

## PROBABLE INTRODUCTIONS OF LICHENS TO SOUTH GEORGIA

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**ABSTRACT.** During a lichenological survey of the sub-Antarctic island of South Georgia, several lichens were found on introduced substrata at a number of localities around the island. From a consideration of their geographical distribution and substrate preferences, it seems that *Caloplaca cinnamomea* (Th. Fr.) Oliv., *Lecidella elaeochroma* (Ach.) Haszl., *Rinodina archaea* (Ach.) Arnold, *R. cf. metaboliza* Vain. and possibly *Parmelia sulcata* Tayl. and *Umbilicaria polyphylla* (L.) Baumg. were introduced during the course of human activities on the island.

THE occurrence of alien vascular plants on the sub-Antarctic island of South Georgia has been known since Skottsberg (1905) recorded *Poa annua* L. from the Cumberland Bay area. Greene (1964) surveyed the island botanically, reporting vegetation composed of tussock, grass heath, and marsh and bog communities. He recorded 51 species of vascular plant, of which 27 were considered to be aliens, having been introduced by human agency during whaling activities on the island. During a lichenological survey of South Georgia carried out in the 1971-72 summer, it was therefore of interest to find a number of lichens growing on introduced substrata, mainly timber, at several of the abandoned whaling stations and expedition huts around the island. Many of these species are indigenous on South Georgia and are typically saxicolous or muscicolous, but some occurred only on timber, and from a consideration of their geographical distribution and substrate preferences, it seems likely they were introduced in a similar way to the alien vascular plants, i.e. by human agency.

All specimens cited are part of the British Antarctic Survey herbarium (AAS) at present housed in the Department of Botany, University of Birmingham.

### THE INTRODUCED SUBSTRATA

The whaling station at Grytviken, Cumberland East Bay, was established in 1904, but building continued until 1930 at least, using timber and other materials imported from a number of regions such as the Falkland Islands and Norway (Matthews, 1931). The wooden ship *Louise*, used as a transport, was beached on the shore near the station shortly after it was established to form a coal store (Matthews, 1931). Lichens were found on the deck of this ship, on a wooden footbridge behind the whaling station and on another wooden footbridge over a dam in Bore Valley, to the north of the station. A small wooden hut was built on the beach at the western end of Sörling Valley, Barff Peninsula, in November 1912 to serve hunting parties from the whaling station at Ocean Harbour. Lichens were found on several timbers on the west side of the hut. The German International Polar-Year Expedition of 1882-83 erected huts and observatories near Köppen Point, Royal Bay, in September 1882. These were burnt by whalers from Grytviken in 1914 (Matthews, 1931) but lichens were found on much of the unburnt timber debris. At the southern end of Binder Beach, Right Whale Bay, and on the beach on the south side of Rogged Bay, lichens were found on timber debris that may have come from shipwrecks. Other whaling stations at Husvik, Leith and Stromness were examined briefly but no lichens were observed on introduced substrata.

### SPECIES GROWING ON TIMBER

A wide range of lichens was found on timber, many being indigenous South Georgian species such as *Caloplaca dimorpha* (Müll. Arg.) Zahlbr., *Rhizocarpon geographicum* (L.) DC. and *Usnea antarctica* Du Rietz, and they were seen growing on wood at most of the localities visited. The species which were found only on timber, and are considered to be introduced, were *Caloplaca cinnamomea* (Th. Fr.) Oliv., *Lecidella elaeochroma* (Ach.) Haszl. (= *Lecidea limitata* (Scop.) Gray), *Parmelia sulcata* Tayl., *Rinodina archaea* (Ach.) Arnold, *R. cf. metaboliza* Vain. and *Umbilicaria polyphylla* (L.) Baumg. The distribution of these species by 5 km. grid square on South Georgia is given in Table I and reasons for considering them to be introduced are given below.

TABLE I. DISTRIBUTION OF PROBABLE LICHEN INTRODUCTIONS ON SOUTH GEORGIA BY 5 km. GRID SQUARE

Species	Square number					
	050 150	130 120	130 125	140 115	155 055	160 095
<i>Caloplaca cinnamomea</i> (Th. Fr.) Oliv.	—	—	—	—	—	+
<i>Lecidella elaeochroma</i> (Ach.) Haszl.	+	+	+	+	+	+
<i>Parmelia sulcata</i> Tayl.	—	+	—	—	—	—
<i>Rinodina archaea</i> (Ach.) Arnold	—	—	—	—	—	+
<i>Rinodina</i> cf. <i>metaboliza</i> Vain.	—	—	+	—	—	—
<i>Umbilicaria polyphylla</i> (L.) Baumg.	—	+	—	—	—	—

+ Indicates presence.

— Indicates absence.

*Caloplaca cinnamomea* (Th. Fr.) Oliv.

This Arctic-alpine species was found in abundance on unburnt timbers at the site of the German International Polar-Year Expedition huts near Köppen Point, Royal Bay. It was not seen at any other locality on the island nor was it seen in suitable muscicolous habitats around Köppen Point. This species occurs mainly on moss and plant detritus in the Arctic (Poelt, 1969) but it also occurs on driftwood (Lyngé, 1926) and wooden huts (Lyngé, 1939). It does not appear to have been recorded previously from the Southern Hemisphere, although some records of *Caloplaca ferruginea* may refer to it. Its restriction to one habitat in one locality on South Georgia suggests an introduced species which has managed to survive nearly a century but it has not managed to establish itself in other habitats in competition with indigenous species.

*Specimen examined:* 160 095 Lindsay 4048a.

*Lecidella elaeochroma* (Ach.) Haszl.

This almost cosmopolitan corticolous and lignicolous species was recorded from nearly all localities where timber was found. At Binder Beach, Right Whale Bay, for instance, this lichen covered most of the exposed surfaces of timber from a shipwreck, and was found in some quantity at its other localities. Its abundance and distribution around the island may suggest that it is a native species but it is apparently obligately corticolous or lignicolous. Since there are no timber-producing plants on South Georgia, this species must have been introduced to the island on one or more occasions, either with timber during the construction of the whaling stations, or on drift wood from the Cape Horn area.

Darbishire's (1912) record of *Lecidea elaeochroma* (Ach.) Th. Fr. from South Georgia refers to a saxicolous species of *Lecidea* and not to the taxon under consideration.

*Specimens examined:* 050 150 Lindsay 3488; 130 120 Lindsay 4295, R. Smith 1354c; 130 125 Lindsay 3111; 140 115 Lindsay 4201, Lindsay 4203; 155 055 Lindsay 4415; 160 095 Lindsay 4047, Lindsay 4052.

*Parmelia sulcata* Tayl.

An almost cosmopolitan species which occurs on a wide range of substrata, this species might be expected to be part of the indigenous flora. However, its single occurrence indicates that it may have been introduced, as the material consists of small thalli from the deck of the hulk *Louise* at Grytviken. It was not found at any other locality, although a special search was made in the Grytviken area. As with *Caloplaca cinnamomea*, this species seems to have

been introduced and survived at only one locality, being unable to spread to other habitats which it should be quite capable of colonizing.

*Specimen examined:* 130 120 R. Smith 1354a.

*Rinodina archaea* (Ach.) Arnold

Small thalli of this lichen were found interspersed with those of *Caloplaca cinnamomea* on unburnt timber at Royal Bay. This species has not previously been recorded from the Southern Hemisphere. In the Northern Hemisphere, it is boreal and alpine in its distribution, occurring on bark and timber, but it is absent from the Arctic (Poelt, 1969). Considering its substrate preferences and known geographical distribution, it may be concluded that this species was almost certainly introduced to South Georgia.

*Specimen examined:* 160 095 Lindsay 4048b.

*Rinodina* cf. *metaboliza* Vain.

A few small thalli were found on a wooden footbridge over a dam in Bore Valley, near Grytviken whaling station. The identification of the material is uncertain, the material agreeing in all respects with that from the Northern Hemisphere except that the ascospores are not swollen at the septum. However, J. W. Sheard (personal communication) has noted that this is a variable feature in this species and may have little taxonomic significance. *R. metaboliza* is a corticolous and lignicolous lichen with a boreal distribution in the Northern Hemisphere which has so far not been reported from the Southern Hemisphere. In the absence of naturally occurring bark and timber on South Georgia, this species must have been introduced by human agency.

*Specimen examined:* 130 125 Lindsay 3212.

*Umbilicaria polyphylla* (L.) Baumg.

Several thalli of this species were found in the same habitat as *Parmelia sulcata*, i.e. on the wooden deck of the *Louise*. Again, a search did not reveal the presence of this normally saxicolous lichen anywhere else on South Georgia. The species is bipolar in its distribution and is known from Fuegia, the Falkland Islands and New Zealand in the Southern Hemisphere; the record from South Georgia is thus the most southerly known. As with *Parmelia sulcata*, the mode of its occurrence suggests that it was introduced to South Georgia and is not part of the indigenous flora.

*Specimen examined:* 130 120 R. Smith 1131.

#### DISCUSSION

The presence of alien vascular plants has been known on South Georgia since 1902 (Kottsborg, 1905), and the introduction of an alien moss *Pseudoscleropodium purum* (Limpr.) Fleisch. to Tristan da Cunha has been recorded by Dickson (1967). It was, therefore, not surprising to discover that several lichens have been introduced to South Georgia.

Introduction of lichens to various regions have been recorded in the Northern Hemisphere. Degelius (1957, p. 44), when discussing the occurrence of corticolous lichens in Iceland remarked "*Xanthoria lobulata* . . . has been found in a planted tree stand (of mountain ash) at an agricultural research station, and it seems most plausible to me that the species has been introduced by man (e.g. with imported tree plants from Denmark)." Lynge (1940a) noted introduced lichens on imported trees and wooden fences in north-east Iceland, whilst Thomson (1963, p. 96) gave a good example of a lichen introduction, when he noted the occurrence of *Physcia millegrana* Degel. on a tree in California. The colony of this species "is well out of the normal range of the species" and "is undoubtedly a splendid example of an adventive lichen introduced from the east coast or midwestern states to the west coast of the United States". Thomson also noted that *Physcia clementii* (Sm.) Lynge may be an introduction to the United States from nursery stock of *Juglans regia* from Europe.

In the Arctic, a range of lichens is known to colonize drift wood cast up on beaches. Lyngé (1926, 1939, 1940b) recorded a number of examples and discussed the origin of the drift wood, although he did not reach any conclusions about the origins of the lichens, many of which occur naturally in other habitats, for example, on moss. It seems from Lyngé's data that the introduction of lichens to South Georgia by drift wood is a most unlikely occurrence, the propagules undoubtedly being killed by the effects of exposure to sea-water.

It thus seems that the obligately lignicolous and corticolous lichens on South Georgia were introduced by human agency, probably as diaspores on timber, during the construction of whaling stations and expedition huts on the island. A consideration of the natural geographical distribution of some of these lichens, i.e. boreal and Arctic-alpine in the Northern Hemisphere, indicates that they were introduced from northern Europe, Norway or the mountain regions of Germany, but unfortunately the origins of most of this timber can only be assumed, since detailed records are lacking.

Five of the species occur at only one locality, *Caloplaca cinnamomea* and *Rinodina archaea* being confined to old buildings in Royal Bay, *Rinodina* cf. *metaboliza* to timbers near the Grytviken whaling station, and *Parmelia sulcata* and *Umbilicaria polyphylla* to the wooden deck of the *Louise*. These species appear unable to spread to timber at other localities whereas *Lecidella elaeochroma*, although almost certainly an introduced species because of its obligately corticolous or lignicolous habit, may be considered as naturalized on South Georgia. It was found in almost all localities where timber or drift wood was found on the beach and also on timber huts. Either it has been introduced a number of times or it has been very successful in dispersal around the island from one original point of introduction.

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#### REFERENCES

- DARBISHIRE, O. V. 1912. The lichens of the Swedish Antarctic Expedition. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 11, 74 pp.
- DEGELIUS, G. 1957. The epiphytic lichen flora of the birch stands in Iceland. *Acta Horti Gothob.*, 22, 1-51.
- DICKSON, J. H. 1967. *Pseudoscleropodium purum* (Limpr.) Fleisch. on St. Helena and its arrival on Tristan da Cunha. *Bryologist*, 70, No. 2, 267-68.
- GREENE, S. W. 1964. The vascular flora of South Georgia. *British Antarctic Survey Scientific Reports*, No. 45, 58 pp.
- LYNGÉ, B. 1926. Lichens from Bear Island (Bjørnøya) collected by Norwegian and Swedish expeditions, chiefly by Th. M. Fries during the Swedish Polar Expedition of 1868. *Resultater norske Spitsbergeneksped.*, No. 9, 3-78.
- . 1939. Lichens from Jan Mayen collected on Norwegian expeditions in 1929 and 1930. *Skr. Svalbard Ishavet*, No. 76, 55 pp.
- . 1940a. Lichens from Iceland, collected by Norwegian botanists in 1937 and 1939. I. Macrolichens. *Skr. norske Vidensk.-Akad., Mat.-naturv. Kl.*, 1940, No. 7, 1-56.
- . 1940b. Lichens from north east Greenland collected on the Norwegian scientific expeditions in 1929 and 1930. II. Microlichens. *Skr. Svalbard Ishavet*, No. 81, 143 pp.
- MATTHEWS, L. H. 1931. *South Georgia: the British Empire's sub-Antarctic outpost*. Bristol, John Wright and Sons Ltd.; London, Simpkin Marshall Ltd.
- POELT, J. 1969. *Bestimmungsschlüssel europäischer Flechten*. Lehre, J. Cramer.
- SKOTTSSBERG, C. [J. F.] 1905. Die Gefäßpflanzen Südgeorgiens. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 3, 12 pp.
- THOMSON, J. W. 1963. The lichen genus *Physcia* in North America. *Beih. Nova Hedwigia*, 1963, Ht. 7, 212 pp.