, muriform ascospores distinguish *Strigula confusa* from all other British species of the genus. The corticolous *S. tagananae* (Harm.) R. C. Harris, from the Canary Islands, Portugal and Ireland, has smaller, muriform ascospores (25–35 × 6.5–8.5 µm) and lateral ostioles (Aptroot & van den Boom 1995, as *S. lateralis*; Harris 1995). McCarthy (2001) has provided a key to the saxicolous species of *Strigula*, which includes nine species with muriform ascospores. Of these, *S. johnsonii* P. M. McCarthy (McCarthy 1995), described from semi-inundated rocks in South Island, New Zealand, is the most similar to *S. confusa*, but that species has a silvery white thallus and almost completely immersed perithecia.

Because of its large, muriform ascospores, *Strigula confusa* has previously been reported as *Thelenella* (*Chromatochlamys*) *muscorum* var. *octospora* (Gilbert & Giavarini 1993; Gilbert & Fryday 1996), and is most likely to be confused with that species or *T. larbalestieri*. However, *Strigula confusa* differs from *Thelenella* in photobiont (*Trentepohlia* in *Strigula*, chlorococcoid in *Thelenella*) and ascus structure. Furthermore, the upper excipulum of *S. confusa*, and other members of the genus, is composed of rounded to angular or elongate cells (approximating to *textura angularis*), whereas that of *Thelenella* is composed of slender cells varying from

textura porrecta to *textura intricata*. The brown (K–, N–) pigmentation in the excipulum of *Strigula* is laid down in pigmented granules external to the cell walls (clearly seen in mounts in K at × 1000). In *Thelenella* the brown to greenish (K–, N± greenish) pigmentation is homogeneous (no granulations visible at × 1000), lining the outer surface of the cells or present as a dilute coloration in the gel matrix.

Thelenella muscorum var. *octospora*, which very rarely occurs in the same habitat as *S. confusa*, further differs in having a very thin, inapparent, varnish-like thallus, and smaller, paler brown, pyriform perithecia, whereas *T. larbalestieri* has a brown, rimose thallus and occurs on semi-inundated, siliceous rocks. *Thelenella larbalestieri* is known from only four collections from the western British Isles (see above). The two recent collections from Wales (Wolseley & Orange 1999; Chambers 2000) are misidentifications of *Strigula confusa* (see below). The main differences between *S. confusa* and the two *Thelenella* species are summarized in Table 1.

Strigula confusa is also likely to be confused with species of *Protothelenella*, (e.g. *P. sphinctrinoides* (Nyl.) H. Mayrhofer & Poelt, *P. sphinctroidella* (Nyl.) H. Mayrhofer & Poelt) but these are usually terricolous, and the asci of this genus have an amyloid tholus.

Genera of pyrenocarpous lichens with muriform ascospores in the *Verrucariales* (e.g. *Leucocarpi*, *Polyblastia*, *Staurothele*), can be distinguished by their lack of persistent paraphysoids.

In the field, *Strigula confusa* is most likely to be confused with *S. alpestris* (Vězda) Hafellner (syn. *S. stigmatella* var. *alpestris* (Vězda) Coppins), which occurs in the same habitat, but this taxon has only transversely septate ascospores.

Distribution and habitat. *Strigula confusa* has been recorded only from the hyperoceanic regions of the west coast of the British Isles, and appears especially frequent in North Wales. It most frequently occurs growing over bryophytes (usually *Hypnum hamulosum* Schimp.) attached to mildly basic rocks (e.g. andesite, mica-schist, basalt) in assemblages rich in rare, calcicole lichens (e.g. *Strigula alpestris*, *Thelopsis melathelia* and *Vestergrenopsis elaeina*). Lichens associated with the Irish specimen included *Dimerella lutea* and *Porocyphus kenmorensis*, with *Enterographa hutchinsiae*, *Epigloea* sp., *Gyalecta jenensis* and *Porina guentheri* var. *guentheri* close by.

The two recent reports of *Strigula confusa* (as *Chromatochlamys larbalestieri*) from mid-Wales (Chambers 2000; Wolseley & Orange 1999) are atypical in occurring on shaded rocks and having pale, unpigmented perithecia. However, typical collections of *S. confusa* do occasionally spread onto rocks (e.g. Fryday 2944), and microscopic examination of one of the Welsh, saxicolous collections (Chambers 2000) revealed significant quantities of the brown granular pigment typical of *Strigula* in the exciple. As these collections also agree with *S. confusa* in all other respects, we have no hesitation in including them in the new species.

Selected additional specimens examined. **Great Britain:** *Wales:* **V.C. 46**, Cardiganshire: Devil's Bridge, Cwm Rheidol, 22/74 71, 6 m, on shaded, slightly basic rock face in woodland, 16 ii 1998, *P. Wolseley & A. Orange* (NMW); Hafod, Nant Gau, 22/77 73, 240 m, on mudstone in deep, sheltered recess above narrow, wooded stream gorge, ii 2000, *S. P. Chambers* (hb. Chambers). **V.C. 49**, Caernarvonshire: Cwm Idwal, N-E of Twll Du, 23/640 588, 500 m, over bryophytes

on side of large, calcareous boulder, 1994, *Fryday* 5318; *ibid.*, 1977, *Coppins* 2776 (E); Pass of Llanberis, Cwm Uchaf, beside Llyn Glas, 23/61 55, 650 m, over bryophytes on basic rock outcrop, 1994, *Fryday* [5698] & *S. Chambers*; Pass of Llanberis, Cwm Glas, 23/61 55, 750 m, over bryophytes on stratified basic rocks on back wall of cwm, 1994, *Fryday* [5711 & 5717] & *S. Chambers*; Pass of Llanberis, Cwm Glas-bach, 23/60 56, 600 m, over bryophytes on calcareous rock face, 1994, *Fryday* 5727, 5733 & 5740; Pass of Llanberis, Cwm Uchaf, damp, north-facing crag, 23/62 55, 825 m, over bryophytes on calcareous rock, 1995, *Fryday* 6343. *England:* **V.C. 69**, Westmorland: Helvellyn, Tarn Crag, 35/35.12, on bryophytes in damp gully, 1991, *O.L. Gilbert* (E). **V.C. 70**, Cumberland: Wastwater Scree, Broad Crag, 35/15 03, 300 m, mildly basic moss cushion and mats on walls of gully, v 1982, *O. L. Gilbert* (BM). *Scotland:* **V.C. 89**, West Perthshire: Ben Lui, Ciochan Beinn Laoigh, 27/27 26, c. 500 m, over bryophytes on basic substrata, 1991, *Fryday* 2883; *ibid.*, 27/26 27, 540–640 m, 1979, *Coppins* 4539 (E). **V.C. 98**, Argyll Main: Glen Coe, base of Aonach Dubh, 27/15 56, 200 m, over bryophytes on andesite crag, 1992, *Fryday* 3233. **V.C. 104**, North Ebeudes: Isle of Skye, Trottenish, Cuithearaing [Quiraing] 18/45 69, 250 m, over bryophytes on shaded basalt crags, 1990, *Fryday* 1263; *ibid.*, 1987, *Coppins* 12642 (E); *ibid.*, Strathaird, An Stac, base of northern crags, 18/542 215, 250 m over bryophytes on low, damp basic crags, 1998, *Fryday* 7000–1, 7004; *ibid.*, Bla Bheinn [Blavan], Coire Uaigneich, 18/542 215, 300 m, damp basic rocks in gully, 1998, *Fryday* 7007–7010; *ibid.*, base of east crags, 18/538 215, 400 m, basic crags, 1998, *Fryday* 7060. **V.C. 105**, West Ross-shire: Beinn Eighe NNR, Meall na h-Airigh-ardain, 18/98 65, c. 250 m, over bryophytes on basic substrata, 1991, *Fryday* 2761; Knochan, Creag a' Chnocain, 29/19 09, c. 250 m, over bryophytes (spreading onto rock) on basic substrata, 1991, *Fryday* 2944.—**Ireland:** **V.C. H1**, South Kerry: Mt Brandon, Lough Avoonane, 01/46 08, over bryophytes on crag above tarn, 1994, *Fryday* [5247] & *O. L. Gilbert*. **V.C. H35**, West Donegal: Assarnacally River, 13/668 901, 130 m, over bryophytes on mica-schist rocks sheltered from a waterfall, 19 vii 2001, *V. J. Giavarini* (hb. Giavarini).

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