NEW TAXA AND NEW RECORDS OF LICHENS FROM SOUTH GEORGIA

By D. C. LINDSAY*

ABSTRACT. The genus *Antarctomia* D. C. Lindsay is described as new for the single species, *A. subcorallinoides* D. C. Lindsay, while *Arthopyrenia praetermissa* D. C. Lindsay is described as a new species of this genus. 17 other lichen species are recorded from South Georgia for the first time.

PENDING completion of manuscripts on the macrolichens and various microlichen genera from South Georgia, it is considered useful to publish descriptions of new taxa and records of species not previously reported from the island. Following the author's visit to the island during 1971–72, many new taxa were discovered and the South Georgian lichen flora is now estimated to comprise approximately 50 genera and 150 species, i.e. a 50 per cent increase on the figures given in Lindsay (1972). It is probable that a number of microlichens have been overlooked and so these figures may be expected to increase further.

All specimens cited are part of the British Antarctic Survey herbarium (AAS), and full data for each specimen have been incorporated in the data bank associated with the herbarium. Records for each species are presented in Table I, localized by grid reference, grouped under

TABLE I. TAXA NOT PREVIOUSLY REPORTED FROM SOUTH GEORGIA

Species	*Specimens examined arranged by 5 km. squares*
Acarospora gwynnii Dodge et Rudolph	120 135 Lindsay 3591; 155 095 Lindsay 3903
Antarctomia subcorallinoides D. C. Lindsay	130 120 Lindsay 4319
Arthopyrenia praetermissa D. C. Lindsay	160 055 Lindsay 4442
Dermatocarpon intestiniforme (Körb.) Hasse	115 140 Lindsay 4361; 155 095 Lindsay 3884
Himantormia lugubris (Hue) M. Lamb	145 095 BAS Misc. 74
Huea austroshetlandica (Zahlbr.) C. W. Dodge	165 075 Lindsay 3601
Lecanora atra (Huds.) Ach.	155 095 Lindsay 4046
L. broccha Nyl. ex Cromb.	130 120 Lindsay 3373
L. dispersa (Pers.) Sommerf.	130 120 Lindsay 4208
L. polytropa (Hoffm.) Rabenh.	160 095 Lindsay 4049
Leptogium puberulum Hue	130 120 Lindsay 4317; 160 090 Lindsay 3533
Massalongia carnosa (Dicks.) Körb.	070 150 Lindsay 3088; 175 065 Lindsay 3720a
Physcia cf. *wainioi* Räs.	130 120 Lindsay 4207; 170 070 Lindsay 3682
Psoroma ciliatum (Ach. ex Fr.) Nyl. ex Hue	070 150 Lindsay 3079; 130 110 Lindsay 3476
Ps. cinnamomeum Malme	055 155 Lindsay 3799
Ramalina terebrata Hook. et Tayl.	075 120 R. Smith 1609; 155 095 Lindsay 4 141
Sticta gaudichaudii (Mont.) Nyl.	055 140 R. Smith 1591
Usnea igniaria Mot.	035 145 BAS Misc. 72
Xanthoria candelaria (L.) Th. Fr.	155 095 Lindsay 4041

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the appropriate 5 km. square of the grid overprint on the South Georgia map in Greene (1964). The species are listed alphabetically for convenience and some notes on geographical distribution are given for each taxon.

Acarospora gwynnii Dodge et Rudolph

This species was previously considered to be restricted to eastern continental Antarctica (Rudolph, 1967) and thus records from South Georgia are a considerable extension of its range. Although Rudolph (1967) indicated that *A. gwynnii* may be a continental Antarctic endemic, absent from the Antarctic Peninsula, it is known from the Oscar II Coast, Trinity Peninsula at the northern extremity of the Antarctic Peninsula and the South Shetland Islands (specimens from these areas in AAS).

Antarctomia D. C. Lindsay **gen. nov.**

Genus similis *Arctomiae* Th. Fr., sed differt ascosporae in asco quaternae, multilocellatae. Typus generis *Antarctomiae subcorallinoidis* D. C. Lindsay.

This genus resembles the Arctic–alpine *Arctomia* Th. Fr. in every respect differing only in having four multilocellate ascospores per ascus, instead of six to eight per ascus, each with up to ten transverse septa. The type, and as yet only known species of *Antarctomia*, is *A. subcorallinoides* D. C. Lindsay.

Antarctomia subcorallinoides D. C. Lindsay **sp. nov.**

Crusta continua formans, squamulosa-corallinoida, 3 mm. crassa, olivacea; squamulae erectae vel assurgentibus, elongatae ad subcylindricae, subtorulosae, irregulariter ramosae et lobulatae, peripheriam versus flabellatae, usque ad 0·5 mm. longae et 0·2 mm. latae. Apothecia squamulae immersae, ad 0·4 mm. in diametra, xerampelinae; paraphyses hyalinae, moniliformae, non ramosae; ascosporae in asco quaternae, uniseriatae, hyalinae vel levissime infuscatae, ellipsoidae, multilocellatae, 45–53 μm. longae et 24–27 μm. latae, cellulis numerosis subcuboideis.

Holotypus: supra saxa uda prope rivula, ad boreo-occidentalis Lacus Hamburgum borealis, Insula Georgia australis, GR 132 123, leg. D. C. Lindsay, 8.iii.1972, Lindsay 4319 (AAS).

Thallus forming a continuous crust over several square centimetres of rock, minutely squamulose-coralloid, up to 3 mm. thick, olivaceous, the lowest third consisting of mineral fragments held together by hyphae, the central part consisting of dead, compressed squamules, the uppermost third of living squamules, appearing rimose-areolate; squamules erect or ascending, elongate to subcylindrical, subtorulose, irregularly branched and lobed; compacted below, becoming ± horizontal on dorsal surface and flabellate towards periphery, up to 0·5 mm. long and 0·2 mm. broad; heteromerous, with upper and lower cortices, hypothallus apparently absent, the thallus being attached to the substratum directly by the lower (dead) surfaces of the squamules. Apothecia infrequent, lecideine, immersed in squamules, up to 0·4 mm. in diameter, disc plane, dull reddish brown, proper margin excluded early; epithecium reddish brown, up to 15 μm. thick, K–, N–; hymenium hyaline, up to 140 μm. tall, K–, N–, I–; hypothecium very pale brown, up to 25 μm. thick, K–, N–; asci subcylindrical, thin-walled, up to 85 by 20 μm.; paraphyses hyaline, unbranched, moniliform; ascospores 4nae, uniseriate, hyaline to light brown, ellipsoid, multilocellate, with numerous, almost cubical cells, 45–53 by 24–27 μm.

Pycnidia not seen. Isidia and soredia absent. Phycobiont *Nostoc*. Thallus negative with K, C, P and I. (Fig. 1.)

Holotype: on damp rock by stream, north-west of northernmost of Hamburg Lakes, South Georgia, grid reference 132 123, leg. D. C. Lindsay, 8.iii.1972, Lindsay 4319 (AAS).

The thallus is quite variable as regards morphology of the squamules which superficially appear coralloid, but they may also be dorsiventral and flattened, becoming flabellate, as at the periphery of the thallus, or erect and subcylindrical in which case they become densely packed so as to appear warted crustose.

This species superficially resembles *Placynthium aspratile* (Ach.) Henss. which may develop similar, pulvinate, coralloid thalli in the Arctic (Henssen, 1963, figs. 55 and 56), but it is much

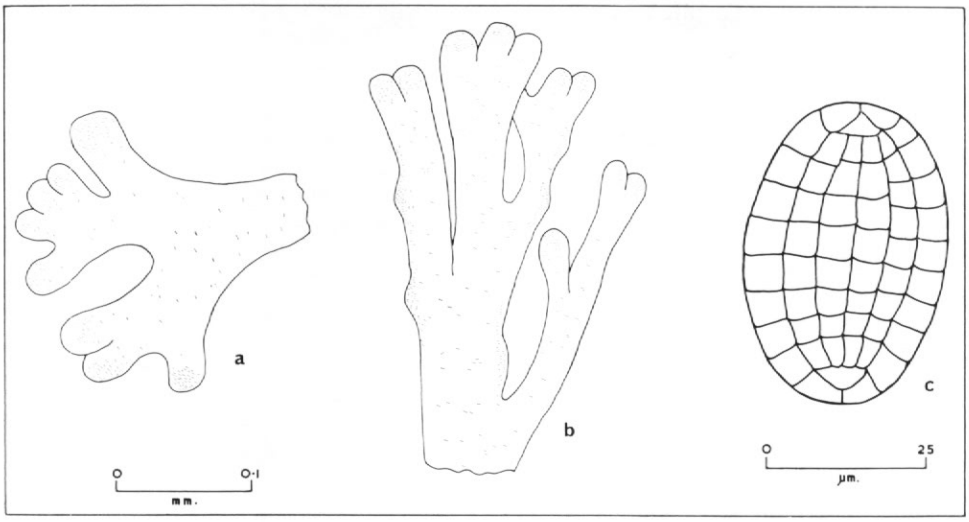

Fig. 1. *Antarctomia subcorallinoides* D. C. Lindsay.
a and b. Variation in morphology of squamules. a. Horizontal squamule viewed from above; b. Erect squamule viewed from the side; c. Ascospore.

smaller and does not produce rhizinae at various levels in the decaying parts of the thallus. It also resembles forms of *Parmeliella corallinoides* (Hoffm.) Zahlbr. which shows a similar growth habit in the Arctic (Henssen, 1963) but it is quite distinct since *Parmeliella*, although possessing a *Nostoc* phycobiont, has simple or 1-septate spores. It is distinguished from *Placynthium*, which has a *Rivularia* or *Scytonema* phycobiont and 1–3 septate spores, by the *Nostoc* phycobiont and multilocellate spores. It approaches *Arctomia*, a genus of infrequent occurrence in the Arctic, in many features but is distinguished by the consistently 4-spored asci and the multilocellate spores, instead of 6–8 spored asci and transversely septate, acicular spores (Henssen, 1969).

Although this species is locally abundant on damp, east-facing rocks at the type locality, where it covers about 2 m. by 1 m. of rock intermixed with other crustose lichens and acrocarpous mosses, its drab colour may have caused it to be overlooked in other suitable habitats elsewhere on South Georgia.

Arthopyrenia praetermissa D. C. Lindsay **sp. nov.**

Thallus epilithicus, crustaceus, olivaceus, laevigatus, continuus, subnitidus, sparse rimosus, modice incrassatus (200–250 μm. crassus); hypothallus anthracinus, 45–105 μm. crassus; gonidia laeteviridia, *c.* 7 μm. in diametro, aliquando catenatus vel agglutinatus, in seriebus verticalibus per fere totam crassitudinem thallo disposita. Pseudothecia thallo immersa, apice parce prominenti, brunneo, *c.* 0·8 mm. in diametro; excipulum globosum, *c.* 350 μm. in diametro, *c.* 25 μm. crassum, involucrellum carbonaceum, 40–45 μm. crassum, excipulum cingens. Asci cylindricae, bitunicatae, ad 65 μm. longae et 15 μm. latae. Sporae octonae, biseriatae, fuscae, clavatae vel subclavatae vel subellipsoidae, triseptatae, cellulae apicalibus inaequalibus, 15–18 μm. longae et 4–6 μm. latae. Thallus intrinsecus et extrinsecus reagentibus immutatibus, contenta pseudothecia iodo non reagens.
Holotypus: supra saxa aqua inundata, alt. 5 m., litus boreo-orientalis, Sinus Dubium, Insula Georgia australis, GR 163 059, leg. D. C. Lindsay, 9.iv.1972, Lindsay 4442 (AAS).

Thallus saxicolous, crustose, olivaceous, smooth, continuous, slightly shining, infrequently rimose, becoming brown when wetted with water, 200–250 μm. thick; on a black hypothallus (which is only evident in sections); cortical layer thin, 10–12 μm. thick, the outer 3–5 μm. consisting of hyaline, ± gelatinized, parenchymatous cells, the inner part dark brown, con-

sisting of compacted, pigmented hyphae; cortex directly subtending the algal layer, which is 65–100 μm. thick, consisting of densely aggregated algal cells arranged irregularly or in vertical rows throughout the thallus, the algal cells *c.* 7 μm. in diameter, bright green, occurring as single globose cells, short chains or aggregates of 4, 6 or 8, surrounded by numerous branched, contorted, thin-walled, septate, fungal hyphae, *c.* 1 μm. in diameter; medullary layer apparently absent, although some patches of tissue free of algal cells do occur directly above the hypothallus; hypothallus black, 45–105 μm. thick, consisting of heavily compacted, carbonized hyphae, the lower half containing numerous minute rock fragments.

Pseudothecia immersed in thallus, only the top quarter projecting above the thallus, dark brown, becoming black when wetted with water, *c.* 0·8 mm. in diameter, scattered irregularly over the thallus; young pseudothecia are immersed almost to the ostiole, becoming more emergent with age; ostiole ± apical, appearing as a slightly sunken black spot up to 100 μm. in diameter; excipulum globose, up to 350 μm. in diameter, *c.* 25 μm. thick, composed of tangentially arranged hyaline hyphae, surrounded by a black involucrellum 40–45 μm. thick, of carbonized hyphae, the involucrellum occasionally fusing with the hypothallus.

Asci cylindrical, bitunicate, up to 65 μm. tall and 15 μm. broad, I–; ascospores 8 per ascus, biseriate, clavate or subclavate to subellipsoid, olivaceous and thinly 1-septate when young, becoming dark brown, 3-septate with apical cells unequal in size when mature, 15–18 μm. long and 4–6 μm. broad.

Pycnidia not seen. Thallus and contents of pseudothecia negative with K, C, KC, P and I. (Fig. 2.)

Holotype: on rock inundated by melt water, alt. 5 m., north-eastern shore of Doubtful Bay, South Georgia, grid reference 163 059, leg. D. C. Lindsay, 9.iv.1972, Lindsay 4442 (AAS).

The involucrellum varies from entirely surrounding the excipulum to covering only the upper two-thirds, a feature that has been noticed for *Arthopyrenia halodytes* (Nyl.) Arnold by Swinscow (1965), who considered that variation in the size and shape of the involucrellum was due to environmental factors. The phycobiont resembles that of *A. halodytes* in morphology (Swinscow, 1965, fig. 2c) but it differs in being bright green, not yellow-brown. *A. praetermissa* resembles, very superficially, *A. halodytes* which has been reported from Fuegia, New Zealand, the Auckland Islands and the Falkland Islands by Santesson (1939; as *A. sublitoralis*), but differs in its non-marine habitat, consistently 4-celled ascospores and bright green phycobiont. *A. praetermissa* is quite distinct from any similar species that has been reported from the Southern Hemisphere. The species of *Arthopyrenia* known from Chile (Follmann, 1961) are all corticolous as are the species known from Argentina (Grassi, 1950). Other species of *Arthopyrenia* known from New Zealand and Iles Kerguelen (Zahlbruckner, 1941; Dodge, 1948), although saxicolous, differ in possessing hyaline 2-celled spores. The related genus *Microthelia* Körb., to which *A. praetermissa* could possibly be referred, is known only from a few corticolous species from Chile (Follmann, 1961) in the Southern Hemisphere. A number of species of *Thelidium* Massal., described from sub-Antarctic islands and continental Antarctica by Dodge (1968) and Dodge and Baker (1938), and several of which are probably more correctly placed in *Arthopyrenia* Massal., have hyaline or brown 2-celled spores.

The dull thallus colouring of this species, which gives it an appearance of a muddy stain on rock, is probably the main reason why it has not been collected previously. Further collecting from suitable habitats on South Georgia will probably show that it is widespread on coastal rocks above high-water mark that are inundated with slightly nitrogenous melt water.

Dermatocarpon intestiniforme (Körb.) Hasse

A bi-polar species previously known in the Southern Hemisphere only from the east coast of the Antarctic Peninsula (Lamb, 1948), *D. intestiniforme* probably has a wide distribution in the maritime Antarctic, being known from two localities on South Georgia (Table I) and from the South Orkney Islands (Signy Island, Lindsay 1270, AAS).

Himantormia lugubris (Hue) M. Lamb

An Antarctic endemic widely distributed in the maritime Antarctic, this species now has its northernmost known locality on South Georgia where it was found at a high altitude (*c.* 700 m.) at Ross Pass.

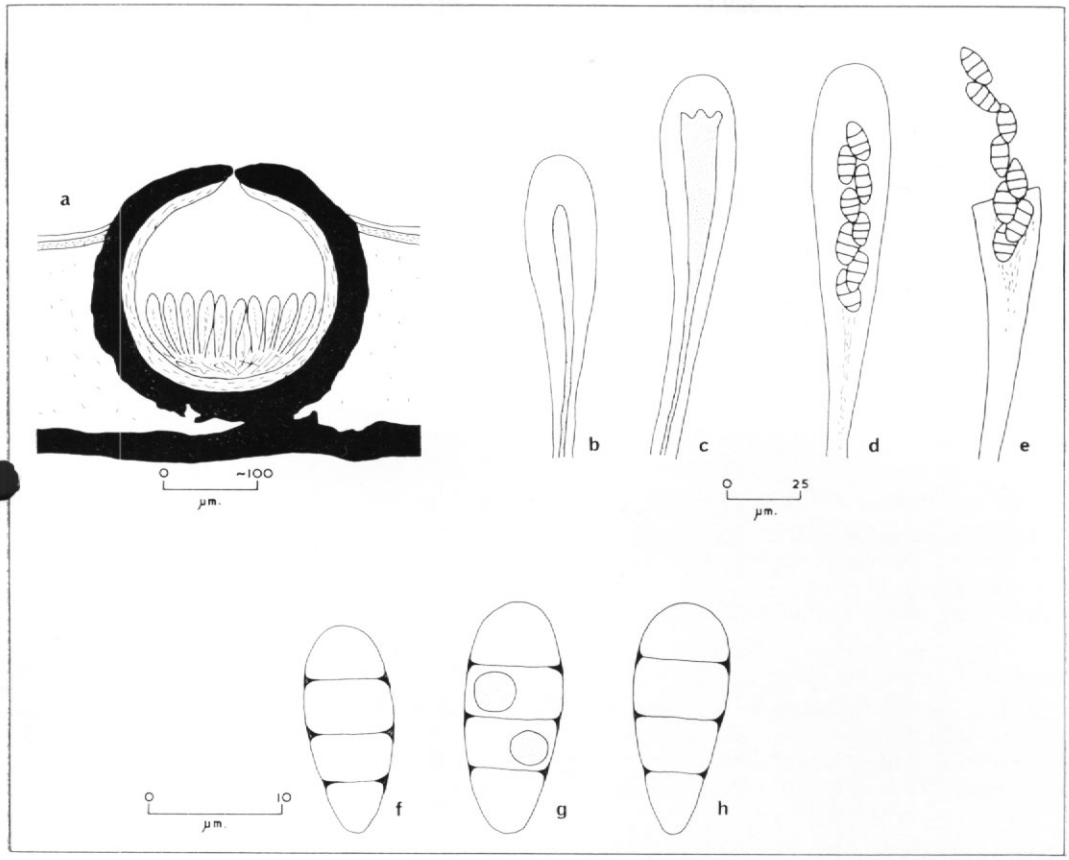

Fig. 2. *Arthopyrenia praetermissa* D. C. Lindsay.
a. Diagrammatic longitudinal section of young pseudothecium, showing carbonaceous involucrellum; b–e. Stages in development of asci and ascospores; f–h. Mature ascospores; g. With two oil droplets.

Huea austroshetlandica (Zahlbr.) C. W. Dodge

Reported from Fuegia, the South Shetland Islands and Fallières Coast, Antarctic Peninsula, by Dodge (1973), this species is now known from South Georgia, where it was found in some abundance on dry boulders at the periphery of a penguin rookery at Iris Bay.

Lecanora atra (Huds.) Ach.

A cosmopolitan species that has also been found in the maritime Antarctic, *L. atra* appears to be widespread on South Georgia, where it occurs as small patches amongst other slightly ornithocoprophilous lichens on bird-perching stones.

Lecanora broccha Nyl. ex Cromb.

Syn.: *Lecanora expectans* Darb. (Darbishire, 1910, p. 5).

This species was first described from Iles Kerguelen by Nylander (*in* Crombie, 1876) and from continental Antarctica as *L. expectans* by Darbishire (1910). *L. broccha* has recently been reported from Schirmachervatna, Dronning Maud Land, by Golubkova and Simonov (1972), which together with previous records indicates a circum-polar Antarctic and circum-polar sub-Antarctic distribution.

Lecanora dispersa (Pers.) Sommerf.

Another cosmopolitan species which has been overlooked on South Georgia because of its small size, *L. dispersa* has been found to be quite frequent as small scattered apothecia on bird-perching stones.

Lecanora polytropa (Hoffm.) Rabenh.

On South Georgia *L. polytropa* has been found in a wide range of habitats, including timber and rusting iron as well as the more usual saxicolous situations. Cosmopolitan, the species occurs throughout the maritime Antarctic and parts of continental Antarctica (Rudolph, 1967).

Leptogium puberulum Hue

This Antarctic endemic, so far only known from the west coast of the Antarctic Peninsula and South Shetland Islands (Hue, 1915; Dodge, 1966) can now be reported from South Georgia. The material is stunted and sterile but all characters agree with the published descriptions.

Massalongia carnosa (Dicks.) Körb.

This is a bi-polar species apparently with a wide distribution in the cooler regions of the Southern Hemisphere, having been reported from Argentina (Lamb, 1958) and New Zealand (Martin, 1966). It is also known from the South Orkney Islands (Signy Island, Lindsay 879a, AAS). Only one of the South Georgian specimens (Lindsay 3088) is fertile.

Physcia cf. *wainioi* Räs.

Unfortunately the material is somewhat stunted but it agrees in nearly all respects with *P. wainioi*, differing only in the poor development of pseudocyphellae on the dorsal surface. *P. wainioi* is widely distributed in the cooler zones of the Northern Hemisphere, but this is apparently the first record of the species from the Southern Hemisphere.

Psoroma ciliatum (Ach. ex Fr.) Nyl. ex Hue

A species with a bicentric sub-Antarctic distribution, being known from the Falkland Islands (specimens in BM), Argentina (Grassi, 1950), Australia (Weber and Wetmore, 1972) and New Zealand (Martin, 1966), *Ps. ciliatum* now has its southernmost known locality on South Georgia (Table I).

Psoroma cinnamomeum Malme

This species was previously reported only from Patagonia and Fuegia (Malme, 1925) so its occurrence on South Georgia is a southerly extension of its known range.

Ramalina terebrata Hook. et Tayl.

R. terebrata was noted from the Falkland Islands, South Shetland Islands and Antarctic Peninsula by Lamb (1964), who indicated that it probably occurred throughout the Scotia Ridge. It was later reported from the South Orkney Islands by Lindsay (1969) and the existence of two specimens from South Georgia (Table I) confirms Lamb's prediction of a widespread distribution throughout the Scotia Ridge.

Sticta gaudichaudii (Mont.) Nyl.

This species is another representative of the strong Fuegian element that occurs in the South Georgian lichen flora, having been reported from Patagonia and Fuegia by numerous authors, e.g. Grassi (1950).

Usnea igniaria Mot.

The occurrence of this species on South Georgia is of interest since this is the first record of *Usnea* subgenus *Usnea* from the Antarctic Peninsula–Scotia Ridge sector of the Antarctic, all other species of *Usnea* known from this sector being referable to subgenus *Neuropogon* (Lamb, 1964). *U. igniaria* is another component of the Fuegian element in the South Georgian lichen flora, having been reported previously from southern Chile and southern Argentina, i.e. mainly from Tierra del Fuego (Lamb, 1958).

Xanthoria candelaria (L.) Th. Fr.

This cosmopolitan species is widespread in both the continental and maritime Antarctic and may be expected to have a wide distribution on South Georgia, where it is known so far from only one locality (Table I).

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REFERENCES

CROMBIE, J. M. 1876. Lichens Terrae Kergueleni: an enumeration of the lichens collected in Kerguelen Land by the Rev. A. E. Eaton during the Venus-Transit Expedition in 1874–75. *J. Linn. Soc.*, Botany, **15**, 180–93.

DARBISHIRE, O. V. 1910. Lichens. (*In National Antarctic Expedition, 1901–1904. Natural History, Vol. V, Botany.* London, British Museum, 1–10.)

DODGE, C. W. 1948. Lichens and lichen parasites. *Rep. B.A.N.Z. antarct. Res. Exped.*, Ser. B, **7**, 276 pp.

————. 1966. Líquenes de las Islas Shetland del Sur y de la Tierra O'Higgins (Península Antártica) recolectados por Gerhard Follmann. *Publ. Inst. antárt. chil.*, No. 6, 12 pp.

————. 1968. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. VII and VIII. *Nova Hedwigia*, **15**, Ht. 2–4, 285–332.

————. 1973. *Lichen flora of the Antarctic continent and adjacent islands*. Canaan, New Hampshire, Phoenix Publishing.

————. *and* G. E. BAKER. 1938. The Second Byrd Antarctic Expedition—Botany. II. Lichens and lichen parasites. *Ann. Mo. bot. Gdn*, **25**, No. 2, 515–718.

FOLLMANN, G. 1961. Catalogo de los líquenes de Chile. Parte I. Pyrenocarpae. *Revta univ., Santiago*, **46**, Pt. 3–4, 173–203.

GOLUBKOVA, N. S. *and* I. M. SIMONOV. 1972. Lishainiki oaze Schirmachera [Lichens of the Schirmacher Ponds]. *Trudy sovet. antarkt. Eksped.*, **60**, 317–27.

GRASSI, M. M. 1950. Contribución al catalogo líquenes argentinos. I. *Lilloa*. **24**, 5–294.

GREENE, S. W. 1964. The vascular flora of South Georgia. *British Antarctic Survey Scientific Reports*, No. 45, 58 pp.

HENSSEN, A. 1963. The North American species of *Placynthium*. *Can. J. Bot.*, **41**, No. 12, 1687–701.

————. 1969. Eine Studie über die Gattung *Arctomia*. *Svensk. bot. Tidskr.*, **63**, Ht. 1, 126–38.

HUE, A. M. 1915. *Lichens*. Paris, Masson et Cie. [Deuxième Expédition Antarctique Française (1908–1910), Sciences naturelles: documents scientifiques, 1–202.]

LAMB, I. M. 1948. Antarctic pyrenocarp lichens. '*Discovery*' *Rep.*, **25**, 1–30.

————. 1958. La vegetación liquénica de los Parques Nacionales Patagónicos. *An. Parq. nac., B. Aires*, No. 7, 188 pp.

————. 1964. Antarctic lichens: I. The genera *Usnea*, *Ramalina*, *Himantormia*, *Alectoria*, *Cornicularia*. *British Antarctic Survey Scientific Reports*, No. 38, 34 pp.

LINDSAY, D. C. 1969. Further data on Antarctic Usneaceae. *British Antarctic Survey Bulletin*, No. 20, 33–40.

————. 1972. Lichens new to South Georgia. *British Antarctic Survey Bulletin*, No. 31, 41–43.

MALME, G. O. A. 1925. Die Pannariazeen des regnellschen Herbars. *Ark. Bot.*, **20A**, No. 3, 1–23.

MARTIN, W. 1966. Census catalogue of the lichen flora of New Zealand. *Trans. R. Soc. N.Z.*, Botany, **3**, No. 8, 139–59.

RUDOLPH, E. D. 1967. Lichen distribution. (*In* BUSHNELL, V., *ed.* Terrestrial life in Antarctica. *Antarct. Map Folio Ser.*, Folio 5, 9–11.)

SANTESSON, R. 1939. Amphibious pyrenolichens. I. *Ark. Bot.*, **29A**, No. 10, 1–67.

SWINSCOW, T. D. V. 1965. Pyrenocarpous lichens: 8. The marine species of *Arthopyrenia* in the British Isles. *Lichenologist*, **3**, Pt. 1, 55–64.

WEBER, W. A. *and* C. M. WETMORE. 1972. Catalogue of the lichens of Australia exclusive of Tasmania. *Nova Hedwigia, Beih.*, **41**, 135 pp.

ZAHLBRUCKNER, A. 1941. Lichenes Novae Zelandiae a cl. H. H. Allan eiusque collaboratoribus lecti. *Denkschr. Akad. Wiss., Wien.*, Math.-nat. Kl., **104**, 1–131.