

Resupinate fungi (Basidiomycetes, Aphyllophorales) of Macquarie Island, Australia

GARY A. LAURSEN, HAROLD H. BURDSALL AND RODNEY D. SEPPELT

LAURSEN, G. A., BURDSALL, H. H. & SEPPELT, R. D. 2002. Resupinate fungi (Basidiomycetes, Aphyllophorales) of Macquarie Island, Australia. *Hikobia* 13: 745-750.

Fourteen collections of resupinate higher fungi in the order Aphyllophorales (Basidiomycetes) were made on Subantarctic Macquarie Island (54°30'S, 158°57' E) in 1995. Of the 14, three proved to lack species-determining characteristic basidiospores and 12 were determined to belong to three species in two genera; *Athelopsis lembospora* (Bourdot) Oberwinkler, *Athelopsis subinconspicua* (Lirschauer) Julich, the first report of this species from the Southern Hemisphere, and *Epithele galzinii* Bres., the first report of *E. galzinii* from an Australian territory and also representing a southern range extension by several hundred kilometers. None are endemic and all are suspected to have reached the Island by long-distance transoceanic wind dispersal from other southern continental sources. Their habitats are restricted to old and clustered culms, frond bracts, and leaf petioles of the fern *Polystichum vestitum* (G. Forst.) C. Presl, the raised pedestals of old giant tussock grass stem bases of *Poa foliosa* (Hook. f.) Hook. f., and the woody, but thin, stems of *Acaena magellanica* (Lam.) Vahl (Rosaceae) and *Coprosma perpusilla* Colenso ssp. *subantarctica* Orchard (Rubiaceae).

Gary A. Laursen. University of Alaska Fairbanks, Institute of Arctic Biology, Fairbanks, AK 99775-6100, USA.

Harold H. Burdall, Jr., retired Center for Forest Mycology Research, Forest Products Laboratory, Forest Service, USDA, Madison, WI 53705 USA.

Rodney D. Seppelt, Australian Antarctic Division, Channel Highway, Kingston, 7050 Tasmania, Australia.

Introduction

Macquarie Island: the setting

Macquarie Island (latitude 54° 30' S, longitude 158° 57'E) is an isolated subantarctic oceanic island 34 km long and 2.5 to 5.5 km wide, located 1,000 km south-south-east of Tasmania, Australia (Fig. 1). The island is an uplifted fragment of a submarine ridge at the junction of two tectonic plates that rises to form a narrow, elongate sub-aerial exposure with an undulating plateau 200–250 (–300) meters above sea level. Macquarie Island is unique among subantarctic islands in having tectonic origins from uplifted oceanic crustal strata. It lies close to but north of an oceanic boundary, the Antarctic Convergence. The

nearest land exposures are the New Zealand shelf island groups of Auckland and Campbell Islands, lying 640 and 700 km to the north-northeast, respectively. Macquarie Island is characterized by having an oceanic climate that is cool, moist and windy with low mean annual temperatures (annual mean of 4.8°C, with a range of 3.3°C), a mean annual precipitation of 895 mm over 315 days, high relative humidity (89% average) and a mean wind speed of 9.3 m/sec. While wind, cloud cover, precipitation and relative humidity vary little throughout the year, there is a marked annual cycle in day length from about 7 hours in mid-winter to 17 hours in mid-summer (Selkirk et al., 1990). These conditions are, therefore, very comparable to island climates at the same lati-

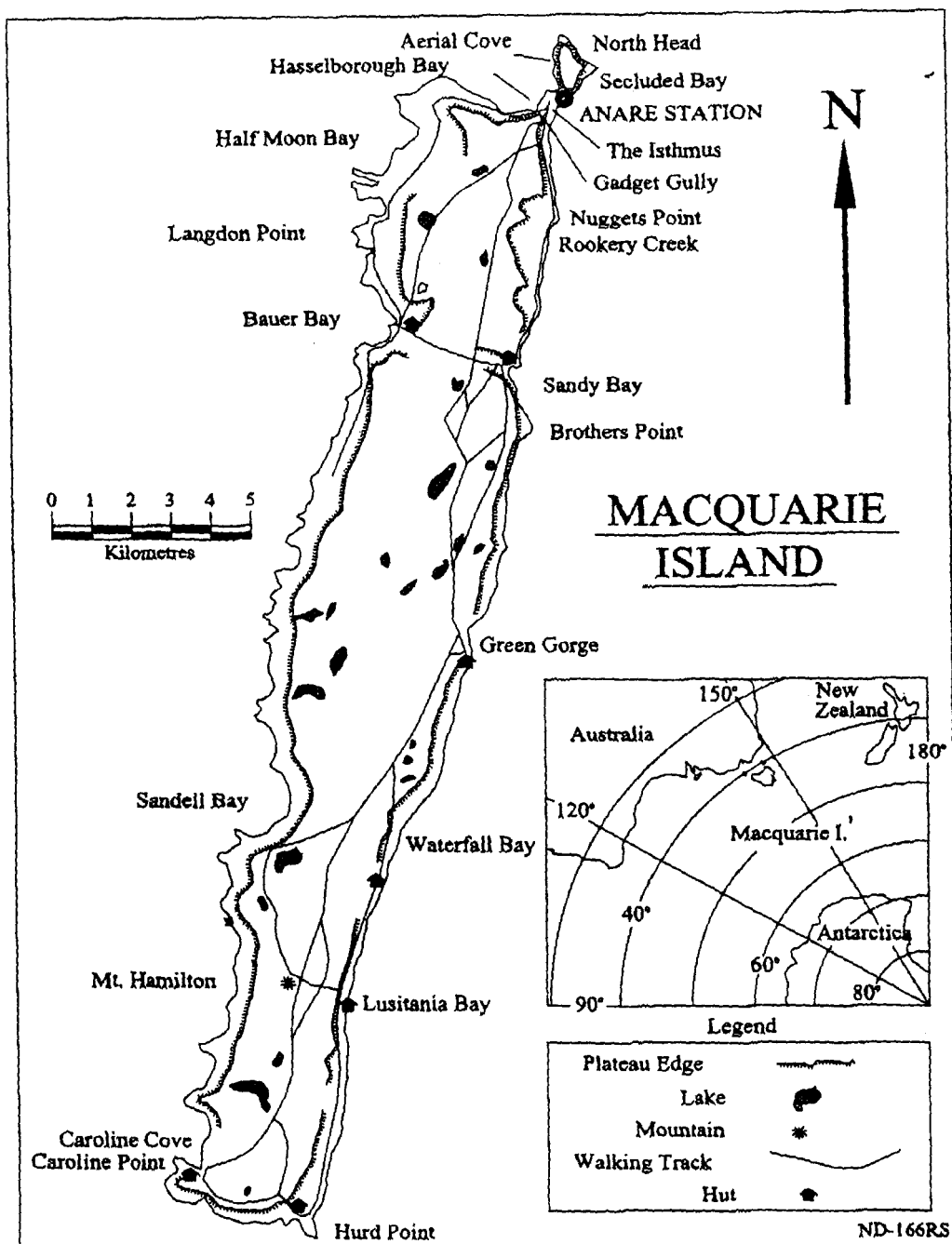


Fig. 1. Macquarie Island and its location (inset), showing the plateau margin, major lakes, walking tracks, field huts, the highest point of land on the island (Mt. Hamilton, 433 m) and significant localities mentioned in the text.

tudes in the Northern Hemisphere.

The surface of Macquarie Island is dotted with numerous lakes, ponds (rams), and streams, and the margin of the island is bounded by steep scarps, generally with angles of 40–45° but as steep as 80° in places, which fall abruptly from the plateau margin to a generally narrow, low-lying coastal raised beach terrace fringe. The west coast is more rugged with its steeper scarps and broader raised bench terraces than the more gently flowing scarps and narrower terraces on the east. Both coastlines are indented with numerous small bays and coves and are fringed by sea stacks and reefs. Raised beaches, remnants of former shorelines exposed at different times during the Island's uplift from the ocean floor, can be found at altitudes of 90 to in excess of 200m in some parts of the island.

The diverse topography of Macquarie Island is reflected in a wide range of micro-environmental variation, particularly with regard to site moisture gradients and wind exposure. Five major vascular plant community types exist on the island (Taylor, 1955; Selkirk et al., 1990); tall tussock and short grasslands; herbfield, including several different subtypes; mires; bogs; and exposed fieldmark communities. Vegetation communities dominated by grassland and herbfield are favoured habitats of introduced rodents (rabbit, black rat, house mouse) and burrow-nesting sea birds.

Biological Components

Macquarie Island has never been connected to any continental landmass. All organisms present have reached the island by long-distance trans-oceanic dispersal by wind, birds and, to a lesser extent, water (Selkirk et al., 1990). The bryophyte flora is represented by around 90 mosses and 50 hepatics, with apparently no endemic taxa. The lichen flora of around 200 taxa includes many doubtfully endemic species described by Dodge (1948, 1968) and Dodge and Rudolph (1955). Taxonomic evaluation of fungal collections made during our field studies in 1995 are continuing but at least 250 taxa, excluding soil fungi, are known. It is unclear what proportion of the fungal flora may be endemic and there are significant numbers of bipolar taxa in all groups.

Vascular flora

Macquarie Island supports forty-six species of vascular plants, 35% of which are grasses and sedges (Taylor 1955; Jenkin 1972, 1975; Jenkin & Ashton 1979; Copson 1984; Selkirk et al. 1990). There are no trees or shrubs present, no ericaceous plants, nor any ectomycorrhizal plants, such as the dwarf birch (*Betula* spp.) or willow (*Salix* spp.) found in subarctic regions. All vegetation is considered to be herbaceous, even though mats of older accumulating *Acaena* and *Coprosma* stems can be rather coarse, perhaps constituting the only natural "woody" substrates available other than the large bases of old tussock grasses (*Poa foliosa*). The depauperate nature of the vascular flora simplifies many of the problems of enumeration, vascular plant identification, and interpretation (e.g., elucidating host-fungus associations for mycorrhizal species) that are inherent in other large-scale ecosystem studies.

Resupinate fungi

Fourteen specimens of fungi suspected to be resupinate saprophytic fungi on "woody" or wood-like substrates were collected on Macquarie Island during the Austral summer of 1995 (January–March). What makes this interesting is the fact that no "native" island species of plants are truly woody. Of these specimens two were sterile (non-sporulating at the time of collection) and were not identifiable due to tissue sterility. Others formed thin white mycelial fans, webs or crust-like fructifications giving them the appearance of being resupinate fungi. Eight of the 12 specimens were identifiable to three species in two genera; *Athelopsis lembospora* (Bourdot) Oberwinkler, *Athelopsis subinconspicua* (Lituchauer) Jülich, and *Epithele galzinii* Bres. There are almost certainly more resupinate species to be found on the island. However, the effective search for such species in these environs necessitates that it be pursued as the primary research focus, not as a secondary effort. It is somewhat surprising that the number of collections made was as high given that there were none of the traditional woody substrates these fungi inhabit.

Microsites that approximate woody habitats are restricted to old and clustered culms of frond bracts and leaf petioles of the fern *Polystichum vestitum* (G. Forst.) C. Presl, the raised pedestals

of old giant tussock grass stem bases of *Poa foliosa* (Hook.f.) Hook.f., and the woody, but thin, stems of *Acaena magellanica* (Lam.) Vahl and *Coprosma perpusilla* Colenso ssp. *subantarctica* Orchard. Given the restricted habitat for this group of Basidiomycetes, all belonging to the Aphyllophorales, it is not surprising that so few species have so far been found.

Methods

Anatomical characterizations of basidiocarps were made from dried material mounted in 5 percent KOH and Melzer's reagent. Whenever possible, and when not otherwise stated, basidiospores were measured from basidiospore prints or from basidiospores deposited on fructification surfaces or from the hymenium to eliminate measuring immature basidiospores. Color notations are made from Kornerup and Wanscher (1967), Methuen Handbook of Colour, by page, row and number. A & O, Zeiss and Leitz binocular and compound microscopes and drawing attachments were used for making descriptions and drawings. Macrophotographs were prepared in the field using a Pentax MX-SLR with a 1:4 50-mm macro lens. Specimens are deposited in the University of Alaska Mycological Herbarium (ALA).

Fungal descriptions

1. *Athelopsis lembospora* (Bourdot) Oberwinkler, Persoonia 7; 3. 1972. (Fig. 2).

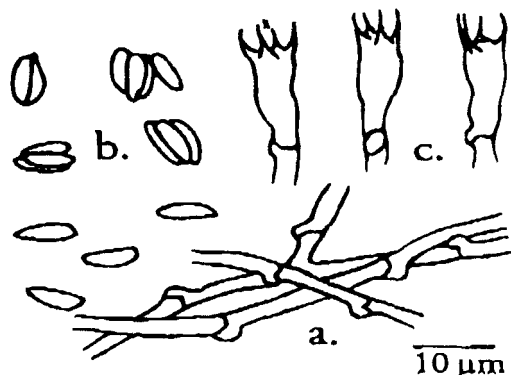


Fig. 2. *Athelopsis lembospora* (Bourdot) Oberwinkler. a, subiculum hyphae. b, spores and spore clusters. c, basidia.

Basidiome broadly effused, smooth, ceraceous, pale cream-color, up to 0.2 mm thick, flaking easily off substrate. Margin concolorous, abrupt, undifferentiated.

Subiculum monomitic, of two layers; one only several hyphal layers thick on the substrate surface, hyphae 4–6 μm diam., hyaline, with slight wall thickening and a large clamp connection at each septum, unencrusted; the second up to 10–15 μm thick, of loosely interwoven hyphae, 2.5–4 μm diam., thin-walled, hyaline, unencrusted, consistently nodose septate and with distinct clamp connections.

Hymenium of basidia only. Basidia 18–24 μm long, broadly clavate, apex up to 6 μm diam. immediately below the sterigmata, often with irregular swellings below, consistently nodose septate at basal septa, 4-sterigmate; sterigmata up to 6 μm long. Basidiospores elongate to narrowly navicular, frequently clustered in groups of 2–4. 6–8 $\times$ 2–3.5 μm , hyaline, thin-walled, smooth, not reacting with Melzer's reagent.

Material examined: Macquarie Island, Australia; on fronds of *Polystichum vestitum* (G. Forst.) C. Presl, GAL 6503, Rookery Creek above Nuggets, 1995.ii.14; GAL 6598, Head of Rookery Creek, 1995; GAL 6680, Rookery Creek above Nuggets, 1995.iii.14; GAL 6702; Rookery Creek above Nuggets, 1995.iii.14.

Discussion: *Athelopsis lembospora* is often associated with well-decayed lignocellulosic materials whether it is wood or another plant part. It is not unexpected to find it on a substrate such as fern fronds and it might well be found on deteriorating grass in dead tussocks on the Island as well. It is distinguished from other *Athelopsis* species by possessing narrow, often slightly navicular basidiospores that are longer than usually found in *Athelopsis* species and are often found in clusters of 2–4 when viewed microscopically.

2. *Athelopsis subinconspicua* (Litschauer) Jülich, Penoonia 8: 292. 1975. (Fig. 3). = *Athelopsis hypochnoidea* Jülich, Willdenowia 6: 22 1. 1971.

Basidiome broadly effused, smooth, ceraceous, white to pale cream, up to 0.1 mm thick, with a slightly velutinous surface. Margin concolorous, abrupt, undifferentiated.

Subiculum monomitic, only several hypha-lay-

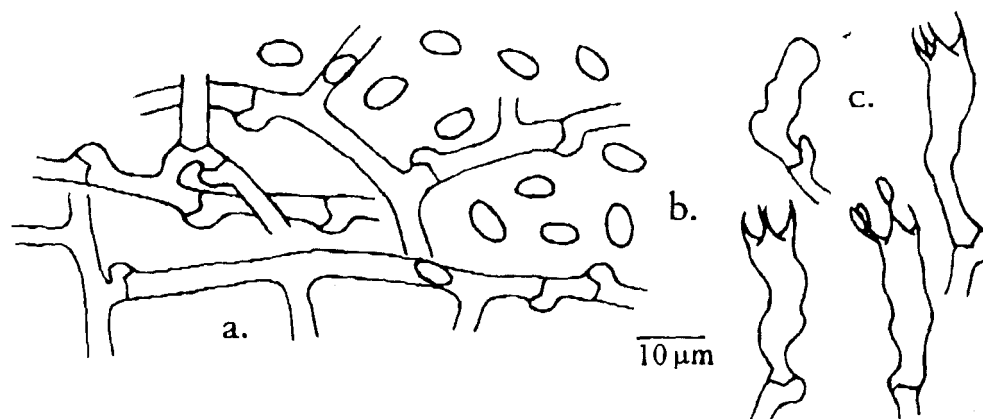


Fig. 3. *Athelopsis subinconspicua* (Litschauer) Jülich. a. subiculum hyphae. b. spores. c. basidia.

ers thick on the substrate surface, hyphae 2.5–5 µm diam., smooth, hyaline, thin walled, consistently clamped, unencrusted.

Hymenium of basidia only. Basidia 18–24 µm long, clavopedunculate to nearly uniform, apex up to 5 µm diam. immediately below the sterigmata, irregularly swollen above the narrowed base, consistently nodose septate at basal septa, 4-stemigmate; sterigmata up to 4 µm long.

Basidiospores clongate to narrowly navicular, 6–8 × 3–4.5 µm, hyaline, thin-walled, smooth, not reacting with Melzer's reagent.

Material examined Macquarie Island, Australia; Rookery Creek and Finch Creek, Sandy B, on *Stilbocarpa polaris* (Homb. et Jacquinol) A. Gray, 1995.IV.08, GAL 7077, GAL 7078.

Discussion: This is the first report of *A. subinconspicua* from the Southern Hemisphere. The specimens examined fit the microscopic description well, but lack the green tint described by Jülich (1971). With so little available material it is not appropriate to describe this taxon as a new species until additional material is collected.

3. *Epithele galzinii* Bres. in Bourdot et Galzin, Bull. Sac. Mycol. France 27: 264. 1911. (Fig. 4).

Basidiome effused on small pieces of fronds and frond petioles, smooth but with a very thin, velutinous texture under a 10 × lens, membranous, white to cream-color, rather adherent to substrate. Margin concolorous, abrupt, undifferentiated.

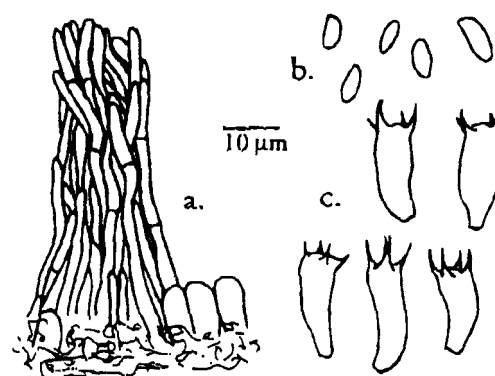


Fig. 4. *Epithele galzinii* Bres. a. hyphal pegs. b. spores. c. basidia.

Subiculum monomitic, up to 100 µm thick, of loosely interwoven hyphae, 2.5–4 µm diam., thin-walled, hyaline, unencrusted, consistently nodose septate, clamp connections difficult to observe, giving rise to aggregations of hyphae oriented perpendicular to the substrate that protrude up to 60 µm, these aggregations up to 25 µm diam., composed of hyphae 2–3 µm diam., thin walled, smooth, simple septate, slightly yellow under the microscope.

Hymenium of basidia only. Basidia 15–20 µm long, broadly clavate, apex up to 6 µm diam., consistently nodose septate at based septa, 4-sterigmate; sterigmata up to 6 µm long.

Basidiospores elongate to nearly cylindrical,

7–9 × 2–3 µm, hyaline, thin-walled, smooth, not reacting with Melzer's reagent.

Material examined: Macquarie Island, Australia; GAL 6353, on *Acaena magellanica* (Lam.) Vahl stems, upper herb field, East side of Half Moon Bay 1995.ii.14; GAL 6508, on leaves of *Polystichum vestitum* (G. Forst.) C. Presl., Head of Rookery Creek. 1995.ii.27.

Discussion: *Epithele galzinii* is widely distributed geographically, having been described from material collected in France. Cunningham (1963) reported it from several locations in New Zealand. This appears to be the first report of *E. galzinii* from an Australian territory and extends the southern range of this species by several hundred kilometers. The occurrence on fern parts is consistent with its habitat wherever it is found.

Acknowledgments

This research was supported by grants (INT-9215273) from the National Science Foundation and (AAD No. 678) from the Australian Antarctic Division made to the University of Alaska Fairbanks, Institute of Arctic Biology. We are especially indebted to the Tasmanian National Parks and Wildlife Service and Mr. Geoff Copson for all permits provided to collect fungi and vascular plant species used in our study. We also thank Mr. Alan Redpath, Australian National Antarctic Research Expedition (ANARE) Station Leader, his support and scientific staff for the logistical assistance provided through the AAD, and Dr. Ken Wilson for sample collection and other assistance while on Macquarie Island. Appreciation is extended to Anna McEldowney for SEM sample preparation and photograph preparation (AAD); to Stan Williams for laboratory logistical support, to Dr. R. Terry Bowyer, Head, Dept. Biology and Wildlife, University of Alaska Fairbanks, for administrative support, and to Richard Veazey (Rasmussen Library Media Services) and Ryan L'Herault for figure and plate

preparation and computer enhancement assistance at UAF.

Literature cited

- Copson, G. R. 1984. An annotated atlas of the vascular flora of Macquarie Island. ANARE Research Notes 18.
- Cunningham, G. H. 1963. The Thelephoraceae of Australia and New Zealand. New Zealand Dept. Sci. Indust. Res. Bull. 145, 359 pp.
- Dodge, C. W. 1948. Lichens and lichen parasites. British. Australian and New Zealand Antarctic Research Expedition 1929–1931. Reports. Series O. Zoology and Botany 7, 276 pp.
- . 1968. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. VII.-VIII, Nova Hedwigia 15: 285–332.
- & Rudolph, E. D. 1955. Lichenological notes on the flora of the Antarctic continent and the subantarctic islands. II. Additions to the lichen flora of Macquarie Island. Ann. Missouri Bot. Gard. 42: 137–43.
- Jenkin, J. F. 1972. Studies on plant growth in a subantarctic environment. Ph.D. thesis, University of Melbourne.
- . 1975. Macquarie Island, Subantarctic. In Rosswall, T. & Heal, O. W. (eds.), Structure and Function of Tundra Ecosystems. Stockholm: Ecological Bulletins. 375–397.
- & Ashton, D. H. 1979. Pattern in *Pleurophyllum* herbfields on Macquarie Island (subantarctic). Austrl. J. Ecol. 4: 47–66.
- Jülich, W. 1971. Einige neue oder unbekannte Corticiaceae (Basidiomycetes). Willdenowia 6: 215–224.
- Selkirk, P. M., Seppelt, R. D., & Selkirk, D.R. 1990. Subantarctic Macquarie Island: environment and biology. Cambridge University Press., Cambridge.
- Taylor, B. W. 1955. The flora, vegetation and soils of Macquarie Island. ANARE Reports, Series 6, volume II. Botany. 192 pp.

Accepted 10. IX. 2002