SHORT NOTES

THE WHITE-PHASE GIANT PETREL OF THE SOUTH ORKNEY ISLANDS

By JAMES W. H. CONROY

ABSTRACT. In recent years there has been a suggestion that in the polymorphic giant petrel (*Macronectes giganteus*) the white colour phase has a preference for the high polar latitudes, and tends to remain there throughout the year, while the dark colour phase migrates to lower latitudes. This hypothesis was first tested by Hudson (1968), who concluded that possibly 25 per cent of the white-phase birds remained in polar regions. Some of his data have been shown to be incomplete and this paper attempts to re-assess the situation. Using only "complete data", there seems to be no difference between the proportion of white-phase chicks ringed on Signy Island and the proportion of white-phase juveniles at risk in the low latitudes. It is concluded that, at least in the juvenile population, there is no evidence of a differential migration of colour phases within the species.

BOURNE AND WARHAM (1966) have suggested that the genus *Macronectes* contains two sibling species of giant petrel, a northern species (*Macronectes halli* (Mathews)) which breeds on the islands at or north of the Antarctic Convergence, and a southern species (*Macronectes giganteus* (Gmelin)) which breeds on the islands at or south of the Antarctic Convergence and on the offshore islands of the Antarctic mainland. In the southern species, two distinct colour phases are identifiable from hatching: dark-phase birds, which at all colonies account for the majority of the breeding population, and white-phase birds. In breeding colonies, the proportion of white-phase birds varies from one locality to another and it has been suggested that it increases with latitude. However, in recent years, several colonies have been found in the far south in which the proportion of white-phase birds tends to be smaller than in some of the more northerly colonies of the Scotia Ridge (Antarctic mainland: Stonehouse (1950), Prévost (1953), Law (1958), I. M. Willey (personal communication); South Shetland Islands: Bennet (1926), Araya and Aravena (1965); South Orkney Islands: Hudson (1968), personal observations).

Both recoveries of ringed giant petrels and sightings of the species at sea show that the birds disperse to areas far to the north of their breeding grounds. These areas include Australia, South Africa, South America and New Zealand. For the purposes of this paper, these regions are considered as low latitudes, and it is here that all the foreign recoveries of ringed giant petrels from the South Orkney Islands have been made. None has been recovered at other Antarctic or sub-Antarctic stations. In the low latitudes, sightings of white-phase giant petrels at sea are infrequent, and this prompted Murphy (1936) to suggest that the white-phase birds prefer a polar environment while the dark-phase birds migrate to seas north of the Antarctic Convergence. Bourne and Warham (1966) also favoured the idea of a "polymorphic species in which the contrasting colour phases deliberately select a different environment", the white coloration presumably being associated with some advantage in the south.

Over the past few years, a large amount of ringing data has been accumulated by the British Antarctic Survey from their station on Signy Island (lat. 60°43′S., long. 45°36′W.), South Orkney Islands. The ringing of giant petrels began there in 1948 soon after the station was established. Because of the long-distance recoveries of birds ringed in the nest, the ringing of the nestlings became a regular feature of activity at this station and, with the exception of a few years in the early 1950's, efforts have been made every year to ring as many as possible of the chicks on the island. It was not until 1958 that white-phase chicks were individually recorded, or counts made of their total numbers. Since then the system has been to record the ring numbers of the white birds in the field and to enter these numbers as being "white" in the ringing registers. In this way it is quite easy to count the total number of white-phase chicks ringed, and whenever a recovery is made its phase is immediately identifiable from the ringing register.

The data used in this paper refer only to those birds ringed as nestlings, since these birds have produced the vast majority of the recoveries from low latitudes. Most of these recoveries occur within a year of the chicks' fledging, although a few recoveries are still made in low latitudes until the birds are about 3 years old. All birds ringed as nestlings and recovered

within 3 years of ringing are referred to here as juveniles. Over 1,000 breeding adult birds have been ringed on Signy Island but there are no comparative data available for their recoveries in low latitudes. Consequently, all the conclusions expressed here refer to only a part of the giant petrel population—the juvenile. With the permission of the British Antarctic Survey, Hudson (1968) used the ringing data to test the hypothesis of differential migration within the species of *Macronectes giganteus*, and his results are summarized below. He used the ringing data for the years 1958–65, excluding 1964 (since too few chicks were ringed in that year). A total of 9,257 nestlings were ringed of which 9·1 per cent were white-phase birds (mean 9·1 per cent; S.D. 0·82). The foreign recoveries are listed as 297, of which 20 are recorded as white-phase juveniles. The white percentage in the foreign recoveries thus appears as 6·7 per cent, different ($P = 0·1$) from the mean of 9·1 per cent in the ringed population. Hudson expressed the white-phase foreign recoveries (6·7 per cent) as a percentage of the range of the white-phase chicks in the ringed population (range taken as 8·3–9·9 per cent, i.e. mean ± 1 S.D.). This gave a range of values between 67 and 80 per cent, and Hudson concluded that "a substantial proportion of white-phase juveniles from the South Orkneys do migrate north, and probably $\frac{3}{4}$ of them do so. Though there is a strong possibility that approximately $\frac{1}{4}$ of white juveniles do not migrate north, there is a one in ten possibility that the ratio on which this is based arose by chance . . ." These conclusions are based on the assumption that there is no difference in the mortality of either phase. At the beginning of the paper, details are given of how the ringing of the white-phase nestlings is individually recorded. However, this system has not always been used; on some occasions only the total number of ringed white-phase chicks has been recorded, without recording the actual ring numbers. In such records there is much dependence on the finder of the bird recording it as a white-phase bird or not; this is far from reliable since many of the recoveries are either of rings only or from birds which have been dead some time and partially decomposed; also many finders have no idea of the existence of the white/dark phases of the species. All of the chicks ringed in the 1958–59 summer and some of those ringed in the 1957–58 summer were recorded in this way. The 297 foreign recoveries listed by Hudson assume that the colour phases have always been accurately identified at the time of ringing. Unfortunately this is not the case; the total includes not only the recoveries of juveniles ringed in 1957–58 and 1958–59 but also the recoveries of juveniles ringed prior to 1958 (i.e. the years before any records were kept of the white-phase birds at ringing). It is the inclusion of these years' ringing data which suggests that there are fewer white-phase juveniles at risk in low latitudes than are in the ringed population on Signy Island. A more accurate conclusion can be drawn by using only the data for those years which are known to be complete (Table I).

TABLE I. PROPORTION OF WHITE-PHASE GIANT PETREL (*Macronectes giganteus*) CHICKS RINGED ON SIGNY ISLAND, AND THEIR RECOVERIES FROM LOW LATITUDES

(The slight differences in the individual year totals in this table and those given by Hudson (1968) are explained by the exclusion from this table of all ringed nestlings known to have failed to fledge.)

Summer	*Number ringed*	*Number white*	*Percentage white*	*Number recovered*	*Number white recovered*	*Percentage white recovered*
1957–58	1,250	121	9·68	55	5	9·09
1959–60	1,456	139	9·55	19	2	10·53
1960–61	1,210	107	8·84	19	3	15·79
1961–62	1,462	146	10·00	24	3	12·5
1962–63	1,286	119	9·24	34	4	11·77
1964–65	1,196	126	10·54	24	2	8·33
Totals and mean	7,860	758	9·64*	175	19	10·86*

* $\chi^2 = 0·295$; $P = 0·5$–$0·7$.

In both sets of data the proportion of white-phase chicks ringed on Signy Island is similar, their respective ranges (mean ±1 S.D.) being 8·9 to 10·16 per cent (mean 9·6 per cent) and 8·3 to 9·9 per cent (mean 9·1 per cent) (Hudson, 1968). In the present study, however, there is no significant difference between the percentage of white chicks ringed on Signy Island and the percentage of white-phase juveniles recovered in low latitudes.

Conclusion

Since there is no significant difference between the proportion of white-phase juveniles recovered in low latitudes and the proportion of white-phase chicks ringed on Signy Island, there appears to be no evidence to support the view that there is a differential migration of colour phases within the species. The few sightings of white-phase giant petrels at sea in low latitudes are probably due to the small proportion in the population as a whole. Also, *Macronectes halli* has no white-phase birds in its populations, and at sea both *M. halli* and *M. giganteus* are similar in appearance, particularly in the juveniles which are very dark in the dark phase of *M. giganteus*. At present there is no accurate method of distinguishing these two species at sea and in low latitudes the presence of *M. halli* increases the number of dark-phase giant petrels seen.

Acknowledgements

I wish to thank Dr. G. M. Dunnet, Dr. I. J. Patterson, Dr. H. Milne and Dr. J. M. Hinton for their advice on the compilation of this paper, and also Dr. M. C. Healey for assistance with the statistical analysis. My thanks are also due to many members of the Signy Island station who ringed the nestlings in previous years. Because of their efforts, the compilation of this paper was possible.

MS. received 24 October 1969

References

Araya, B. *and* W. Aravena. 1965. Las aves de Punta Armonia, Isla Nelson, Antártica Chilena. Censo y distribución. *Publnes Inst. antárt. chil.*, No. 7, 18 pp.

Bennet, A. G. 1926. A list of the birds of the Falkland Islands and Dependencies. *Ibis*, **12**, No. 2, 306–33.

Bourne, W. R. P. *and* J. Warham. 1966. Geographical variation in the giant petrels of the genus *Macronectes*. *Ardea*, **54**, No. 1/2, 45–67.

Hudson, R. 1968. The white-phase giant petrels of the South Orkney Islands. *Ardea*, **56**, No. 1/2, 178–83.

Law, P. 1958. Australian coastal exploration in Antarctica. *Geogrl J.*, **124**, Pt. 2, 151–62.

Murphy, R. C. 1936. *Oceanic birds of South America*. New York, American Museum of Natural History.

Prévost, J. 1953. Notes sur l'écologie des petrels de Terre Adélie. *Alauda*, **21**, No. 4, 205–22.

Stonehouse, B. 1950. Report on biological activities at Base E, 1948–49 (F.I.D.Sc. Bureau No. 34/50), 8 pp. [Unpublished.]

NOTES ON ANTARCTIC LICHENS: II. THE GENUS *Peltigera*

By D. C. Lindsay

Abstract. Three species of *Peltigera* are recorded from the sub-Antarctic island of South Georgia and two species from the Antarctic Peninsula–Scotia Ridge sector of the maritime Antarctic.

Representatives of the genus *Peltigera* have been reported from numerous localities in the sub-Antarctic botanical zone as defined by Greene (1964), e.g. by Crombie (1876*a*, *b*), Hue (1915), Bouly de Lesdain (1931), Dodge (1948, 1966, 1968) and Dodge and Rudolph (1955). Until recently (Dodge, 1968) the genus had not been recorded from south of lat. 60°S. This paper reports three species, *Peltigera horizontalis* (Huds.) Baumg., *P. spuria* (Ach.) Funck and *P. zahlbruckneri* Gyeln. from the sub-Antarctic island of South Georgia, and two species, *P. rufescens* (Weiss) Humb. and *P. spuria* from localities in the South Orkney Islands, South Shetland Islands and on the west coast of the Antarctic Peninsula.

Dodge and Rudolph (1955) and Dodge (1966) have described several, presumably endemic, species from Macquarie Island and Archipel de Kerguelen. Dodge (1968) has also described a new species from material collected from the west coast of the Antarctic Peninsula, the first

record of the genus from within the Antarctic botanical zone. However, all the other authors cited above have referred material of *Peltigera* from the sub-Antarctic islands to previously described, cosmopolitan species, and further collections will probably show that the "endemic" species are, in fact, forms of well-known Northern Hemisphere species.

Nomenclature follows that of James (1965) but for ease of reference the species discussed are arranged alphabetically. All of the specimens cited in this paper, unless otherwise stated, are part of the British Antarctic Survey herbarium, at present housed in the Department of Botany, University of Birmingham. Distribution data are briefly noted for each species by island group or coasts, the latter including all offshore islands.

A key to the species of *Peltigera* occurring along the Antarctic Peninsula and on the islands of the Scotia Ridge is given below.

1. Thallus without veins on the lower surface .. .. *P. zahlbruckneri*
   Thallus with veins on the lower surface 2

2. Thallus lobes sorediate .. .. *P. spuria*
   Thallus lobes not sorediate 3

3. Upper surface of thallus yellowish green or brownish green, smooth and shiny .. .. *P. horizontalis*
   Upper surface of thallus reddish brown, with tomentum at least near the margins .. .. *P. rufescens*

Peltigera horizontalis (Huds.) Baumg.

The record of this species from South Georgia (Table I) represents the southernmost locality known for this cosmopolitan species. The specimen, although small (4 cm. diameter), is obviously referable to this species and is abundantly fertile.

Specimen examined

South Georgia:
Holmestrand — Greene 2605

Peltigera rufescens (Weiss) Humb.

The Graham Coast localities listed in Table I represent the southernmost known localities for this cosmopolitan species. Dodge (1968, p. 307–08) described a new species, *Peltigera antarctica*, from material collected from the Melchior Islands, Danco Coast, and cited specimens from South Georgia, collected by Skottsberg during the Swedish South Polar Expedition of 1901–03, as belonging to this species. However, Darbishire (1912) had already determined Skottsberg's material as *P. rufescens* and when Skottsberg's South Georgian specimens preserved in Stockholm were examined they proved to be *P. rufescens*.

Specimens examined

South Georgia:
Cumberland Bay — Skottsberg 59, 68

South Orkney Islands:
Signy Island — Lindsay 931, 935

Antarctic Peninsula (west coast):
Graham Coast — Corner 637b, 669, 690

All specimens, except Skottsberg 59, were sterile.

Peltigera spuria (Ach.) Funck

This is a cosmopolitan species which is here reported for the first time from within the Antarctic botanical zone and from South Georgia (Table I). It appears to grow in a wide

TABLE I. COLLECTING DATA OF SPECIES OF *Peltigera* FROM NEW ANTARCTIC LOCALITIES

Species	*Locality*	*Habitat*	*Collection number*	*Date of collection*
P. horizontalis	*South Georgia:* Holmestrand, near Esmark Glacier	On east-facing rocks behind shore (*c.* 30 m.) [Grid ref. 083 128]	Greene 2605	11 March 1961
P. rufescens	*South Orkney Islands:* Signy Island, Observation Bluff	On *Dicranum* bank (100 m.)	Lindsay 931	9 March 1966
	Three Lakes Valley	Amongst moss over marble (20 m.)	Lindsay 935	12 March 1966
	Antarctic Peninsula (west coast): Graham Coast, Cape Pérez	Edges of rock, wet from melt water above (15 m.)	Corner 637b	5 November 1964
	Cape Tuxen	Moist conditions (60 m.)	Corner 690	26 November 1964
P. spuria	*South Georgia:* Stromness Bay, near Hansen Point	On *Polytrichum* banks (*c.* 15 m.) [Grid ref. 120 139]	Greene 3342	24 March 1961
	South Shetland Islands: Livingston Island, Byers Peninsula	On *Drepanocladus* (30 m.)	Lindsay 124	3 December 1965
	Antarctic Peninsula (west coast): Graham Coast, Berthelot Islands	Moist and sheltered rock ledge with mosses (18 m.)	Corner 615	3 November 1964
	Argentine Islands, Galindez Island	Dry sheltered ledge (5 m.)	Corner 700b	29 November 1964
P. zahlbruckneri	*South Georgia:* Stromness Bay, south-west from Husvik	Amongst *Rostkovia* (*c.* 3 m.) [Grid ref. 118 135]	Greene 3149	20 March 1961
	Cumberland West Bay, Bore Valley north	In *Festuca* association (*c.* 110 m.) [Grid ref. 132 126]	Greene 1970	11 February 1961
	Sacramento Bight, east-facing slopes of Brocken	In rock crevices (*c.* 160 m.) [Grid ref. 161 101]	Greene 2445	27 February 1961

variety of habitats but in the South Shetland Islands the author noticed that it was restricted to north-facing well-irrigated carpets of *Drepanocladus* or *Brachythecium*.

All the material examined was sterile.

Specimens examined

South Georgia:

Stromness Bay Greene 3342

South Shetland Islands:
Livingston Island — Lindsay 124, 414, 508

Antarctic Peninsula (west coast):
Graham Coast — Corner 615, 700b; R. Smith 766

Peltigera zahlbruckneri Gyeln.

This species has previously been recorded from Fuegia, the Himalayas and central Africa (des Abbayes, 1962). The records for South Georgia (Table I) therefore represent the southernmost known localities for this species. It is probable, however, that previous records for *Peltigera malacea* (Ach.) Funck from the Southern Hemisphere may well refer to this species.

On South Georgia, *P. zahlbruckneri* seems to grow in a variety of habitats but it is principally associated with flowering plants, unlike the other species of *Peltigera* on the same island, and has been found at altitudes from just above sea-level to over 160 m.

All the material seen was sterile.

Specimens examined

South Georgia:
Stromness Bay — Greene 3149, 3216
Cumberland West Bay — Greene 1970
Cumberland East Bay — Greene 1508
Sacramento Bight — Greene 2445

ACKNOWLEDGEMENTS

I should like to thank the Curator of the Botanical Section, Naturhistoriska Riksmuseum, Stockholm, for the loan of material, and Professor J. G. Hawkes, Mason Professor of Botany, University of Birmingham, for facilities provided in his department.

MS. received 19 January 1970

REFERENCES

BOULY DE LESDAIN, M. 1931. Lichens recuellis en 1930 dans les Îles Kerguelen, Saint-Paul et Amsterdam, par M. Aubert de la Rue. *Annls Cryptog. exot.*, **4**, 98–103.

CROMBIE, J. M. 1876*a*. Lichenes 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.

————. 1876*b*. On the lichens collected by Professor R. O. Cunningham in the Falkland Islands, Fuegia, Patagonia, and the island of Chiloe during the voyage of H.M.S. 'Nassau', 1867–9. *J. Linn. Soc.*, Botany, **15**, 222–34.

DARBISHIRE, O. V. 1912. The lichens of the Swedish Antarctic Expedition. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 4, Lief. 11, 74 pp.

DES ABBAYES, H. 1962. Lichens foliacés et fruticuleux d'Afrique centrale récoltés par l'Expédition Suisse au Virunga en 1954–55. *Revue bryol. lichen.*, N.S., **31**, Fasc. 3–4, 239–50.

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

————. 1966. Lichens from Kerguelen, collected by E. Aubert de la Rüe. *Comité National Française des Recherches Antarctiques*, **15**, No. 1, 1–8.

————. 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.

————. *and* E. D. RUDOLPH. 1955. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. *Ann. Mo. bot. Gdn*, **42**, 132–49.

GREENE, S. W. 1964. Plants of the land. (*In* PRIESTLEY, R. E., ADIE, R. J. *and* G. DE Q. ROBIN, *ed. Antarctic research*. London, Butterworth and Co. (Publishers) Ltd., 240–53.)

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

JAMES, P. W. 1965. A new check-list of British lichens. *Lichenologist*, **3**, Pt. 1, 95–153.

NOTES ON ANTARCTIC LICHENS: III. *Cystocoleus niger* (Huds.) Hariot

By D. C. LINDSAY

ABSTRACT. *Cystocoleus niger* (Huds.) Hariot is reported from South Georgia and several localities on the Antarctic Peninsula and islands of the Scotia Ridge, and it is the first record of this genus from within the Antarctic botanical zone.

THE genus *Cystocoleus* does not appear to have been previously recorded from the Antarctic or sub-Antarctic, and it has been confused by many authors with species of the genus *Coenogonium*. Santesson (1952) has pointed out that the essential difference between these two genera lies in the character of the fungal component of the lichen. In *Cystocoleus* the fungal component is a deuteromycete, whereas in *Coenogonium* it is an ascomycete, and consequently ascocarps are found fairly frequently in the latter genus but never in the former. *Coenogonium* has been placed in the Gyalectaceae and *Cystocoleus* in the lichenized Fungi Imperfecti by Santesson (1952). A further difference between these two genera is shown by their geographical distribution. *Coenogonium* is more or less restricted to the tropics and sub-tropics, whereas *Cystocoleus* is temperate and boreal in its distribution in the Northern Hemisphere, having been found north of lat. 72°N. in Greenland (Lynge, 1940).

So far, there have not been any records for either genus from within the Antarctic botanical zone, but *Coenogonium* has been reported from some of the sub-Antarctic Islands (Dodge, 1948, 1966). Dodge (1948) recorded *Coenogonium subtorulosum* Müll. Arg. from Macquarie Island and later described a new species, *C. kerguelense*, from Archipel de Kerguelen (Dodge, 1966). The former species, to judge from its type description given by Müller [Argoviensis] (1896), is believed by the present author to be correctly referred to *Coenogonium* as defined by Santesson (1952), but the status of the latter species (*C. kerguelense*) is less certain, since Dodge (1966) when describing it gave no indication of its affinities with any previously described species. The description is brief and could apply equally well to either a species of *Coenogonium* or *Cystocoleus*.

The genus *Cystocoleus* can now be reported with confidence from within Antarctic regions from specimens in the British Antarctic Survey's herbarium, at present housed in the Department of Botany, University of Birmingham. To judge from the records listed below, it appears that *Cystocoleus niger* is widespread throughout the Antarctic Peninsula and islands of the Scotia Ridge. It grows over acrocarpous mosses or soil in shallow dry rock crevices with an altitudinal range of from 8 m. to over 580 m.

In the Antarctic, it is unlikely to be confused with any other lichen except a species of *Zahlbrucknerella*, which is found in similar habitats. Since the *Zahlbrucknerella* appears brownish olive in the fresh state in the field, the species is easily separated from the black *Cystocoleus*.

Specimens examined

South Georgia:
Bird Island — Greene 358

South Orkney Islands:
Signy Island — Lindsay 1274a, 1384, 1425

Antarctic Peninsula (west coast):
Graham Coast — Corner 563; R. Smith 760

Antarctic Peninsula (east coast):
Wilkins Coast — Cousins 44a

Further details of some of these collections are given in Table I.

TABLE I. COLLECTING DATA FOR *Cystocoleus niger* (Huds.) Hariot FROM ANTARCTIC LOCALITIES

Locality	*Habitat*	*Collection number*	*Date of collection*
South Georgia: Bird Island, *c.* 1 mile (1·6 km.) east of Jordan Cove	On *Dicranum* mounds on tussock slopes (*c.* 30 m.) [Grid ref. 030 150]	Greene 358	18 December 1960
South Orkney Islands: Signy Island, Borge Bay	On moss in rock crevices (*c.* 8 m.)	Lindsay 1274a	10 October 1966
Antarctic Peninsula (west coast): Graham Coast, Argentine Islands, Galindez Island	Crevices in rock (8 m.)	Corner 563	28 July 1964
Antarctic Peninsula (east coast): Wilkins Coast, unnamed locality at lat. 69°30′S., long. 62°38′W.	East side of large nunatak (*c.* 580 m.)	Cousins 44a	10 November 1965

ACKNOWLEDGEMENTS

I wish to thank Professor J. G. Hawkes, Mason Professor of Botany, University of Birmingham, for facilities provided in his department.

MS. received 19 January 1970

REFERENCES

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

———. 1966. Lichens from Kerguelen, collected by E. Aubert de la Rüe. *Comité National Française des Recherches Antarctiques*, **15**, No. 1, 1–8.

LYNGE, B. 1940. Lichens from north east Greenland collected on the Norwegian Scientific Expeditions in 1929 and 1930. II. Microlichens. *Skr. Svalbard Ishavet*, No. 81, 143 pp.

MÜLLER [ARGOVIENSIS], J. 1896. Lichenes Colensoani a Reverendiss. Colenso in Novâ Zelandiâ Septentrionali prope Napier Lecti, et Nuperius Missi, in Herbario Reg. Kewensi servati, quos determinavit. *J. Linn. Soc.*, Botany, **32**, 197–208.

SANTESSON, R. 1952. Foliicolous lichens I. A revision of the taxonomy of the obligately foliicolous, lichenized fungi. *Symb. bot. upsal.*, **12**, Pt. 1, 3–590.