

## ECTOMYCORRHIZAL FUNGI AND NON-AGARICOID BASIDIOMYCETOUS MACROMYCETES OF THE FALKLANDS

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Fifty-one species of basidiomycetes are recorded from the Southern Atlantic archipelago of the Falkland Islands. Several other fungi are discussed in the light of these findings. Some of these fungi are recorded for the first time from the Falklands and especially from some of the smaller islands of the group adjacent to West and East Falkland. The world distributions of the fungi dealt with in this compilation, particularly in the southern hemisphere, are given where they are known. Comments are made on the possible reasons for the occurrence of the species in the Falklands, especially the ectomycorrhizal taxa.

*Keywords.* Basidiomycota, biodiversity, ectomycorrhizal, saprotrophs, southern hemisphere, subantarctic.

### INTRODUCTION

This is the second contribution in a series of papers covering the mycota of the South Antarctic Falkland archipelago. Until this study was undertaken records of the fungi of the area were rather sparse. Pegler *et al.* (1980) documented 31 species including those recorded by previous workers; this was later added to by Jalink & Nauta (1993). Watling & Richardson (2010) were more specific and dealt only with the coprophilous fungi, many being found on rabbit droppings, goose dung and dung of domesticated farm stock such as horse, cattle and sheep. They recorded 97 species, bringing the total number of species recorded to 199. This figure falls short of that based on the collections made by Tom Eggeling and his collaborators during the period 1997–2009. From these collections some 466 species are indicated for the Falklands, including those addressed below. Unfortunately a handful of these 466 are only designated to a genus or affinity to a known taxon because of insufficient or inadequate material. Eggeling, whilst resident in the Falklands, was able to collect most of the year round and his collections are the subject of this series. The present part deals with ectomycorrhizal species and non-agaricoid basidiomycetes and adds considerably to the previously known mycota.

The present account, in parallel to the majority of coprophils, deals with another group of mainly introduced fungi. There is little doubt that many of them have been introduced with their tree hosts or with woody substrates. The grassland species may

in fact represent a native mycota, a concept which will be expanded within a later paper. In Eggeling's notes attached to many included species are the terms 'common' or even 'very common' and 'widespread'. This suggests that the fungi involved might have relatively rapidly colonised sites and even spread.

#### MATERIALS AND METHODS

Unless otherwise stated T. Eggeling is the collector of the material. Except for the recent collections by Richard Lewis, all collections have been given an Eggeling reference number. A map of the area is included in the first paper of the series (Watling & Richardson, 2010) and a coloured map showing the sites in the archipelago is found in Liddle (2007). All but a few of the most common species are housed in the herbarium of the Royal Botanic Garden Edinburgh, Scotland, except recent collections made by R. Lewis, which are housed in the Royal Botanic Gardens, Kew, London. The material was collected and processed by T. Eggeling as outlined in Henderson *et al.* (1969) and short descriptions were made of the habitat and field features.

#### NATURAL COMMUNITIES

The original natural vegetation of the Falkland Islands probably resembled that of an Atlantic heath of the northern hemisphere, covered in dwarf shrub heath and upland grassland of parallel but endemic species and with valleys densely clothed in plants such as *Chilotrichum diffusum* (G.Forst.) Kuntze (Asteraceae).

Although some areas still support the natural plant cover of tussock grass (*Poa* (*Parodiochloa*) *flabellata* (Lam.) Raspali; Poaceae), the fern *Blechnum magellanicum* Desv. (Polypodiaceae), *Cortaderia pilosa* (d'Urv.) Hack. (Poaceae) grassland or *Empetrum rubrum* Vahl (Empetraceae), *Gaultheria pumila* (L.f.) D.J.Middleton (Ericaceae) and *Baccharis magellanica* (Lam.) Pers. (Asteraceae) heath, such plant communities have been greatly modified, especially through the introduction of livestock and the improvement of the soil for the encouragement of richer pastures. Some of the plant associations, such as the *Hebe* shrub assemblage, are now largely confined to inaccessible areas. This is in part because of the invasion from introduced plants such as gorse (*Ulex europaeus* L.) but also due to the development of gardens around habitation. The latter has supplied a very different and rich array of substrates unknown until humans settled. Thus eucalypts, willows, rowans and pines are just a few of the non-native phanerogams which are now found in the Falkland Islands. Many of the fungi recorded are associated with these anthropogenic activities. Although it has been possible to address the question of what might grow with members of the native flora, any future work needs to concentrate not on the homesteads and man-made communities, as done by many visiting collectors to the islands, but on the remnants of the natural vegetation. Further information is given in Watling & Richardson (2010).

## RECORDS OF FUNGI

Abbreviations employed are E.F.: East Falkland; W.F.: West Falkland; TWE: T.W.Eggeling. The numerical TWE code refers to the numbers given to the collections by Tom W. Eggeling whilst in the Falkland Islands, and if there is more than one collection under that number a secondary number has been given, for example -01, -02; see *Podoserpula* below.

## PUTATIVE ECTOMYCORRHIZAL FUNGI

## Agaricales

*Hymenogastraceae****Hebeloma crustuliniforme*** (Bull.: Fr.) Quél.

This is a fairly widespread agaric of both natural and planted woodland in the northern hemisphere, known from European, Asiatic and New World plant assemblages. It is known from Australia (May *et al.*, 2003) and New Zealand (Gadgil, 2005). No *Hebeloma* spp. are recorded from Tierra del Fuego (Horak, 1979), although the present taxon is known from Argentina (Wright & Albertó, 2002). Of the two collections from the Falklands at least the first was associated with the 2-needled *Pinus contorta* Douglas ex Loudon, a North American species, in a garden (TWE 3524, Snake Hill, Stanley, E.F., 442/4172, 1 iv 2000 & TWE 5103, same locality, 13 iv 2008 – both collected by Manfred Keenleyside). This species has most certainly been introduced with exotic plantings.

***Hebeloma leucosarx*** P.D.Orton

This agaric was recognised as distinct from *Hebeloma crustuliniforme*, to which it is similar, by Orton (1960) and has undoubtedly been included in the concept of that species. The distribution in the southern hemisphere is unknown but in Europe it is a widespread species generally of rather damp woodland. In the Falklands it was on soil and amongst leaf litter under *Salix* in improved grassland (TWE 3493, near Manager's House, Teal Inlet, E.F., 442/0087, 26 vi 2002; TWE 3647, near Wind Pump, Darwin, E.F., 342/6558, 29 iv 2000). This species has undoubtedly been introduced with arborescent salices.

***Hebeloma mesophaeum*** (Pers.) Quél.

A common and widespread member of the genus in the northern hemisphere and generally associated with *Betula* and *Salix*. It is a rather variable species and it is represented in Australia by the type variety and several forms (May *et al.*, 2003), although not known from New Zealand. This species has been found growing in the Falklands under *Sorbus aucuparia* L. and *Salix* in improved grassland (TWE 3567, Manager's House, Teal Inlet, E.F., 442/0087, 26 vi 2002 & TWE 3568, same locality and date – both collected by Manfred Keenleyside). Material agreeing with *Hebeloma mesophaeum* var. *crassipes* Vesterh., which differs in its sturdier build, was found in gardens at both 36 Davis Street (TWE 5133, 442/4072, 29 iv 2008, coll. Megan Eggeling) and 22 Ross Street (TWE 5202, 442/4072, 22 v 2008, coll. Greta Skene), both in Stanley, E.F. This variety is what was previously thought to be *Hebeloma fastibile* (Pers.) P.Kummer *auct. Europ.* In parallel to the other *Hebeloma* spp. noted it undoubtedly has been introduced to the Falkland Islands.

## Boletales

### *Coniophoraceae*

#### **Hygrophoropsis aurantiaca** (Wulfen: Fr.) Maire

This species is one of the most frequently recorded agarics for the Falkland Islands, paralleling a similar abundance to that in Europe and North America. It is widely distributed and often very common in the many sites where it occurs, especially with planted exotic conifers in the northern hemisphere; it frequents a wide range of natural plant communities. It is well known in Australia (May *et al.*, 2003) but not New Zealand. In the Falkland Islands it is known from natural communities associated with endemic phanerogams, for example *Bolax gummifer* (Lam.) Spreng. and *Baccharis magellanica*, and in short grass; however, it occurs in a wider range of grassland habitats in the Falklands than elsewhere (TWE 3088, on cushion-top, with *Bolax gummifer*, dwarf shrub heath, Mount William, E.F., 442/347, 17 v 1998; TWE 3100, with *Baccharis magellanica*, dwarf shrub heath, near Gypsy Cove, Cape Pembroke, E.F., 442/4474, 28 ii 1999; TWE 3134, improved grassland, racecourse, Stanley, E.F., 442/3972, 7 iv 1999, coll. Megan Eggeling; TWE 3163, south of racecourse, Stanley, E.F., 22 iv 1999; TWE 5047, racecourse, Stanley, E.F., 442/3872, 4 iv 2008; TWE 3168, acid grassland, Sapper's Hill, Stanley, E.F., 442/3871, 24 iv 1999; TWE 3375, amongst short grass and mosses, south of golf course, Stanley, E.F., 442/3772, 25 ii 2000; TWE 3435, horse dung enriched improved grassland, west of Gardener's Cottage, Stanley, E.F., 442/3972, 14 iii 2000; TWE 3453, short grass in garden, adjacent to Tax Office, Stanley, E.F., 442/4072, 20 iii 2000 & TWE 3454, on lawn, garden, Snake Hill, Stanley, E.F., 442/4172, 20 iii 2000 – both collected by Manfred Keenleyside; TWE 3474-02, in short grass, Teal Inlet, E.F., 442/0087, 2 iv 2000 & TWE 3533, 26 iii 2000 – both collected by Manfred Keenleyside; TWE 3476, acid grassland with *Cortaderia pilosa*, Moody Brook Valley, E.F., 442/3672, 26 iii 2000, coll. David Broughton; TWE 3577, on goose grazed coastal greens, Fairy Cove, E.F., 442/3973, 15 iv 2000; TWE 3871-01, improved grassland, near Settlement, Goose Green, E.F., 342/6456, 29 iv 2001, legit Manfred Keenleyside; TWE 5046, in garden, Snake Hill, Stanley, E.F., 442/4172, 2 iv 2008, legit Manfred Keenleyside; TWE 5055–5057 on peaty soil, Fitzroy, E.F., 442/1461, 442/1461 & 442/1361, all 6 iv 2008; TWE 5070, on peaty soil, in dwarf shrub heath, Ghost Peat Banks, Teal Inlet, E.F., 442/0180, 6 iv 2008, coll. Manfred Keenleyside; TWE 5161, in tussock, East Island, Bluff Cove, E.F., 6 v 2008, (-01, -02, -04) 442/2561, 442/2562 & 442/276). *Hygrophoropsis aurantiaca* var. *pallida* Cooke is also known from Falkland, differing in the overall paler colour but otherwise similar. It has been recorded from acid grassland, coastal greens, shelter belts and dwarf shrub heath much the same as *Hygrophoropsis aurantiaca* var. *aurantiaca*. Its distribution elsewhere is much the same as the type variety (TWE 3171, on gravelly peat, Sapper's Hill, Stanley, E.F., 442/3871, 24 iv 1999; TWE 3195, Moody Brook, E.F., 26 iv 1999, coll. Manfred Keenleyside; TWE 5134, near FIPASS, Stanley, E.F., 442/4372, 30 iv 2008, coll. Megan Eggeling; TWE 5161-03, East Island, Bluff Cove, E.F., 442/2661, 6 v 2008; TWE 5177, North Shelterbelt, Abattoir, Sand Bay, E.F., 442/3269, 11 v 2008; TWE 5208, near shore, Long Island, E.F., 442/3283, 25 v 2008; TWE 5284, east of trig. pt., Bleaker Island, E.F., 342/6910, 29 vi 2008, coll. Megan Eggeling).

#### **Hygrophoropsis macrospora** (D.Reid) Kuyper

This species is very close to *Hygrophoropsis aurantiaca* and undoubtedly has been confused with it in the past as it differs mainly only in its larger basidiospores and paler colours. Its distribution is poorly known even in Europe because of confusion between it and *Hygrophoropsis aurantiaca*. *Hygrophoropsis macrospora* is not recognised as distinct by many workers. A single record agreeing with this species has been found under *Pinus contorta* in Falkland (TWE 5251-01, in shelter belt, Fitzroy, E.F., 442/1361, 6 vi 2008).

*Gomphidiaceae: Suilloideae***Suillus luteus** (L.: Fr.) Roussel

A widespread and common boreal European, Asiatic and New World bolete associated with members of the Pinaceae. It is familiar to European mycologists growing with the 2-needled *Pinus sylvestris* L. but in North America it is considered more a plantation associate. It has been recorded growing with the 2-needled *Pinus contorta* used in shelter belts and as a plantation crop in many parts of the world. This bolete has been extensively introduced to many countries in the southern hemisphere, including Australia, New Zealand and South America (Watling & Li, 1999; Gadgil, 2005). It is the commonest bolete in the Falklands. Records of this bolete are known from garden grounds and shelter belts, Govt. House, Stanley, E.F., 442/3972, iv 1986, coll. Ian J. Strange, det. D.A. Reid; TWE 3510, Manager's House, Teal Inlet, E.F., 442/0087, 1 iv 2000; TWE 3781, west of Community School, Stanley, E.F., 442/3972, 15 xii 2000 & TWE 3831, 4 ii 2001; TWE 3853, west of Govt. House, Stanley, E.F., 442/3972, 10 iii 2001; TWE 5064, fern bed in shelter belt, north of Black Rincorn, Fitzroy, E.F., 442/1361, 6 iv 2008; TWE 5104, on lawn, 36 Davis St., Stanley, E.F., 442/4072, 15 iv 2008; TWE 5138, lawn, Memorial Wood, Stanley, E.F., 442/4172, 30 iv 2008, coll. Megan Eggeling; TWE 5170, in grass, Dean St., Stanley, E.F., 442/4172, 9 v 2008, coll. Fiona Wallace-Nannig; TWE 5178, in grass, North Shelterbelt, Abattoir, Sand Bay, E.F., 442/3269, 11 v 2008; TWE 5199, shelter belt, Saladero, E.F., 342/5767, 17 v 2008. The late Bobby Tulloch also recorded this species from East Falkland in 1992 (pers. comm.) whilst carrying out bird monitoring.

A single collection of this species in a fern bed possibly associated with the 3-needled *Pinus radiata* D. Don has been noted for Falkland (TWE 5028, Memorial Wood, Stanley, E.F., 442/4172, 15 iii 2008). *Pinus radiata* is also of North American origin and although of restricted natural distribution in California it is planted extensively as a plantation tree in Australia, New Zealand and South America where *Suillus luteus* is often an associate. Collections under unidentified *Pinus* sp. are TWE 5224, in garden, Manager's House, Teal Inlet, E.F., 442/0087, 1 vi 2008 and RL 0736, in coniferous woodland, Memorial Wood, Stanley, E.F., 442/4172, 25 ii 2009, coll. Richard Lewis. Some collections where the material is not in the best of preservation are TWE 3189, 3190 & 3191, valley greens, east of Teal Inlet, East Falkland, 442/0087, 25 iv 1999; woodland west of Community School, Stanley, E.F., 442/3972, x 1992; see Jalink & Nauta (1993). There is very little doubt that these collections represent *Suillus luteus* and the records, if considered correct, extend the distribution of *S. luteus* in the Falklands.

**Suillus punctatipes** (Snell & E.A. Dick) Singer

This is a member of the *Suillus granulatus*-consortium, differing from the rather more common and widespread European *S. granulatus* in the arrangement of the pores and rather more developed glandular patches on the stipe; they are difficult to distinguish when only rather mature dried material is presented. Described originally from North America it is also recorded from Australia (Watling & Gregory, 1988). This species is recorded with hesitation (TWE 3192, under *Pinus contorta*, Manager's House, Teal Inlet, E.F., 442/0087, 25 iv 1999). *Suillus punctatipes* will have undoubtedly been introduced with exotic Pinaceae. It might be expected that *Suillus granulatus* would appear in the Falklands, again introduced with exotic pines, as it is a relatively common species and has a wider host range than the annulate *S. luteus*; it has been recorded from SE Asia, Australia, New Zealand (McNabb, 1968) and South America. Corner (1972) surprisingly records *Suillus granulatus* in native forest in Malaysia well away from conifers.

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*Paxillaceae****Paxillus involutus*** (Batsch: Fr.) Fr.

This species is a widespread and common agaric found in various boreal European, Asiatic and New World plant communities. It is now known to be a species complex, which is presently being assessed by molecular means; the wide interpretation adopted in most current texts is taken herein. This fungus in its widest sense possesses an extensive host range covering arborescent angiosperms in addition to coniferous elements. It has been introduced to many countries in the southern hemisphere including Australia (Watling & Gregory, 1991; Watling & Li, 1999) and Argentina (Wright & Albertó, 2002); surprisingly it does not appear for New Zealand in Gadgil (2005), although recorded from there by McNabb (1969).

A single collection has been made in the Falklands amongst bryophytes under conifers (TWE 5165, Memorial Wood, Stanley, E.F., 442/4172, 30 iv 2008, coll. Megan A. Eggeling). It has not been possible to distinguish to which micro-species this collection belongs.

*Serpulaceae****Austropaxillus contulmensis*** (Garrido) Bresinsky

This paxilloid agaric was described from Chile from under *Nothofagus* (Garrido, 1988) and appears to be restricted to the southern hemisphere. *Austropaxillus* is equivalent to *Paxillus* in the northern hemisphere, except where the latter has been introduced with exotic plantings south of the equator. It is doubtful as to whether *Austropaxillus contulmensis* is native to the Falklands, occurring as it does under *Pinus contorta*, but only further work will clarify this (TWE 5027, in fern bed under *Pinus contorta*, Memorial Wood, Stanley, E.F., 442/4172, 14 iii 2008; in shelter belt, north of Black Rincon, Fitzroy, E.F., 442/1361, 6 iv 2008). This species is similar to *Paxillus muelleri* Berk. and *P. infundibuliformis* Cleland, both species being well represented in Australia (Watling & Gregory, 1991; Watling & Li, 1999; May *et al.*, 2003), and to the complex around *Paxillus statuum* (Speg.) Singer, known from Tierra del Fuego (Horak, 1979). A collection has been made of the superficially similar European *Paxillus involutus* (see above) in the same locality as *Austropaxillus contulmensis*. However, microscopic features distinguish the two fungi. At present in Europe several entities have been recognised within *Paxillus involutus*, encompassing some of the features of *Austropaxillus contulmensis*, so molecular analysis is urgently required using Falkland material.

**Hydnangiales***Hydnangiaceae****Hydnangium carneum*** Wallr.

This hypogeous false truffle is associated with eucalypts both in its native Australia and often where eucalypts have been planted in both southern and northern hemispheres. It was amongst roots associated with introduced eucalypts in Falkland (TWE 3045 & 3154, 1, Jeremy Moore Avenue, Stanley, E.F., 442/3972, 3 iv 1998 & 17 iv 1999). This find in the Falklands is its most southerly latitude.

***Laccaria laccata*** (Scop.: Fr.) Cooke

This agaric has an enormously wide distribution and is a component of many different plant assemblages ranging from sea level to mountain tops. Some infraspecific variation has been recorded. It is common in both southern and northern hemispheres where it occurs in natural communities and with introduced arborescent vascular plants. This is a pioneer fungus having

been found forming sheathing mycorrhizas with many colonising plants. The present material is associated with pines and willows and is known from gardens and shelter belts in Falkland (TWE 3569, under *Salix*, garden ground, near Manager's House, Teal Inlet, E.F., 442/0087, 9 iv 2000, coll. Manfred Keenleyside; TWE 3669, under *Salix*, 8 Ross Rd. South, Stanley, E.F., 442/3972, 17 v 2002, coll. Phyl Randell; TWE 5201-01, on peaty soil under *Pinus radiata*, 22 Ross Rd. East, Stanley, E.F., 442/4272, 22 v 2008, coll. Greta Skene; TWE 5203, same locality and collector, and under same host; TWE 5221 & TWE 5223, in fern bed under *Pinus contorta*, Estancia, E.F., 442/1977, 1 vi 2008). *Laccaria tetraspora* Singer is very closely related and often synonymised with *L. laccata*; it is recorded from Argentina (Wright & Albertó, 2002) and from Tierra del Fuego (Horak, 1979). The two other species from Tierra del Fuego are *Laccaria echinospora* (Speg.) Singer and *L. galerinoides* Singer and these might be expected ultimately to be found in the Falklands.

#### **Laccaria proxima** (Boud.) Pat.

This species is no less widespread in its distribution than *Laccaria laccata* but is less common. In Europe it is probably most frequently associated with planted conifers, although a form often separated out as a distinct taxon, *Laccaria proximella* Singer, is found in montane to arctic communities. *Laccaria proxima* is recorded from under conifers in Falkland (TWE 3563, under *Pinus contorta*, Brenton Loch, E.F., 342/5766, 9 iv 2000, coll. Aidan Kerr; TWE 5074, under *Cupressus macrocarpa* Gord. in garden, Brandon Rd. West, Stanley, E.F., 442/4072, 9 iv 2008, coll. Helen Otle; TWE 5176, under *Pinus contorta* in shelter belt, Abattoir, Sand Bay, E.F., 442/3269, 10 ii 2008; TWE 5248, under *P. contorta* in shelter belt, Fitzroy, E.F., 442/1361, 6 vi 2008). The Falkland material represents the type variety. *Laccaria proxima* differs from *L. laccata* in the distinctly ellipsoid as opposed to spherical basidiospores and generally is of a larger size, and possesses a roughened stipe and usually raphanoid odour.

### **Thelephorales**

#### *Thelephoraceae*

#### **Thelephora terrestris** Ehrh. ex Willd.

This is a very common earth fan usually associated with conifers on mineral soils, either in plantations or in natural plant assemblages. It is considered to have a wide host range and is widespread in both hemispheres. There are many records from Australasia, including Australia and New Zealand (Cunningham, 1963; Corner, 1968). There is a single record from Falkland (TWE 5181-01, on peat, associated with *Pinus contorta*, North Shelterbelt, Abattoir, Sand Bay, E.F., 442/3269, 11 v 2008).

### SAPROTROPHIC FUNGI

#### Hymenomycetous Heterobasidiae

#### **Dacrymycetales**

#### *Dacrymycetaceae*

#### **Dacrymyces stillatus** Nees

This is a very common and widespread jelly fungus growing on woody debris on the forest floor or in shrubberies or on worked wood (especially door jambs, garden sheds and fences generally of coniferous nature). It is known from both hemispheres, including Australia (May *et al.*, 2003). It has been found on dead wood in Falkland (TWE 3451, near FICS, Stanley, E.F., 442/3972, 16 iii 2000; TWE 3637, north side of Bay, Darwin, E.F., 342/6558, 29 iv 2002,

coll. Megan Eggeling). However, in Falkland *Dacrymyces stillatus* is apparently more frequent on imported and dressed wood than on woody debris (TWE 3246, near FICS, Stanley, E.F., 442/3972, 17 v 1999; TWE 5200-01, Sapper Hill, Stanley, E.F., 442/3871, 21 v 2008; TWE 5201-02, in built-up area, Fire Station, Stanley, E.F., 442/4072, 22 v 2008; TWE 5310, built-up area, Seaman's Centre, FIPASS, Stanley, E.F., 442/4372, 6 vii 2008). All the collections above are predominantly in the anamorphic stage. A further collection on branches of the introduced *Ulex europaeus* recorded by Jalink & Nauta (1993) is probably this taxon. It is likely to have been introduced to the Falklands with timber.

## **Tremellales**

### *Exidiaceae*

#### **Exidiopsis effusa** (Sacc.) F.H.Moeller

Although this species appears to be widespread in Eurasia it is poorly documented because of its vague shape, slightly coriaceous texture and almost transient basidiomes. This jelly fungus is not recorded from Australia or South America. There is a single record from Falkland (TWE 3710, on deciduous wood, in garden, Manager's House, Teal Inlet, E.F., 442/0087, 2 vii 2000). This species has probably been introduced with the substrate.

### *Tremellaceae*

#### **Tremella mesenterica** Retz.

This jelly fungus is common and widespread in the British Isles, especially on old stems of *Ulex europaeus* on which it was also most commonly found in Falkland. It is known from Australia, New Zealand and Argentina; there are records from North and Central America – Costa Rica (Martin, 1952). All but one collection from Falkland are on branches or twigs or both of *Ulex* (TWE 3078, airstrip, Port Howard, W.F., 342/2678, 24 iv 1998; TWE 3182, east of Teal Inlet, E.F., 442/0087, 24 v 1999; TWE 3307, Westerley, Hill Cove, W.F., 242/7582, 29 xii 1999; TWE 3008, Purvis House, Port Howard, W.F., 342/2097, 1 i 2000; TWE 3456, Stevenson's Paddock, Stanley, E.F., 442/3672, 23 iii 2000 & TWE 3854-01, 10 iii 2001; TWE 3511, near Manager's House, Teal Inlet, E.F., 442/0087, 1 iv 2000; TWE 3613, Memorial to H. Jones, Darwin, E.F., 342/6458, 29 iv 2000; TWE 3733, valley east of Cemetery, Darwin, E.F., 342/6458, 22 vii 2000; TWE 3735, near Old Water Pump, Darwin, E.F., 342/6458, 22 vii 2000; TWE 3756, Govt. House, Stanley, E.F., 442/3972, 28 viii 2000; TWE 3803, by Settlement, New Island, W.F., 242/0360, 31 xii 2000). A single record has been made on branches of *Sorbus* sp. in garden (TWE 5227, Manager's House, Teal Inlet, E.F., 442/0087, 1 vi 2008).

This fungus has possibly been introduced along with its non-native hosts. However, in New Zealand (McNabb, 1966) it is found on both native and introduced plants, and in Australia occurs predominantly on ornamental introductions.

## **Hymenomycetous and Gasteromycetous Basidiomycetes**

### **Agaricales**

#### *Physalacriaceae*

#### **Cylindrobasidium laeve** (Pers.: Fr.) Chamuris

This corticioid member of a mainly agaricoid order is rather widespread in the northern hemisphere and is recorded from Australia, although apparently not New Zealand

(Cunningham, 1963). Originally it was identified from the Falklands under the synonym *Cylindrobasidium evolvens* (Pers.) Jülich (TWE 3376, on stems of *Chilotrichum/Baccharis*, near Estancia Brook, E.F., 442/2176, 26 ii 2000).

### *Favolaschiaceae*

#### **Favolaschia**

Members of this genus have been generally classified as aphylophoroid fungi (Singer, 1974) because of the presence of a poroid hymenophore and acanthophysoid sterile cells. However, some structural studies complemented with molecular analyses show its true position is within the tricholomatoid fungi and it will therefore be dealt with in a later part of the series. *Favolaschia horakii* Watling on the haulms of *Poa* (*Parodiochloa*) *flabellata* is described from the Falklands (Watling, 1999) and two collections of an unidentified species growing on *Ulex europaeus* have been made.

### *Lycoperdaceae*

#### **Bovista aestivalis** (Bonord.) Demoulin

This species, often recorded under *Lycoperdon polymorphum* Vittad., is known from the western Atlantic seaboard to Central Europe extending to Turkey and Pakistan (Kreisel, 1967). It is also known from Australia (May *et al.*, 2003). This puffball is represented by a single collection from Falkland (TWE 3342, in coastal green north of 'Lady Elizabeth', Cape Pembroke, E.F., 442/4473, 18 ii 2000), although Jalink & Nauta (1993) note a collection close to this species.

#### **Bovista brunnea** Berk.

This fuzzball is known only from the southern hemisphere, being recorded from Chile and Argentina, Australia and New Zealand (Kreisel, 1967). In Falkland it is found amongst grass in coastal greens (TWE 3023, Sand Grass Bay, Rincon Grande, E.F., 443/1003, 10 i 1998; TWE 3900, Bertha's Beach, E.F., 442/0550, 12 v 2001).

#### **Bovista dermatoxantha** (Vittad.) De Toni

This grassland species is widespread but nowhere common, and is most often recorded under the synonym *Bovista pusilla* (Batsch: Pers.) Pers. It is recorded from Brazil and Argentina in addition to Puerto Rico, Colombia and French Guinea and is known from Australia. It is widespread in Europe (Kreisel, 1967). In the Falklands it is found in coastal greens, except where indicated (TWE 3022, Sand Grass Bay, Rincon Grande, E.F., 443/1003, 10 i 1998; TWE 3057, northeast end of Bertha's Beach, E.F., 442/0751, 4 iv 1998; TWE 3145, improved grassland, near Settlement, Bleaker Island, E.F., 342/7314, 13 iv 1999; TWE 3547, Elephant Beach, Cape Dolphin, E.F., 343/7006, 8 iv 2000; TWE 3888-01, & -02, Bertha's Beach, E.F., 442/0449 & 442/0550 respectively, 12 v 2001; TWE 5006, sandy soil, east of 'Lady Elizabeth', Cape Pembroke, E.F., 442/4573, 7 ii 2008; TWE 5014, valley greens, south of track to Bertha's Beach, E.F., 342/0249, 23 ii 2008; TWE 5016, on peaty soil, southwest end of Bertha's Beach, E.F., 342/0449, 23 ii 2008; TWE 5023, playing fields built-up area, Mt. Pleasant Airport, E.F., 342/0056, 1 iii 2008; TWE 5111, sandy soil in neutral grassland, northeast of airport, Cape Pembroke, E.F., 442/4773, 19 iv 2008).

#### **Bovista limosa** Rostr.

This fuzzball is known from the Falklands based on a collection with *Cotula scariosa* (Cass.) Franchet (TWE 5052, sandy soil, Shell Point, Fitzroy, E.F., 442/1460, 6 iv 2008). It is

characterised by favouring rather dry, often calcareous sandy soils amongst lichens and mosses. It is not recorded from Australia or New Zealand. It is rare in North America and even restricted in distribution in those countries in Europe where it is found. This species is also known from Greenland, which may indicate a bipolar distribution.

***Bovista nigrescens* Pers.**

This is a common and widespread fuffball and undoubtedly more common in the British Isles than the next species. It is recorded from throughout Europe but not from Australia or New Zealand nor from South America. Based on basidiospore morphology alone a possible collection of this species is noted by Jalink & Nauta (1993).

***Bovista plumbea* Pers.**

This is a rather common and widespread grassland fuffball, often in similar localities to *Bovista nigrescens*. It is known from Algeria and throughout Europe, including Russia west to Turkey and Iraq; it is also recorded from North America and from New Zealand but not Australia (Kreisel, 1967). There are two collections from Falkland (TWE 3549, on peaty soil in valley greens, south of track to Bertha's Beach, E.F., 342/0249, 23 ii 2008; TWE 5168, on peaty soil in coastal green, Tussac Point, Cape Pembroke, E.F., 442/4374, 10 v 2008).

***Calvatia gigantea* (Batsch) Lloyd**

This is a widespread puffball often associated with anthropogenic activity; it is for instance common around derelict crofts in Scotland, farmyards and margins of refuse tips in other areas of the British Isles. It might therefore be expected to be more common around the sheep corrals in the Falklands. It appears to be a cosmopolitan species, ranging from boreal areas of Europe to subtropical sites (Pilát, 1958); it is recorded from Australia. Two collections by Elinor Vallentin (1909–1911) from Shallow Bay, West Falkland (EV0045 & 0046: 242/99) are noted in Cotton (1915).

***Lycoperdon ericaeum* Bonord.**

The distribution of this puffball outside Europe is very poorly understood. There is a single record agreeing with the published descriptions from a grassland area in Falkland (TWE 3150, improved grassland, near Settlement, Bleaker Island, E.F., 342/7314, 13 iv 1999).

***Lycoperdon excipuliformis* Pers.: Pers.**

This puffball is recorded from grasslands, including those in alpine areas, and even from woodland. Although recorded only recently from Australia it is widespread as a Euroasiatic puffball (Pilát, 1958). It was originally described in *Lycoperdon* but in many European and Australian checklists it will be found under *Handkea* or even *Calvatia*. However, molecular work by Larsson & Jeppson (2008) has clearly shown this fungus must be returned to its original genus. There is a single record for the Falkland archipelago (Jalink & Nauta, 1993).

***Lycoperdon lilacinum* (Berk. & Mont.) Masee**

A mainly southern puffball, although also recorded from continental Europe. In North America, where it is recorded as *Calvatia cyathiformis* (Bosc.) Morgan (Zeller & Smith, 1964), it is reported as being one of the commonest species of *Calvatia*. In Australia May *et al.* (2003) keep these two species separate based on a record of Grgurinovic (1997). Under *Calvatia cyathiformis* this fungus is noted from the Falklands by Jalink & Nauta (1993) but it was earlier recorded as *Lycoperdon lilacinum* in Cotton (1915) based on a collection by Elinor Vallentin (1909–1911) from Roy Cove, 242/68, W.F. More recent collections, also from West Falkland, are TWE 3123 & 3124, coastal greens, Elephant Bay, Pebble Island, W.F., 343/1912,

21 iii 1999. It is closely related to *Lycoperdon utriformis* (see below) and, although previously placed in *Calvatia*, must be returned to the genus *Lycoperdon*.

#### ***Lycoperdon lividum* Pers.**

Throughout its distribution this is a common puffball, mainly occurring in sandy grasslands. It is recorded from Europe under the synonym *Lycoperdon spadiceum* Pers. and is also known from Australia but apparently not from North America (Coker & Couch, 1928). Two collections of *Lycoperdon lividum* have been made from coastal greens in Falkland (TWE 3898, Bertha's Beach, E.F., 442/0851, 12 v 2001; TWE 5079, Sussex Creek, Port Sussex, E.F., 342/6274, 13 iv 2008), one collection from dwarf shrub heath (TWE 3268, Cape Pembroke, E.F., 442/4773, 12 vi 1999) and another from valley greens (TWE 5080, near Hell's Kitchen, Port Sussex, E.F., 342/6274, 13 iv 2008).

#### ***Lycoperdon nigrescens* Pers.**

A single putative collection probably of this species, under the synonym *Lycoperdon foetidum* Bonord., is noted in Jalink & Nauta (1993).

#### ***Lycoperdon turneri* Ellis & Everh.**

This is a boreal to cool temperate species, recorded most frequently from Europe and Arctic areas as *Calvatia tatrensis* Hollos. It is unknown from Australia but is well represented in Greenland and northern areas of Europe and North America; it becomes less frequent in western areas with, for instance, only a single recent record from Scotland. It is known from coastal and valley greens and neutral grassland (TWE 5019, sandy peaty soil, northeast end of Bertha's Beach, E.F., 342/0650, 23 ii 2008; TWE 5051, Shell Point, Fitzroy, E.F., 442/1460, 6 iv 2008; TWE 5077, with *Cotula scariosa*, Sussex Creek, Port Sussex, E.F., 342/6273, 13 iv 2008; TWE 5096, with *Cotula*, northeast of Old Shanty Ridge, Port Sussex, E.F., 342/6573, 13 iv 2008; TWE 5110, northeast of airport, Cape Pembroke, E.F., 442/4773, 19 iv 2008; TWE 5128, southwest end of Bertha's Beach, E.F., 442/0347, 20 iv 2008 & Yorke Bay Road, Cape Pembroke, E.F., 442/4574, 25 ii 2009, coll. Richard Lewis 1746). The Falkland material agrees with this arctic/subarctic puffball and possibly represents a truly bipolar distribution seen in several other organisms.

#### ***Lycoperdon utriformis* Bull.**

This species is one of the earliest fungi recorded from the Falkland Islands (Berkeley, 1847); it is better known in most texts as either *Calvatia caelata* (Bull.) Morgan or more recently as *Handkea utriformis* (Bull.) Kreisel. This puffball is known from Western and Eastern Europe and from Australia. The work of Larsson & Jeppson (2008), however, shows that it must have a position within *Lycoperdon*, the genus in which it was originally placed. It differs predominantly from *Lycoperdon lilacinum* (Berk. & Mont.) Massee (see above) in the olivaceous gleba. There is a note in Cotton (1915) of a collection by Elinor Vallentin (1909–1911). Recent records from Falkland include TWE 3013-01, coastal green, The Neck, Saunders Island, W.F., 243/7411, 16 xii 1997; TWE 3303, improved grassland, east of Purvis House, Port Howard, W.F., 342/2097, 2 i 2000; TWE 5030, coastal greens, Rookery Sands, near Fanning, E.F., 342/5399, 21 iii 2008; Stanley, E.F., 442/4072, 3 i 2009, coll. Richard Lewis 0324; Goose Green, E.F., 342/6456, 3 i 2009, coll. Richard Lewis 0365.

#### ***Vascellum* sp.**

An immature collection has been examined which may represent *Vascellum pratense* (Pers.: Pers.) Kreisel, a widespread puffball in Europe, Australia, Africa and Asia; it is less frequent in North America. It is often recorded throughout its range under one or other of the synonyms *Lycoperdon hyemale* Bull. and *Vascellum depressum* (Bonord.) Smarda. The Falkland collection is from dwarf shrub heath (TWE 3267, Cape Pembroke, E.F., 442/4873, 12 vi 1999).

### Note

Several collections of immature puffballs have been submitted for examination, which at the moment defy identification. At least four additional species of *Lycoperdon* may be present, two each in East Falkland and West Falkland. Those collections from East Falkland include: TWE 3425, acid grassland, north slopes of Sapper Hill, Stanley, 422/3872, 11 iii 2000, legit Megan Eggeling; TWE 3525, sand-dunes, northwest of airport, Cape Pembroke, 442/4673, 1 iv 2000, coll. Manfred Keenleyside; TWE 3548, coastal greens, Elephant Beach, Cape Dolphin, 343/7006, 8 iv 2000; TWE 3224, coastal greens, east of 'Lady Elizabeth', Cape Pembroke, 442/4573, 11 iii 2000; TWE 3843, coastal greens, near Christina Bay, Cape Pembroke, 442/4973, 18 ii 2001. Those from West Falkland include: TWE 3796, improved grassland, Settlement, Weddell, 242/3143, 28 xii 2000; TWE 3786, acid grassland, Waterfall Valley, Weddell, 242/2943, 26 xii 2000. Fresh collections are required to expand our knowledge of the puffballs of the Falklands; the information above indicates a potentially rich mycota.

### *Typhulaceae*

#### ***Typhula placorrhiza* (Reichardt) Fr.**

This club fungus is widespread but not common anywhere; the subtle dull brown colour of the club and the fact that it is attached to a sclerotium buried amongst leafy debris suggests it has probably been under-recorded over most of its distribution. According to Corner (1950) it is known from temperate areas of Europe, North America and Asia but it is not known from Australia or New Zealand (Corner, 1950; Petersen, 1988). There is a single collection from the Falklands (TWE 3566, leaf litter of *Sorbus aucuparia*, Manager's House, E.F., 442/0087, 9 iv 2000, coll. Manfred Keenleyside) which may have been introduced with plant material as a resting structure, which subsequently produced the fertile club.

### **Atheliales**

#### *Atheliaceae*

#### ***Conferticium* cf. *ochraceum* (Fr.) Hallenb.**

*Conferticium ochraceum* is not well known. It was formerly placed in *Gloeocystidiellum* because of the amyloid spores but differs in the densely packed context, mixture of metuloids and gloeocystidia, ellipsoid basidiospores and lack of clamp-connections (Hallenberg, 1980). The closely related *Conferticium ravum* (Burt) Ginns & G.W.Freeman, which may be confused with *C. ochraceum*, has been recorded from Australia. The present collection is tentatively referred to *Conferticium ochraceum* but it shows some slightly unusual features, including the habitat on *Ulex* stems which is a rather unusual host (TWE 3188, east of Teal Inlet, E.F., 442/0087, 25 iv 1999).

#### ***Radulomyces confluens* (Fr.) M.P.Christ.**

This is a very common and widespread crust fungus and is found on woody debris of a variety of frondose hosts. It is widespread both in Europe and in Australia and New Zealand (Cunningham, 1963). Six collections are known from the Falkland archipelago, all from East Falkland, and three on *Populus* in the same garden (TWE 3105, on poplar, Malvina House Gardens, Stanley, E.F., 442/4072, 15 iii 1999, also TWE 3338, 18 ii 2000 & TWE 3605, 22 iv 2000; TWE 3254, on deciduous wood in garden, 1, Jeremy Moore Avenue, Stanley, E.F., 442/3972, 31 v 1999; TWE 3723, on deciduous wood, Manager's House, Teal Inlet, 442/0087, 15 vii 2000; TWE 3842, on stems of *Ribes rubrum* L., in garden, Tax Office, Stanley, E.F., 442/4027, 13 ii 2001).

## Cantharellales

### *Clavariaceae*

#### **Clavaria fragilis** Holmsk.

This fairy club fungus is found in grassland and is noted for its pure white clubs. It appears in many texts as *Clavaria vermicularis* Fr. This species is generally common in temperate areas of Europe and North America and is also known from Sri Lanka, South Africa, Australia, China, Japan and Indonesia (Corner, 1950). There is a single collection on peaty-sandy soils in a coastal Falkland grassland (TWE 3096, Cape Pembroke, E.F., 442/4973, 2 viii 1998).

#### **Clavulinopsis corniculata** (Fr.) Corner f. **simplex** Donk

*Clavulinopsis corniculata* is a common grassland and open woodland fairy club in Europe and North America; it is also known from Japan and Australia (Corner, 1950) and South America (Corner, 1970). The Falkland collections are referable to *Clavulinopsis corniculata* f. *simplex* Donk, where the clubs are poorly branched, perhaps because of grazing. All the Falkland collections of this species are from coastal grasslands (TWE 5206, near shore Long Island, E.F., 442/3183, 25 v 2008; TWE 5217, south of lighthouse, Cape Pembroke, E.F., 442/5073, 31 v 2008; TWE 5267, near Tussac Point, Cape Pembroke, E.F., 442/4374, 16 vi 2008; TWE 5304, Hardassa Bay, Cape Pembroke, E.F., 442/4374, 6 vii 2008; TWE 5311, southeast of airport, Cape Pembroke, E.F., 442/4872, 20 vii 2008). The globose basidiospores with a large central guttule are characteristic. This form is known from several sites in Europe (Corner, 1950), in addition to Brazil (Corner, 1970).

#### **Clavulinopsis helvola** (Pers.: Fr.) Corner

A widespread and common club fungus known from grasslands in Europe, North America, Japan, South Africa and Australia; it is also known from the Atlantic Islands (Corner, 1950) and Brazil (Corner, 1970). *Clavulinopsis helvola* is less frequently found as terrestrial in woods. All the Falkland collections are from coastal greens (TWE 3072, Lodge, Port Howard, E.F., 342/2578, 24 iv 1998; TWE 3214, west of Christina Bay, Cape Pembroke, E.F., 442/4872, 2 v 1999; TWE 3219, Christina Bay, Cape Pembroke, E.F., 4542/4973, coll. Manfred Keenleyside & TWE 3945, Christina Bay as above, 2 vi 2001; TWE 3946, near Fish Rock, Cape Pembroke, E.F., 442/5073, 2 vi 2001). This species is often recorded erroneously as *Clavaria inaequalis* Fr. This name has been referred by some authors to other taxa so it is best considered a *nomen ambiguum* (Corner, 1950).

#### **Clavulinopsis luteoalba** (Rea) Corner

This fairy club fungus is rather common and widespread in European and North American grasslands and is also known from Japan (Corner, 1950). In Falkland it is found in acid grassland (TWE 3866, east of Hill Head House, E.F., 342/8858, 15 iv 2001, coll. Jill & Les Harris).

### *Sistotremataceae*

#### **Brevicellicium olivascens** (Bres.) K.H.Larss. & Hjortstam

This corticioid member of the family is widespread on a variety of deciduous woods in the northern hemisphere; it is not known from Australia even under *Odontia*, the preferred genus of classical authors. The Falkland collection was on *Ulex europaeus* (TWE 3713, in copse, eastern end of Teal Inlet, E.F., 442/0087, 2 vii 2000).

## Gomphales

### Ramariaceae

#### **Ramaria** sp.

A single collection of an unidentified coral fungus, growing amongst *Blechnum magellanicum*, is recorded by Jalink & Nauta (1993). Members of *Ramaria* are ectomycorrhizal and this collection demands further study, especially if fresh material can be re-found. Species separation is notoriously difficult in this genus and species are often very specific in their preferred habitat.

## Hymenochaetales

### Chaetoporellaceae

#### **Peniophorella praetermissum** (P.Karst.) K.H.Larss.

This crust fungus is common, widespread and rather variable; it may be found on both deciduous and coniferous wood. It is recorded throughout Europe and is known from Australia by a single record (Fryar *et al.*, 1999) but not known from New Zealand (Cunningham, 1963). It is characterised by elongate cystidia, which may have oily apices, and the presence of stephanocysts, considered to be elaborate nematode catching organs. The Falkland material is on stems of *Ulex europaeus* (TWE 3746 & 3749, Moody Brook Valley, E.F., 442/3373, 12 viii 2000). Probably better known in most texts as a member of *Hyphoderma*.

#### **Peniophorella puberum** (Fr.) Karst.

As with *Peniophorella praetermissum*, *P. puberum* is common and widespread. It is characterised in the genus by distinctive strongly ornamented cystidia. It is found on decorticated woody debris of deciduous trees but can occur, although less frequently, on coniferous material. In Europe it has a more northern and western distribution; it is known from Australia (May *et al.*, 2003) and New Zealand (Cunningham, 1963). Two Falkland collections are on branches and stems of *Ulex europaeus* (TWE 3711-02, Moody Brook Valley, E.F., 442/3373, 12 viii 2000; TWE 5107-03, west of Community School, Stanley, E.F., 442/3972, 17 iv 2008) and a third on *Sorbus aucuparia* (TWE 371, Manager's House, Teal Inlet, E.F., 442/0087, 2 vii 2000). This species was formerly placed in *Hyphoderma*.

#### **Rickenella**

Members of this genus have traditionally been assigned to the Agaricales as they are agaricoid in form. A position within the Hymenochaetales is a surprise, even though long, somewhat thickened, hyaline pileo-, caulo-, cheilo- and pleurocystidia are present. A single species, *Rickenella fibula* (Bull.) Raitheh., is recorded from Falkland but the material exhibits such variation it even encompasses what has been called *Gerronema schusteri* Singer. A full discussion is left to a later part in this series when non-mycorrhizal agaricoid fungi are considered. *Rickenella fibula* is recorded from Eurasia, Tierra del Fuego (Horak, 1979) and Australia (May *et al.*, 2003).

## Phanerochaetales

### Phanerochaetaceae

#### **Phanerochaete sordida** (P.Karst.) J.Erikss. & Ryvarden

This is a common and widespread saprotroph on a wide range of woody substrates, especially decayed branches of Fagaceae, although sometimes on *Ulex*; it is rarely found on

coniferous wood. This crust fungus is one of the commonest resupinates in Northern and Western Europe and is recorded from Australia and New Zealand (Cunningham, 1963). Some records appear under the synonym *Peniophora cremea* (Bres.) Sacc. & Syd. This species is rather variable microscopically in its fusiform to cylindrical cystidia with a tapering apex, which may be encrusted or not and shortened or not; the subicular hyphae are relatively thick-walled and branch at right angles and rarely possess clamp-connections. It is recognised by the whitish or cream-coloured hymenial surface (TWE 3527, on twigs on the ground, garden Manager's House, Teal Inlet, E.F., 442/0087, 1 iv 2000). Judging from the habitat it looks as if this fungus has been introduced.

***Phanerochaete velutina* (Fr.) P.Karst.**

This species is common and widespread in Europe on decayed wood of deciduous trees of many kinds, often appearing in the same plant assemblage as *Phanerochaete sordida*; it is rarely on coniferous wood. The Falkland collection is on branches of *Ulex europaeus* (TWE 3750, Moody Brook Valley, E.F., 442/3373, 12 viii 2000). This fungus is characterised by the crystal-covered basal hyphae and distinctive ornamented cystidia. The hymenium becomes dirty reddish in alkaline solutions, unlike the confusingly morphologically similar *Phanerochaete radicata* (Henn.) Nakasone *et al.* (= *P. filamentosa* (Berk. & M.A.Curtis) Burds. *aut. Europ.*), which in contrast turns cherry red with alkaline. *Phanerochaete radicata* is recorded for Australia but, as in Europe, there may be mixed interpretations (May *et al.*, 2003) of these species leading to difficulty in forming a clear picture of their true distribution in the southern hemisphere. *Phanerochaete velutina* is not recorded from New Zealand (Cunningham, 1963). This species has probably been introduced with its substrate to the Falklands.

## Plicaturales

### *Plicaturaceae*

***Podoserpula pusio* (Berk.) D.A.Reid**

This is understandably called the pagoda fungus from its unique structure of tiers of unilateral hymenia dispersed along an erect compacted stipe. It is known from Venezuela (as *Podoserpula pusio* var. *austroamerica* D.A.Reid), New Zealand (as *Podoserpula pusio* var. *tristis* D.A.Reid) and from Australia (*Podoserpula pusio* var. *pusio* and *P. pusio* var. *ellipsospora* D.A.Reid); see Reid (1962). The material from Falkland agrees with the type variety and is illustrated by Watling & Eggeling (2009) based on these specimens. The collections come from a variety of habitats, from haulms of tussock grass (*Poa* (*Parodiichloa*) *flabellata*) to peaty soil in shelter belts and dwarf heath, to cushion-tops in dwarf heath (TWE 5160-01 & -02, in tussock, East Island, Bluff Cove, E.F., 442/2561, 6 v 2008; TWE 5179, N. Shelterbelt, Abattoir, Sand Bay, E.F., 442/3629, 11 v 2008; TWE 5298, dwarf shrub heath, southeast of First Island, Bleaker Island, E.F., 342/7373, 30 vi 2008; TWE 5320, tussac, Stick in the Mud Island, W.F., 242/1347, 5 viii 2008, coll. Helen Otley).

## Poriales

### *Corioloraceae*

***Trametes versicolor* (L.) Pilát**

The so-called turkey tail is very well known from both southern and northern hemispheres, including Australia and New Zealand (Cunningham, 1965); it grows on a range of woody substrates but more rarely on coniferous materials. There is a single early record by Berkeley

(1847) so it is truly surprising that this common lignicolous bracket fungus has not been re-found on the Falklands. Undoubtedly introduced with its substrate.

## Russulales

### *Peniophoraceae*

#### **Peniophora incarnata** (Pers.) P.Karst.

This distinctive, rich pink crust fungus is common and widespread throughout Europe in parks and gardens as well as woodland on a variety of deciduous woods. It is particularly common as a colonist on dead branches of *Ulex europaeus*, the host on which it was found in the Falklands. It is recorded by May *et al.* (2003) from Australia and by Cunningham (1963) from New Zealand. Three collections were on this host with one additional collection from Teal Inlet on unidentified willow (TWE 3745 & TWE 3747, Moody Brook Valley, E.F., 442/3373, 12 viii 2000; TWE 3955, Tin Whistle Gate, Sound House, E.F., 342/4438, 19 ix 2001; TWE 5228, on *Salix*, Manager's House, Teal Inlet, E.F., 442/0087, 1 vi 2008). It was probably introduced along with its host to the Falklands; see *Tremella mesenterica* above for similarities in distribution and host preferences. Apart from the pink hymenial colour this species can be recognised by its lack of brown basal hyphae and the numerous thin-walled sulphocystidia accompanying encrusted cystidia.

### *Stereaceae*

#### **Stereum hirsutum** (Willd.) Gray

This curtain crust is very common and widespread on a variety of angiosperm woods throughout both hemispheres, although it becomes more restricted in host preferences northwards. It is probably one of the commonest crust fungi in Europe and is also known from throughout Asia, Australia (May *et al.*, 2003) and New Zealand (Cunningham, 1963). In Falkland it occurs on a whole range of woody substrates but is much more rarely found on worked wood (TWE 3659, on wood & TWE 3737, on plywood, both in garden 7 Snake Street, Stanley, E.F., 442/4172, 10 v 2000 & 26 vii 2000 respectively, coll. Manfred Keenleyside; also TWE 3752, on *Ulex europaeus*, branches, Moody Brook Valley, E.F., 442/3373, 12 viii 2000). This species is easily recognised by the pale-coloured, tomentose upper surface and yellow-orange hymenium. It is generally considered saprotrophic but may at times act as a weak parasite.

## Trechisporales

### *Trechisporaceae*

#### **Trechispora confinis** (Bourd. & Galz.) Libert

Although overlooked on account of its rather fugacious nature this species is common and widespread on woodland debris of various kinds, ranging from leaf litter, old wood (especially of *Fagus sylvatica* L.), fern debris and even old bracket fungi. When first examined it was thought to be *Trechispora cohaerens* (Schwein.) Jülich & Stalpers, a species with which it was synonymised by some authors, but this latter species grows on coniferous material. Both species are known from throughout Europe, although *Trechispora cohaerens* has a more southern distribution; they are not known from Australia or New Zealand (Cunningham, 1963). In the Falklands it is found on various angiosperm branches (TWE 3526, on *Sorbus aucuparia* branches, Manager's House, Teal Inlet, E.F., 422/0087, 21 iv 2000; TWE 3631, on moss and grass, north side of Darwin Bay, E.F., 342/6559, 29 iv 2000; TWE 3722, on

deciduous twigs in garden, Manager's House, Teal Inlet, E.F., 442/0087, 15 vii 2000). It is characterised within the genus by the smooth, minute basidiospores and has probably been overlooked in the Falklands.

### CONCLUSION

Geographical studies show that fungi, like plants and animals, have complex histories of vicariance and dispersal (Taylor *et al.*, 2006; Matheny *et al.*, 2009). Although long distance dispersal may be rare it is often the best explanation of some fungal distributions in the southern hemisphere (Moncalvo & Buchanan, 2008). For some taxa the natural distribution has been blurred by human activity (Brasier & Buck, 2001) and even slight changes might be expected once a population has been isolated for several generations.

Undoubtedly all the ectomycorrhizal fungi recorded for the Falkland Islands, the boletes and allies, hydngangoid and telephoroid fungi and *Hebeloma* spp., have been introduced with their hosts. It could be, though, that even after introduction they have subsequently switched hosts. Interestingly there have been no species of *Cortinarius* or *Inocybe* found in the Falklands as yet, which contrasts with the rich mycota of these genera in Tierra del Fuego (Horak, 1979). One might have expected that if plant material had been brought from South America at least one or two species would have arrived. The Russulales are represented in the archipelago only by saprotrophic, non-agaricoid members. Ectomycorrhizal members of the agaricoid genera *Lactarius* and *Russula* have not yet been found. The record of *Hydnangium carneum* is the most southerly location for this false truffle. No other strictly eucalypt associated fungus has been found in the Falklands but *Hydnangium carneum* may be favoured as it is known to be quite amenable to transportation. It has, for instance, been found in many countries long before other typical eucalypt associates were recorded, for example California, USA and even in Europe as far northwest as Mull in Scotland. There is no doubt that some species, for example *Suillus luteus*, *Laccaria laccata* and *L. proxima*, have become naturalised and may have spread to other suitable hosts on the Falklands. Other species are of more restricted distribution, based on the fruiting patterns seen, and probably have not spread. They may even be due to a single introduction with their associated host.

It is more difficult to ascertain which of the saprotrophic fungi are native and which are not, although a good stab can be made at answering this question. All the wood-inhabiting crust fungi so far recorded are widespread and common, certainly in Europe, a part of the world which has been in regular contact with the Falklands, importing building materials and so on. These species, including the jelly fungi, have probably all been introduced on imported substrates. As some species are known only from single collections (although the collections are only made when there are observable basidiomes) this may have been the only introduction of that taxon to the archipelago.

It must be appreciated that the records appearing in this paper are based on the appearance of the basidiomes so the collector had to be at the place of fructification

at the right time; there is every possibility that the fungus is present but not fruiting! However, the resupinates identified in the present study, as well as being widespread and common, show great variation, which might indicate that several cryptic species will be found to be involved. It is possible that we are in fact dealing with original local populations. The texts used for their identification are the standard works by Eriksson & Ryvarden (1973–1988) which encompass such variation.

It is significant that the host of *Tremella mesenterica* in the Falkland Islands is *Ulex europaeus*. This is its most common host, certainly in the British Isles, and the number of collections indicates that there have been either multiple introductions or it has spread within the gorse population. The same might apply to *Dacrymyces stillatus*, probably introduced on worked wood. *Ulex* also acts as host for several other species of saprotrophs, for example *Peniophora incarnata* and *Stereum hirsutum*.

The spectacular *Podoserpula* may also have been introduced but, given its distribution in Australia and South America, coupled with our ignorance of its ecology, the situation is not clear. Chalmers *et al.* (1996) have shown how the prevailing winds might offer a lift to the Falklands from South America for the light diaspores. The puffballs and club fungi recorded, excepting *Typhula placorrhiza*, although widespread and common elsewhere, could have been introduced. The *Typhula* has a parallel pattern of distribution in the world to that expressed by the crust fungi. It has possibly been introduced with plant material in its sclerotial form; certainly studies by Warcup (1957) on soils from Australian wheat fields, where sclerotia of a range of fungi are found after soil sieving, indicate how easy it is to miss such structures and how they can be distributed. Judging from the fact that coastal grasslands were a feature of the Falklands before European colonisation, the puff- and fuzzballs may well be native to the islands, maintained and possibly extended in their range by the grazing of domesticated stock. *Bovista dermatoxantha* and *Lycoperdon lividum*, *L. turneri* and *L. utriformis* all certainly appear widespread.

Finally, it must be emphasised how important it is that the *Ramaria* sp. noted by Jalink & Nauta (1993) in dwarf shrub heath should be looked out for in any later surveys. The presence of this genus in the Falkland Islands is of very great interest, especially in respect to the rich mycotas of gomphoid fungi in Australia and South America.

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## REFERENCES

- BERKELEY, M. J. (1847). Fungi. In: HOOKER, J. D. *The Botany. The Voyage of H.M. discovery ships Erebus and Terror in the years 1839–1843*, pp. 447–454. London.
- BRASIER, C. M. & BUCK, K. W. (2001). Rapid evolutionary changes in a globally invading fungal pathogen (Dutch Elm disease). *Biol. Invasions* 3: 223–233.
- CHALMERS, M. O., HARPER, M. A. & MARSHALL, W. A. (1996). *An Illustrated Catalogue of Airborne Microbiota from the Maritime Antarctic*. Cambridge, UK: British Antarctic Survey.
- COKER, W. C. & COUCH, J. N. (1928). *The Gasteromycetes of the Eastern United States and Canada*. Chapel Hill, NC: University of North Carolina Press.
- CORNER, E. J. H. (1950). A monograph of *Clavaria* and allied genera. *Ann. Bot. Mem.* 1: 1–740.
- CORNER, E. J. H. (1968). A monograph of *Thelephora* (Basidiomycetes). *Beih. Nova Hedwigia* 27: 1–110.
- CORNER, E. J. H. (1970). Supplement to 'A monograph of *Clavaria* and allied genera'. *Beih. Nova Hedwigia* 33: 1–299.
- CORNER, E. J. H. (1972). *Boletus in Malaysia*. Singapore: Government Printing Office.
- COTTON, A. D. (1915). Cryptogams from the Falkland Islands collected by Mrs Vallentin. *J. Linn. Soc. Bot.* 43: 137–231.
- CUNNINGHAM, G. H. (1963). The Thelephoraceae of Australia and New Zealand. *Bull. New Zealand Dept. Sci. Industr. Res.* 145: 1–359.
- CUNNINGHAM, G. H. (1965). The Polyporaceae of Australia and New Zealand. *Bull. New Zealand Dept. Sci. Industr. Res.* 164: 1–304.
- ERIKSSON, J. & RYVARDEN, L. (1973–1988). *The Corticiaceae of North Europe*, vols 1–8. Oslo, Norway: Fungiflora.
- FRYAR, S. C., KIRBY, G. C. & HYDE, K. D. (1999). Species abundance patterns of two wood decay basidiomycete communities. *Fungal Divers.* 3: 39–56.
- GADGIL, P. (2005). *Fungi of New Zealand. Vol. 4. Fungi on Trees and Shrubs in New Zealand*. Fungal Diversity Research Series 16. Hong Kong, SAR China: Fungal Diversity Press.
- GARRIDO, N. (1988). Agaricales s.l. und ihre Mykorrhizen in den *Nothofagus*-Wäldern Mittelchiles. *Biblioth. Mycol.* 120: 1–528.
- GRGURINOVIC, C. A. (1997). *Larger Fungi of South Australia*. Adelaide: Botanic Gardens of Adelaide and State Herbarium.
- HALLENBERG, N. (1980). New taxa of the Corticiaceae from N. Iran. *Mycotaxon* 11(2): 447–475.
- HENDERSON, D. M., ORTON, P. D. & WATLING, R. (1969). *British Fungus Flora: Agarics & Boleti*. Edinburgh: Royal Botanic Garden Edinburgh/Her Majesty's Stationery Office.
- HORAK, E. (1979). Fungi: Basidiomycetes, Agaricales y Gasteromycete secotoides. In: GUARRERA, S. A., GAMUNDI DE AMOS, I. J. & MATTERI, C. M. (eds) *Flora Criptogamica de Tierra del Fuego* 11(6). Buenos Aires: Fundacio para la Education, la Cienca y la Cultura.
- JALINK, L. M. & NAUTA, M. (1993). The mycoflora of the Falkland Islands – 1. Introduction and preliminary results. In: PETRINI, O. & LAURSEN, G. A. (eds) *Proceedings of the 3rd and 4th International Symposia on Arctic and Alpine Mycology*. *Biblioth. Mycol.* 150: 105–120.
- KREISEL, H. (1967). Taxonomisch-Pflanzengeographische monographie der Gattung *Bovista*. *Beih. Nova Hedwigia* 25: 1–244.
- LARSSON, E. & JEPSON, M. (2008). Phylogenetic relations among species and genera of Lycoperdaceae based on ITS and LSU sequence data from north European taxa. *Mycol. Res.* 112: 4–22.
- LIDDLE, A. (2007). *Plants of the Falkland Islands*. London: Falkland Island Conservation.

- MARTIN, G. W. (1952). Revision of the North Central Tremellales. *Stud. Nat. Hist. Iowa Univ.* 19: 1–122.
- MATHENY, P. B., AIME, C. M., BOUGHER, N., BUYCK, B., DESJARDIN, D., HORAK, E. ET AL. (2009). Out of the palaeotropics? Historical biogeography and diversification of the cosmopolitan ectomycorrhizal mushroom family Inocybaceae. *J. Biogeogr.* 36: 577–592.
- MAY, T. W., MILNE, J., SHINGLES, S. & JONES, R. H. (2003). *Fungi of Australia. Vol. 2B. Catalogue and Bibliography of Australian Fungi 2. Basidiomycota p.p. and Myxomycota p.p.* Canberra, Commonwealth of Australia: Australian Biological Resources Study.
- MCNABB, R. F. R. (1966). New Zealand Tremellales II. *New Zealand J. Bot.* 4(4): 533–545.
- MCNABB, R. F. R. (1968). The Boletaceae of New Zealand. *New Zealand J. Bot.* 6: 137–176.
- MCNABB, R. F. R. (1969). The Paxillaceae of New Zealand. *New Zealand J. Bot.* 7: 350–362.
- MONCALVO, J.-M. & BUCHANAN, P. K. (2008). Molecular evidence for long distance dispersal across the Southern Hemisphere in the *Ganoderma applanatum-australe* species complex (Basidiomycotina). *Mycol. Res.* 112: 425–436.
- ORTON, P. D. (1960). New Check List of British Agarics and Boleti. Part III. Notes on genera and species in the list. *Trans. Brit. Mycol. Soc.* 43(2): 159–439.
- PEGLER, D. N., SPOONER, B. M. & SMITH, R. I. L. (1980). Higher fungi of Antarctica, subantarctic zone and Falkland Islands. *Kew Bull.* 35: 499–562.
- PETERSEN, R. H. (1988). The clavarioid fungi of New Zealand. *Bull. New Zealand Dept. Sci. Industr. Res.* 236: 1–170.
- PILÁT, A. (1958). *Flora CSR: Gasteromycetes*. Prague: Akademie věd České.
- REID, D. A. (1962). *Podoserpula* Reid: A new fungus based on *Craterellus pusio* Berk. (*C. multiplex* Cke. & Mass.). *Kew Bull.* 16: 437–445.
- SINGER, R. (1974). A monograph of *Favolaschia*. *Beih. Nova Hedwigia* 50: 1–108.
- TAYLOR, J. W., TURNER, E., TOWNSEND, J. P., DETTMAN, J. R. & JACOBSON, D. (2006). Eukaryotic microbes, species recognition and the geographic limits of species; examples from the kingdom Fungi. *Philos. Trans., Ser. B* 361: 1947–1963.
- WARCUP, J. H. (1957). Studies on the occurrence and activity of fungi in a wheat-field soil. *Trans. Brit. Mycol. Soc.* 43: 237–262.
- WATLING, R. (1999). A kaleidoscope of fungi. Presidential Address. *Trans. Brit. Mycol. Soc.* 90: 1–28.
- WATLING, R. & EGGELING, T. (2009). Pagoda fungus, *Podoserpula pusio*, found in the Falklands. *Field Mycol.* 10(2): 56.
- WATLING, R. & GREGORY, N. M. (1988). Observations on the boletes of the Cooloola Sandmass, Queensland and notes on their distribution in Australia. Part 2A. Smooth-spored taxa: Introduction, keys and references. *Proc. Roy. Soc. Queensland* 99: 65–76.
- WATLING, R. & GREGORY, N. M. (1991). Observations on the boletes of the Cooloola Sandmass, Queensland and their distribution in Australia. Part 3. Lamellate taxa. *Edinburgh J. Bot.* 48(3): 353–391.
- WATLING, R. & LI, TAI-HUI (1999). *Australian Boletes: A Preliminary Survey*. Edinburgh: Royal Botanic Garden Edinburgh.
- WATLING, R. & RICHARDSON, M. J. (2010). Coprophilous fungi of the Falkland Islands. *Edinburgh J. Bot.* 67: 399–423.
- WRIGHT, G. & ALBERTÓ, E. (2002). *Hongos, Guía de la Región Pampeana. I. Hongos con laminillas*. Buenos Aires: Literature of Latin America.
- ZELLER, S. M. & SMITH, A. H. (1964). The genus *Calvatia* in North America. *Lloydia* 27: 147–186.