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# A snow mold fungus *Typhula incarnata* from the Faroe Islands

**Tamotsu Hoshino[1,2], Magnus Gaard[3], Michiko Kiriaki[1] and Isao Yumoto[1,4]**

*1 National Institute of Advanced Industrial Science and Technology (AIST), 2-17-2-1, Tsukisamu-higashi, Toyohira-ku, Sapporo 062-8517 Japan.*

*2 Division of Biological Sciences, Graduate School of Science, Hokkaido University, N10 W8, Kita-ku, Sapporo 060-0810, Japan.*

*3 The Faroese Museum of Natural History, FO-100 Tórshavn, The Faroe Islands.*

*4 Division of Applied Bioscience, Graduate School of Agriculture, Hokkaido University, N9 W9, Kita-ku, Sapporo 060-0809, Japan.*

ABSTRACT: Snow mold fungus, *Typhula incarnata*, was recorded from Tórshavn, Sonnfelli and Vestmanna in Streymoy, which is a new record from the Faroe Island. Thermal dependence of mycelial growths and pathogenic activities of all isolates collected from the Faroe Islands were similar to those of isolates from West Greenland.

## INTRODUCTION

Snow mold fungi are psychrophilic or psychrotrophic fungal pathogens of perennial grasses and winter cereals in the Northern Hemisphere (HSIANG *et al.* 1999). Typical snow mold, *Microdochium nivale* (Fries) Samuel's & Hallett, *Sclerotinia borealis* Bub. & Vleug., *Typhula incarnata* Lasch ex. Fr. and *T. ishikariensis* Imai that are the important pathogenic fungi, distributed around Nordic countries as Denmark (where *M. nivale* and *T. incarnata* have been found: WELLING & JENSEN 1970), Finland (JAMALAINEN 1949, 1957), Greenland (where *S. borealis*, *T. incarnata* and *T. ishikariensis* have been found: HOSHINO *et al.* unpublished results), Iceland (where *M. nivale*, *T. incarnata* and *T. ishikariensis* have been found: KRISTINSSON & GUÐLEIFSSON 1976), Kola peninsula in Russian Arctic (PETROV 1983), Norway (ÅRSVOLL 1975) including Svalbard (where *T. ishikariensis* and *S. borealis* have been found: HOSHINO *et al.* 2003) and Sweden (EKSTRAND 1955). A check list of fungi in the Faroe Islands was published by VESTERHOLT (1998). No snow mold fungi are listed there. However, a related saprophytic species, *T. micans* (Fr.) Berthier was found near Sandur in Sandoy. In addition, one species of snow mold fungi, *T. incarnata* is distributed in North Scotland and the British Islands (GRAY 1963).

In April 2000, we found *T. incarnata* in in Streymoy. Here, we describe morphologies of sclerotia and basidiocarps and physiological characteristics of isolates from the Faroe Islands.

## MATERIAL AND METHODS

**Isolation of snow mold fungi from overwintering grass leaves.** Fungal sclerotia were collected from decayed leaves or stems of *Agrostis canina* and *A. capillaris* from Tórshavn, Sonnfelli and Vestmanna in Streymoy on 7-10 April, 2000 (Fig. 1). Sclerotia were put in paper envelopes and were dried at room temperature during transportation. Fungal sclerotia were surface sterilized in 70% (v/v) ethanol and 0.5% (as active chlorine) sodium hypochlorite solution and thoroughly washed with sterilized distilled water. They were then cut with sterilized razor blades, placed on potato dextrose agar (PDA) so that cut surfaces were in contact with the agar, and incubated at 5˚C. Mycelium from growing margins of colonies were transferred to new PDA plates (9 cm in diameter). All isolates were maintained on PDA slant cultures at 0˚C. *T. incarnata* from Iceland and Greenland were used for comparison.

FIGURE 1. Sclerotia of *Typhula incarnata* in the Faroe Islands. Each bar is 5mm. Red arrows show sclerotia on decayed leaves.

**Production of basidiocarps.** Sclerotia which were formed in PDA plates, were placed in flowerpots (9 cm in diameter) containing humid, unsterile soil. Isolates from Faroe Islands had failed to produce basidiocarps in artificial condition. Sclerotia were kept in outdoor (in the fall to promote fructication) in the shade at temperature ranges from -4 to 15˚C for 30 days .

**Mating experiments.** Basidiocarps were soaked separately in 500µl autoclaved water in test tubes and kept overnight in refrigerator (4˚C). The test tubes were shaken to remove bisidiospores from the basidiocarps. The basidiospore suspension was appropriately thinned, spread on PDA plates containing lactic acid, and incubated at 10˚C for two weeks. Colonies with smooth hyphae (monokaryons) were subcultured on PDA slants at 0˚C.

Monokaryon and tester isolates of dikaryon were paired on PDA plates and incubated at 10˚C for 14 days, and a small agar block was cut out from

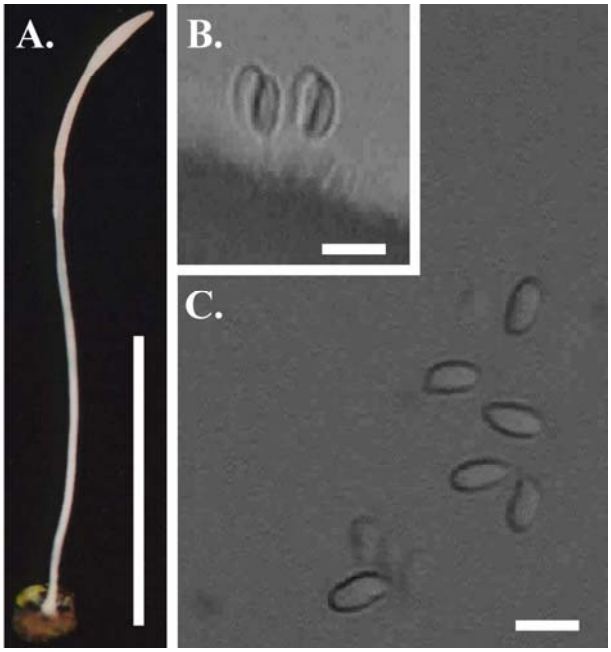


FIGURE 2. Basidiocarp and bisidiospore of *T. incarnata* in the Faroe Islands. A. Basidiocarp. B. Basidospores with basidia. C. Basidiospores. Bar of A is 1 cm. Those of B and C are 10 µm.

monokaryon colonies near both colony junction and transplanted to other PDA plate. Growth from the block was then examined for the presence of clamp connections on hyphae 5 to 7 days later. The presence of clamp connections on hyphae was criterion of compatibility of monokaryons with tester isolates.

**Growth temperature of mycelia.**
Mycelial discs 5mm in diameter were cut from the margin of an actively growing colony, transferred to the centers of PDA plates, and inoculated at 5 different temperatures from 0 to 20˚C, in duplicate. After 1, 2 and 3 weeks of inoculation, the colony diameters were determined. The linear mycelial growth rate per week was calculated after the initial lag period.

**Infection experiments.**
Winter wheat (variety "Chihoku komugi") plants were grown in a glasshouse to the three-leaf stage, and five mm diam mycelial disc was inoculated with plants and incubated in a moist container at 0˚C for 1 month. Then inoculated plants were regrown in glasshouse for 3 weeks. The estimate of aggressiveness was based on dry weight of plants after regrowth.

## RESULTS AND DISCUSSION

**Snow mold diseases of overwintering grasses in the Faroe Islands.**
We found a few infections of snow mold fungi caused by *M. nivale* in Tórshavn and by *T. incarnata* in various areas in Streymoy. However, host plants of both fungi had weak damage by fungal infections. Therefore, snow mold diseases are not significant for overwintering of grasses and cereals in natural conditions in the Faroe Islands. *M. nivale* normally requires two months and *T. incarnata* needs less than three months snow cover to develop serious injury on

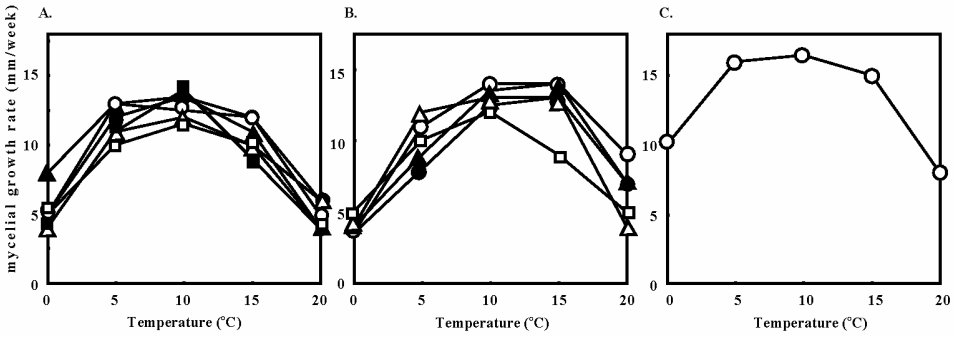


FIGURE 3. Effects of culture temperature on mycelial growth of *Typhula incarnata* from the Faroe Islands, Iceland and Greenland. A. Isolates from the Faroe Islands. Localities of isolates are Tórshavn (open and closed circles), Sonnfelli (open and closed triangles) and Vestmanna (open and closed squares). B. Isolates from Iceland. Localities of isolates are Akureyri (open circles, closed circles and open triangles), Glaumbæ (closed triangles) and Reykholt (open squares). C. Isolate from West Greenland (Nuuk).

fodder grass and winter cereals. Their slight attacks have been observed even without a snow cover (ÅRSVOLL 1973).

Other snow mold fungi reported from the Nordic countries, as *S. borealis* and *T. ishikariensis* were not found. Those fungi are psychrophiles and primarily found at localities with more than 5 months snow cover (ÅRSVOLL 1973). They have not adapted to the warm climate condition of the Faroe Islands.

## DESCRIPTION OF SPECIES

**1. *Typhula incarnata*** Lasch ex Fr.

Syn.: *T. elegantula* Karst., *T. graminum* auct. non Karst., *T. itoana* Imai

New to the Faroe Islands.

Fungal sclerotia were found in overwintering leaves of *Agrostis canina* and *A. capillaris*. The sclerotia were orange-brown, oval to kidney-shaped, formed on and in leaves (Fig. 1). The diameter of sclerotia was 1.5 - 4.0 mm. The fungus was widely spread in Streymoy.

Basidiocarp and basidiospores of this fungus were shown in Fig. 2. Basidiocarps are 1 - 2 cm high, solitary or gregarious from sclerotium. Head 0.3 - 0.7 cm long, 0.2 - 0.4 cm thick, long clavate or nearly

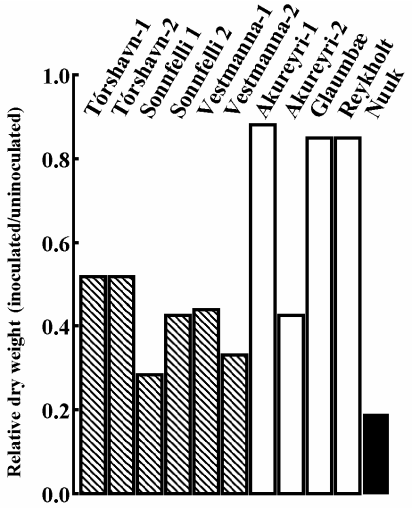


FIGURE 4. The phytopathogenic activities of *Typhula incarnata* from the Faroe Islands, Iceland and West Greenland.

TABLE 1. Mating reaction of Typhula incarnata from the Faroe Islands

| | | Tester dikaryons | | | |
|---|---|---|---|---|---|
| | | Iceland | | | Greenland |
| | | Akureyri | Glaumbær | Reykholt | Nuuk |
| Tested monokaryons Localities | | | | | |
| Tórshavn | 1-1 | + | + | + | + |
| | 1-2 | + | + | + | + |
| | 1-3 | + | + | + | + |
| | 2-1 | + | + | + | + |
| | 2-2 | + | + | + | + |
| | 2-3 | + | + | + | + |
| Sonnfelli | 1-1 | + | + | + | + |
| | 1-2 | + | + | + | + |
| | 1-3 | + | + | + | + |
| | 2-1 | + | + | + | + |
| | 2-2 | + | + | + | + |
| | 2-3 | + | + | + | + |
| Vestmanna | 1-1 | + | + | + | + |
| | 1-2 | + | + | + | + |
| | 1-3 | + | + | + | + |
| | 2-1 | + | + | + | + |
| | 2-2 | + | + | + | + |
| | 2-3 | + | + | + | + |

+ : compatible with vigorous growth.

linear, light pink. Basidia had 4 basidiospores. Basidiospores ellipsoidal 8-10 × 3-4 μm, smooth. Those morphological dimensions are similar to those given by CORNER (1950) and BERTHIER (1976). The specimens of fungal sclerotia and basidiocarps are kept in the Faroese Museum of Natural History.

**Mating reaction.**

We obtained 18 monokaryons from basidiospores of isolates from the Faroe Islands. All monokaryons from the Faroe Islands mated with isolates (dikaryons) from Iceland and Greenland (Table 1). These results suggested that isolates from the Faroe Islands had same genetic background as isolates from Iceland and Greenland.

**Thermal dependence of mycelial growth rate and pathogenic activity of *T. incarnata* from the Faroe Islands.**

Mycelial growth rates of collected isolates from the North Atlantic islands were different. All isolates could grow at 0 and 20˚C on PDA plates. Optimum growth temperature of isolates from the Faroe Islands and Greenland were 5 - 10˚C and those of isolates from Iceland were 10˚C (Fig. 3). Isolates from the Faroe Islands showed relatively higher growth rate than isolates from Iceland.

Figure 4 showed phytopathogenic activities of tested isolates. Isolates from the Faroe Islands and West Greenland had higher aggressivity than those from Iceland.

The Faroe Islands have short period (ca. 30 days) of snow cover and West Greenland has shallow snow cover with frequent soil freezing during winter. Climate conditions in the Faroe Islands and West Greenland were one of the factors to limit the mycelial growth season of *T. incarnata*.

## ACKNOWLEDGMENTS

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