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Soil fungi isolated from Icelandic farmland

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Abstract: Fungi were isolated from soil samples collected at the farm Bryðjuholt in Southern Iceland in the fall of 1981 and 1982, from five adjacent sites, each representing different vegetation. Using soil dilution method the fungi were isolated and grown in pure culture. Only the species which could be identified to a species are reported or 5 zygomycetes, 6 ascomycetes and 27 hyphomycetes, a total of 38 species. Thereof 17 species are reported new to Iceland.

Little is known about fungi in Icelandic soils. LAUBE (1971) investigated Icelandic Mucorales, and some ascomycetes, thereof several species isolated from soil. From soil samples collected in Surtsey in 1972, 11 species of soil fungi were isolated (HENRIKSSON & HENRIKSSON 1974). Following winterkilling of grasses in 1968 and 1969, KOMMEDAHL (1972) and KOMMEDAHL & Einar I. SIGGEIRSSON (1973) isolated 6 *Fusarium* species from soil and root samples collected from spots of killed grasses in South and North Iceland. Clearly, fungi of other genera grew amongst the *Fusarium* colonies, but only three such species were mentioned. Guðríður Gyða EYJÓLFSDÓTTIR, Sigurgeir ÓLAFSSON & BREWER (1988) compared the fungal floras found in highland and lowland sheep pastures (experimental grazing pens) based on fungi isolated from 40 and 54 soil samples respectively, collected in the summers of 1982 and 1983. They reported 30 species from the lowland plot and 21 species from the highland plot, a total of 38 different species. Several other taxa which were not assigned to a species, were also reported. GRAVESEN et al. (1983) and HALLAS & GRAVESEN (1987) investigated the microfungi and mites isolated from hay and haydust, some of which may originate from soil.

This investigation is based on 17 soil samples from farmland in Southern Iceland, collected in the fall of 1981 and 1982. Samples were collected from the lowest area of a mire where *Sphagnum* was predominant, from gently sloping areas of the mire, from adjacent dry *Racomitrium*-dominated moss and grass heath, from a rind of uncultivated grassland connecting the heath to the mire, from a hayfield cultivated 30 years earlier from the moss and grass heath, and from dried mire near a drainage ditch.

MATERIALS AND METHODS

Soil samples were collected at the farm Bryðjuholt, Hrunamannahreppur, Árnessýsla (64°10'N 20°21'V), 65-80 m above sea level. From the mire Vikakelda (near the east bank of the river Hvítá), the adjacent dry moss and grass heath Flatholt and its southeastern corner which is a 30 years old cultivated hayfield.

Samples were collected on the following dates at the sites listed below:

1) 31.08.1981 (dried before plating, sites 1 (T) and 3 (M), the cores collected at each site are numbered 1, 2 or 3 (e.g. M-3).
2) 17.09.1981 (plated 18.09.1981, sites 1 (T), 2 (H), 3 (M) and 4 (B), these cores are identified by the number 0 (e.g. M-0).
3) 13.10.1982 (plated 14.10.1982, sites 1, 2, 3 and 5, isolates identified by numbers only (e.g. 2213).

The experimental sites, each representing different vegetation and isolation codes from which collection date, site and core number of each isolate can be read:

1) cultivated grassland, a hayfield, approximately 30 years old (T-1, T-0, 3101-3121, 3301-3331). Two samples (T-3 & 3201-3237) are from a *Deschampsia caespitosa* tuft;
2) the undisturbed nearby dry moss (*Racomitrium*) and grass heath (H-0, 1101-1135, 1201-1237);
3) mire (M-1 from a patch of mire surrounded by running water; M-2 & 2201-2216 from a *Sphagnum* tuft; M-0, M-3 & 2101-2123 from a gently sloping mire);
4) close to a drainage ditch, dried mire (B-0),
5) a rind of uncultivated grassland connecting the moss and grass heath to the sloping mire (4101-4142).

In the first two collections, which later were considered as a preliminary investigation, the soil cores taken were 10 cm long and 4 cm wide. The samples from the first collection were dried at 30°C in an oven and 1 g of dry soil was diluted and plated, while 10 g of fresh soil from the centre of the core was used when the second collection was diluted and plated (see Guðríður Gyða EYJÓLFSDÓTTIR 1984).

On the last collection date sterile steel borers, 16 cm long and 2.2 cm wide, one for each sample, was used to cut the cores. Each sample (still inside the borer) was placed in a new plastic bag and brought to the laboratory. The samples were stored at 4°C overnight and the following day using the methods used by Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) and are described in BREWER et al. (1971) and BREWER & TAYLOR (1980), the top 1 cm (surface vegetation) of the core was cut away and 2-4 g of soil from just below the surface was placed in 100 ml of sterile water in a sterile 250 ml Erlenmeyer flask and mixed by shaking. The sample was diluted by transferring 10 ml of soil solution to 90 ml of water, making a series of 10^2, 10^3, 10^4, and 10^5 dilutions. From each of the last two dilutions, 1 ml of the soil solution was placed in each of 10 Petri plates and mixed with cool

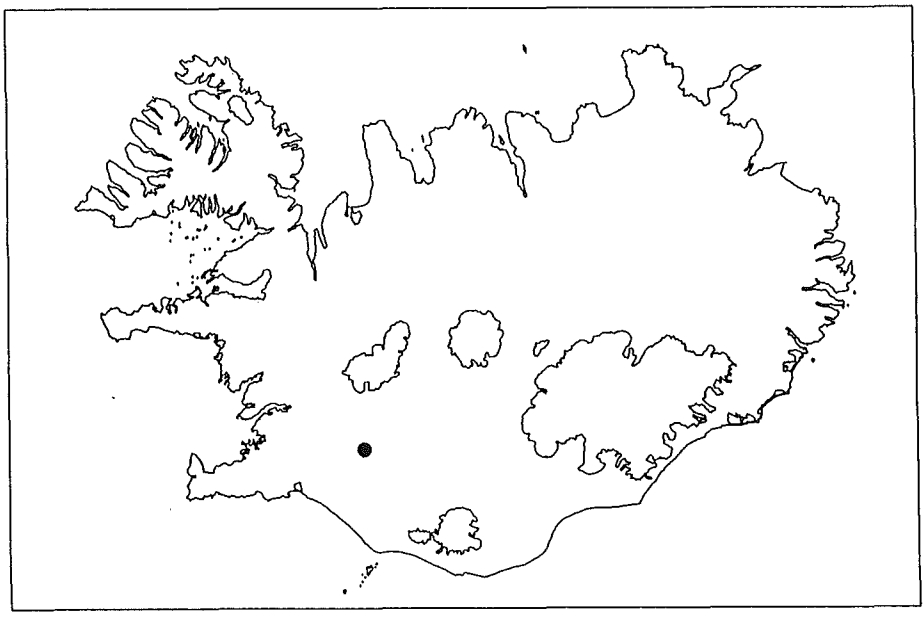

FIGURE 1. Location of the sampling site.

(45°C) agar medium. The isolation medium contained: 20 g malt extract powder; 20 g agar; 6 g cellulose powder; 1 g starch (boiled in 40 ml of water); 1 ml Rose Bengal solution (from stock solution: 3.5 g in 100 ml water); and 1 l deionized water.

The plates were kept at about 24°C for 5-7 days. For each sample the colonies growing in the set of 10 plates of the 10^5 dilution were examined using a dissecting microscope and the number of each type recorded. The 10^4 dilution plates were then examined for types not appearing in the greatest dilution and their number recorded. One colony of each type was selected and isolated onto 2 % malt extract agar slant in a culture tube. The dry weight of the soil diluted was obtained by drying 10 ml of the solution from the first flask in an oven at 105°C.

RESULTS

Only the isolates which could be assigned to a species are reported below. For each species, each identified isolate is listed by its isolation number and when the species is known from Iceland, its previous records are noted. Many of the species reported here were described in culture, while other were listed in appendix of my 4th year thesis (Guðríður Gyða EYJÓLFSDÓTTIR 1984). However, five species from this study are reported here first. Guðríður Gyða EYJÓLFSDÓTTIR (1984) lists the isolates from the

third collection date in numerical order and the taxa to which they were assigned. The following species were isolated from Icelandic farmland soils:

Aspergillus fumigatus Fresen.

Isolated from gently sloping mire: 2120.
GRAVESEN et al. (1983) report it from hay and haydust.

Aspergillus niger Tiegh.

Isolated from mire: 108 M-0. GRAVESEN et al. (1983) and HALLAS & GRAVESEN (1987) report it from hay and haydust.

Chaetomium elatum Kunze : Fr.

Isolated from hayfield: 134 T-1.
New record for Iceland.

Chrysosporium merdarium (Link : Fr.) J. W. Carmich.

Isolated from hayfield: 3224, 3105, 3223, 3214 and 3306, 3204. The isolates vere quite variable, the last two produce brown pigment and synnemata.
New record for Iceland.

Cladosporium cladosporioides (Fresen.) G. A. de Vries

Isolated from hayfield and from gently sloping mire: 3110; 212b T-0; 1, 211 T-3; 12f T-1 and 44 M-3.
Bjarni E. GUÐLEIFSSON (1984) isolated it from a sample of mycelium-like mat collected from overwintered grassland in the spring. Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) report it from highland and lowland soil samples.

Cladosporium herbarum (Pers. : Fr.) Link

Isolated from dry moss and grass heath, hayfield and from gently sloping mire: 68, 64a H-0; 216 T-0 and 107 M-0.
This is a common species, first recorded in Iceland by JOHANSON (1884) and ROSTRUP (1885) who reported it on dead plant parts from few places, but ROSTRUP (1903) and LARSEN (1932) consider it common throughout Iceland. It was isolated from highland and lowland soils (Guðríður Gyða EYJÓLFSDÓTTIR et al. 1988) and from hay (HALLAS & GRAVESEN 1987).

Coemansia scorpioidea Linder

Isolated from mire, and from dried mire near a ditch: 129 M-1; 164, 214 B-0.
New record for Iceland.

Coemansia thaxteri Linder

Isolated from dry moss and grass heath: 147 H-0.
New record for Iceland.

Cylindrocarpon destructans (Zinssm.) Scholten

Isolated from dry moss and grass heath and mire, including a sample from a *Sphagnum* tuft: 1113, 2106, 2205.

KOMMEDAHL & Einar I. SIGGEIRSSON (1973) report it as one of the species which they occasionally isolated from soil samples from hayfields damaged by winterkilling of grasses. As their study was on *Fusarium* species only, their report did not give details on the origin of these *Cylindrocarpon* colonies.

Cylindrocarpon didymum (Hartig) Wollenw.

Isolated from dry moss and grass heath and uncultivated grassland: 1218, 4135.
New record for Iceland.

Eurotium herbariorum (F. H. Wigg. : Fr.) Link

Isolated from mire and hayfield: 2112, 3119, 3212, 3218.
First reported by ROSTRUP (1903) on dead plant material from several places.

Geomyces pannorum (Link) Sigler & J. W. Carmich.

Isolated from mire, from a *Sphagnum* tuft: 58, 187, 188a M-2.
New record for Iceland.

Gliocladium catenulatum J. C. Gilman & E. V. Abbott

Isolated from mire, both gently sloping and from a *Sphagnum* tuft: 2103, 2107, 2108, 2208, 2210.

First reported by Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) who isolated it from lowland soil only, where it was one of the most common species in this drained mire.

Humicola grisea Traaen var. *grisea*

Isolated from dry moss and grass heath and from hayfield: 1124, 1217; 101, 109a, 192 T-0.

Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from one sample of the highland soils.

Lecythophora mutabilis (J. F. H. Beyma) W. Gams & McGinnis

Isolated from dry moss and grass heath and hayfield: 1133, 1119, 1231, 1216 one type and 1224, 3308 the other. The isolates were quite variable but mostly of two types; colonies of the former type were beige at first but

became yellowish from the middle and finally olive green and faintly zonate. Colonies of the latter type were pink until rather old when they became greyish-blue in the middle or in sectors.

New record for Iceland.

Monodictys levis (Wiltshire) S. Hughes

Isolated from dry moss and grass heath: 1235

New record for Iceland.

Mortierella ramanniana (Møller) Linnem. var. *ramanniana*

Isolated from dry moss and grass heath: 1103, 1121, 1201; 66, 78 H-0.

LAUBE (1971) reported it from soil in South and Southwest Iceland and Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from highland soils.

Mucor hiemalis Wehmer f. *hiemalis*

Isolated from hayfield, uncultivated grassland, dry moss and grass heath and from dried mire near a ditch. One mating type: 3112, 3201; 19a T-1; 132b T-3; 92 B-0; 79b H-0 and the other mating type 3217, 4122; 7 T-3.

LAUBE (1971) considered this species as the most common *Mucor* species in Iceland and HENRIKSSON & HENRIKSSON (1974) isolated it in Surtsey. Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it once from highland soils but from 20 samples of the lowland soils.

Oidiodendron flavum Svilv.

Isolated from dry moss and grass heath: 1115, 1134.

New record for Iceland.

Oidiodendron truncatum G. L. Barron

Isolated from dry moss and grass heath: 1130.

Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from highland soils.

Paecilomyces carneus (Duché & R. Heim) A.H.S. Br. & G. Sm.

Isolated from hayfield, uncultivated grassland, and from dried mire near a ditch: 3107, 3114, 3213, 3320, 4142; 82, 96, 97, 163a B-0; 21 T-3.

Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) considered it as one of the most common lowland species, not found in the highland soils.

Paecilomyces farinosus (Holm : Fr.) A.H.S. Br. & G. Sm.

Isolated from dry moss and grass heath and from dried mire near a ditch: 156, 149b, 151, 178b, 203 H-0; 205, 167c, 87a B-0.

New record for Iceland.

Penicillium lividum Westling

Isolated from dry moss and grass heath: 1129.
New record for Iceland.

Preussia aemulans (Rehm) Arx

Isolated from a *Deschampsia caespitosa* tuft in hayfield: 3216, 3220.
New record for Iceland.

Pseudallescheria cf. ***boydii*** (Shear) McGinnis, Padhye & Ajello

Isolated from hayfield: 217 T-0.
This isolate produced larger ascospores (7.0)8.0-9.0 x 5.0-6.5 µm and larger *Graphium*-type conidia 7.0-11.0 x 3.0-4.0 µm, while the *Scedosporium*-type conidia were within the size range given by DOMSCH et al. (1980). Apart from producing somewhat larger ascospores and conidia than *P. boydii* this isolate seems to belong to that species.

Pseudeurotium zonatum J. F. H. Beyma

Isolated from gently sloping mire: 2104; 17, 120 M-3; 197 M-0.
Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) reported it as one of the most common species in the lowland soils.

Sesquillium candelabrum (Bonord.) W. Gams

Isolated from mire, from a *Sphagnum* tuft: 136 M-2.
New record for Iceland.

Sporormiella intermedia (Auersw.) S. I. Ahmed & Cain

Isolated from dry moss and grass heath: 1126.
Reported by ROSTRUP (1903) and by LARSEN (1932) and LAUBE (1971) on various dung types throughout Iceland.

Tolypocladium niveum (O. Rostr.) Bissett

Isolated from uncultivated grassland: 4125, 4138.
Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from the highland soils.

Trichocladium opacum (Corda) S. Hughes

Isolated from hayfield, grassland, dry moss and grass heath and gently sloping mire: 1112, 1123, 3206, 3318, 4121; 5, 36c T-3; 183 T-1; 128 M-3; 154, 155, 237 H-0.
Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) considered it frequent both in lowland and highland soils.

Trichoderma aureoviride Vuill.

Isolated from uncultivated grassland: 4130.

New record for Iceland.

Trichoderma hamatum (Bonord.) Bainier (species aggregate)

Isolated from mire: 2117.

Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from lowland soils.

Trichoderma viride Pers.

Isolated from hayfield and from a dried mire near a draining ditch: 3104, 3108; 141 T-1; 38, 139a T-3; 167c1 B-0.

HENRIKSSON & HENRIKSSON (1974) reported it from soil in Surtsey, KOMMEDAHL (1972) shows a photograph of *T. viride* amongst *Fusarium* colonies being isolated from a soil sample from Reykjavík. Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from the lowland soils.

Trichosporiella cerebriformis (G. A. de Vries & Kleine-Natrop) W. Gams

Isolated from dry moss and grass heath and from mire from a *Sphagnum* tuft : 1230, 1236, 2202, 2207, 2209, 2211.

New record for Iceland.

Truncatella angustata (Pers. : Link.) S. Hughes

Isolated from dry moss and grass heath, uncultivated grassland, and from gently sloping mire: 1101, 1222, 1229, 2113, 4105; 185, 186 H-0.

Hörður KRISTINSSON & Bjarni GUÐLEIFSSON (1976) reported it from dead grass leaves, Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from highland and lowland soils.

Verticillium chlamydosporium (Kamyschko ex G. L. Barron & Onions) W. Gams var. *catenulatum* (Kamyschko ex Onions & G. L. Barron) W. Gams

Isolated from mire: 229 M-1.

New record for Iceland.

Volutella ciliata Alb. & Schwein. : Fr.

Isolated from dried mire near a ditch: 95b, 215 B-0.

ROSTRUP (1903) reported it on rotten potatoes and LARSEN (1932) added sheep dung as its substrate.

Zygorrhynchus moelleri Vuill.

Isolated from hayfield, dry moss and grass heath and uncultivated grassland: 3113, 3219, 3301, 4129; 191 T-1; 115 H-0.

LAUBE (1971) reported it from soil samples from Southwest Iceland and East Iceland, Guðríður Gyða EYJÓLFSDÓTTIR et al. (1988) isolated it from highland soils.

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