

# LIGNICOLOUS MARINE FUNGI FROM PRINCE EDWARD ISLAND WITH A DESCRIPTION OF DIDYMOSPHAERIA LIGNOMARIS SP. NOV.<sup>1</sup>

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Twenty marine fungi, 13 ascomycetes and 7 deuteromycetes, were isolated from 5 sites in waters around Prince Edward Island. Fungi were isolated from blocks and panels of birch, spruce and pine wood submerged for 5 months and from intertidal and driftwood. All are first reports for the coast of P.E.I. Most of the fungi are common in the region. *Didymosphaeria lignomaris* Strongman and Miller is described as a new species and *Cirrenalia macrocephala* is reported for the first time from Atlantic Canada.

Les auteurs ont isolés vingt mycètes marines, 13 ascomycètes et 7 deuteromycètes, dans cinq endroits dans les eaux côtières de l'Île-du-Prince-Édouard. Les mycètes ont été isolés sur des blocs et des morceaux de panneau de bouleau, épinette et pin submergés pendant cinq mois, et aussi sur bois soit de la zone intertidal, soit sur la ligne de plage. Tous ces mycètes sont signalés pour la première fois le long de la côte de l-P-E; la plupart sont assez commun dans la région. *Didymosphaeria lignomaris* est décrite comme une nouvelle espèce, tandis que *Cirrenalia macrocephala* est signalée pour le première fois dans le Canada Atlantique.

## Introduction

Three provinces of Atlantic Canada have been investigated for the presence of lignicolous fungi. Meyers and Reynolds (1960) isolated marine fungi from submerged wood at Halifax and Liverpool. N.S.; St. Andrew's, N.B.; and Argentia, Nfld. Hughes (1968) recorded marine fungi on driftwood from two sites on the eastern coast of Nfld. The Bay of Fundy, located between N.B. and N.S., has been extensively studied. Neish (1970) isolated marine fungi from driftwood at 7 sites on the N.S. coast. Boland and Grund (1979) reported fungi on wood and *Spartina* species from the salt marshes of the Minas basin. Miller and Whitney (1981) described fungi from intertidal and drift wood at 8 sites and from submerged panels at 1 site on the N.B. coast of the Bay of Fundy.

One area of the Atlantic provinces that has not been investigated for the presence of marine fungi is in the waters around Prince Edward Island. These waters are part of

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the Gulf of St. Lawrence and have different hydrographical characteristics than the waters at the places listed above (i.e.) higher average surface temperatures in summer and coverage by ice all winter. Details of the physical and biological features of coast of P.E.I. can be found in Stephenson and Stephenson (1954a,b).

This paper reports lignicolous marine fungi found at 5 sites on the coast of P.E.I. and describes a new species of the genus *Didymosphaeria*.

## Materials and Methods

### Sites

Site 1 (46° 35.5' N 63° 51.5' W) is in Malpeque Bay, a sheltered bay opening on the north shore of P.E.I. Sites 2 (46° 33' N 63° 51.5' W), and 3 (46° 33' N 63° 41' W) are on the north shore of P.E.I. The north shore has a 10-20 m horizontal tidal range, high energy beaches and severe ice scouring. Sites 4 (46° 24.5' N 64° 0.85' W) and 5 (46° 24' N 64° 06' W) are on the south shore of P.E.I. These areas have a 20-30 m horizontal tidal range, moderate energy beaches and moderate ice scouring. Vertical tidal range at all sites is 1-3 m. Summer surface water temperatures average 19-21°C, with slightly warmer temperatures on the south shore. Surface water temperatures can reach extremes of 25°C at most of the sites. Summer salinities in the area average 27-30 ‰. In the winter ice formed at all sites.

### Collection techniques

Three types of wood cut into panels and blocks were submerged from May to October at sites 1, 3 and 4 in 1983 and sites 1, 2 and 4 in 1984. The types of wood used were: birch (*Betula alleghaniensis* Britton), spruce (*Picea glauca* (Moench) Voss) and pine (*Pinus strobus* L.). Panels were 14 cm x 10 cm x 2 cm and blocks were 2.5 cm x 2.5 cm x 2.0 cm. Before submergence the wood was sterilized by steaming for 1 hr at 100°C then for a further hour after 24 hr at room temperature. Panels were strung together with polypropylene rope in a "sandwich" arrangement (Meyers & Reynolds 1958), each string consisting of two sets of three panels of the same type. Blocks (ten of any one type per bag) were placed in fiberglass screen bags (20 cm x 30 cm) and tied 60 cm apart on polypropylene rope. The panels and blocks were transported to each site in sterilized plastic bags. Submersion consisted of placing panels and blocks, two sets of each, at each site so that they were covered by about 0.5 m of water at low tide.

After five months the wood was collected and put into sterilized plastic bags. In addition, intertidal and driftwood were collected from the beach at sites 1, 3 and 5 and placed in sterile plastic bags. All the wood was transported, on ice, to the laboratory in Fredericton, N.B. where it was stored at 5°C, pending isolation and identification of the fungi present.

### Isolations and identification

Isolation of fungi from the wood were made onto artificial medium within 5 days of removal of the wood from the water. The medium consisted of glucose (1 g), yeast extract (0.1 g) and agar (18 g) in 1L of seawater 28 ‰ (Johnson & Sparrow 1961) plus penicillin G and streptomycin sulphate (0.5 g/L of each). Either ascospores, conidia or hyphae were streaked on the surface of the medium in Petri dishes. The dishes were incubated at 25°C in the dark until growth occurred. Pure cultures were obtained by transferring, to cornmeal-artificial seawater (Lyman & Fleming 1940)-agar medium, single-spore isolates in the case of spores, and hyphal-tip isolates in the case of hyphae. These were stored at 5°C on 2% malt extract-seawater agar or seawater agar slants.

For identification and voucher of these fungi permanent slides were made using the technique described by Kohlmeyer and Kohlmeyer (1979). Identification was based on ascocarp, ascus and spore characteristics. The slides were deposited in the Connell Memorial Herbarium (UNB) at the University of New Brunswick, Fredericton, N.B.

### Results and Discussion

A total of 20 lignicolous marine fungi were isolated including one new species. All the fungi listed are first reports for the coast of P.E.I. Although the hydrographic characteristics around P.E.I. are different from the waters around the other Atlantic provinces, the fungi are similar. Description of these 20 fungi follows:

#### Ascomycetes

1. *Ceriosporopsis halima* Linder, in Barghoorn and Linder, *Farlowia* 1:409, 1944.  
Ascospores 23-26 x 9-10 (-13)  $\mu\text{m}$  (excluding appendages).  
Habitat: submerged panels (spruce (sp), pine (p) and birch (b)), and blocks (sp, p, b) at sites 1, 2 and 4. Intertidal wood at sites 1 and 3. Previously reported in Nova Scotia (Neish 1970) and the Bay of Fundy (Miller & Whitney 1981). Other Canadian reports noted in Booth (1981).
2. *Ceriosporopsis tubulifera* (Kohlm.) Kirk, in Kohlmeyer, *Can. J. Bot.* 50:1953, 1972.  
Ascospores 21-26 x 10-13  $\mu\text{m}$  (excluding appendages).  
Habitat: intertidal wood (site 3). Ascocarps were deeply embedded under ascocarps of *Halosphaeriopsis mediosetigera* in well-rotted pieces of intertidal wood. Previously reported in the Bay of Fundy (Miller & Whitney 1981), in Nova Scotia (Neish 1970) and Newfoundland (Hughes 1968) as *Halosphaeria tubulifera*. Other Canadian reports noted in Booth (1981).
3. *Corollospora maritima* Werdermann, *Notizbl. Bot. Gart. Berlin* 8:248, 1922.  
Ascospores (26-) 31-33 x 7.5-8  $\mu\text{m}$ .  
Habitat: submerged panels (sp, b) at site 1, (sp) at site 2; blocks (sp, p, b) at site 1, and intertidal wood at site 1. This fungus was found fruiting on sand or mud stuck on wood as well as on the wood itself. Previously reported in the Bay of Fundy (Miller and Whitney 1981) and in Nova Scotia (Neish 1970). The other Canadian report is from British Columbia (Hughes 1969).
4. *Halosphaeria appendiculata* Linder, in Barghoorn and Linder, *Farlowia* 1:412, 1944.  
Ascospores 23.5-26 x 10-13  $\mu\text{m}$  (excluding appendages).  
Habitat: submerged panels (b) at sites 1 and 4; blocks (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981), Nova Scotia (Neish 1970) and Nfld. (Hughes 1968). The other Canadian report is from British Columbia (Hughes 1969).
5. *Halosphaeria hamata* (Hohnk.) Kohlm. *Can. J. Bot.* 50: 1956, 1972.  
Ascospores 23.5-28.5 x 8-13  $\mu\text{m}$ .  
Habitat: submerged panels and blocks (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and in Nova Scotia (Neish 1970; Boland & Grund 1979). The other Canadian report is from British Columbia (Hughes 1969).
6. *Halosphaeriopsis mediosetigera* (Cribb et Cribb) T.W. Johnson, J. Elisha Mitchell Sci. Soc. 74:44, 1958.  
Ascospores 39-44 (-48) x 15-20  $\mu\text{m}$ .  
Habitat: intertidal wood at sites 1, 3 and 5; submerged panels (b) at site 4. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Boland & Grund 1979) as *Halosphaeria mediosetigera*. Other Canadian reports noted in Booth (1981).

7. *Leptosphaeria oraemaris* Linder, in Barghoorn and Linder, *Farlowia* 1:413, 1944. Ascospores 21-23 x 5-7  $\mu\text{m}$ . One septum at equator of spore.

Habitat: intertidal wood at sites 3 and 5. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Neish 1970).

8. *Lulworthia* sp.

Ascospores (182-) (195-) 220-286 (-364) x 3-5  $\mu\text{m}$ . These ascospores had a conical apical chamber at each end and a large guttule at the midpoint of the spore.

Habitat: submerged panels (sp, b) at sites 1, 2 and 4; blocks (sp) at site 4 and (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981), Nova Scotia (Neish 1970) and Nfld. (Hughes 1968). Other Canadian reports noted in Booth (1981). We agree with Hughes (1968) and Kohlmeyer and Kohlmeyer (1979) that further taxonomic research is needed to separate species.

9. *Nais inornata* Kohlm., Nova Hedwegia 4:409, 1962.

Ascospores 26-31 x 13-15  $\mu\text{m}$ .

Habitat: submerged blocks (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Boland & Grund 1979). Other Canadian reports noted in Booth (1981).

10. *Nereiospora cristata* (Kohlm.) Jones, Johnson and Moss, *Botanical Journal of the Linnean Society* 87:206, 1983.

Ascospores 33-41 x 12-16  $\mu\text{m}$  (excluding appendages).

Habitat: intertidal wood at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981), Nova Scotia (Neish 1970) and Nfld. (Hughes 1968) as *Corollospora cristata* (Kohlm.) Kohlm. The other Canadian report is from British Columbia (Hughes 1969).

11. *Remispora pilleata* Kohlm. Nova Hedwegia 6:319, 1963.

Ascospores (28.6-) 31.2-36.4 x 18.2-20.8  $\mu\text{m}$  (excluding appendages).

Habitat: intertidal wood at sites 1 and 4. Previously reported in Nfld. (Hughes 1968) and the Bay of Fundy (Miller & Whitney 1981) as *Halosphaeria pilleata* (Kohlm.) Kohlm. The other Canadian report is from British Columbia (Hughes 1969).

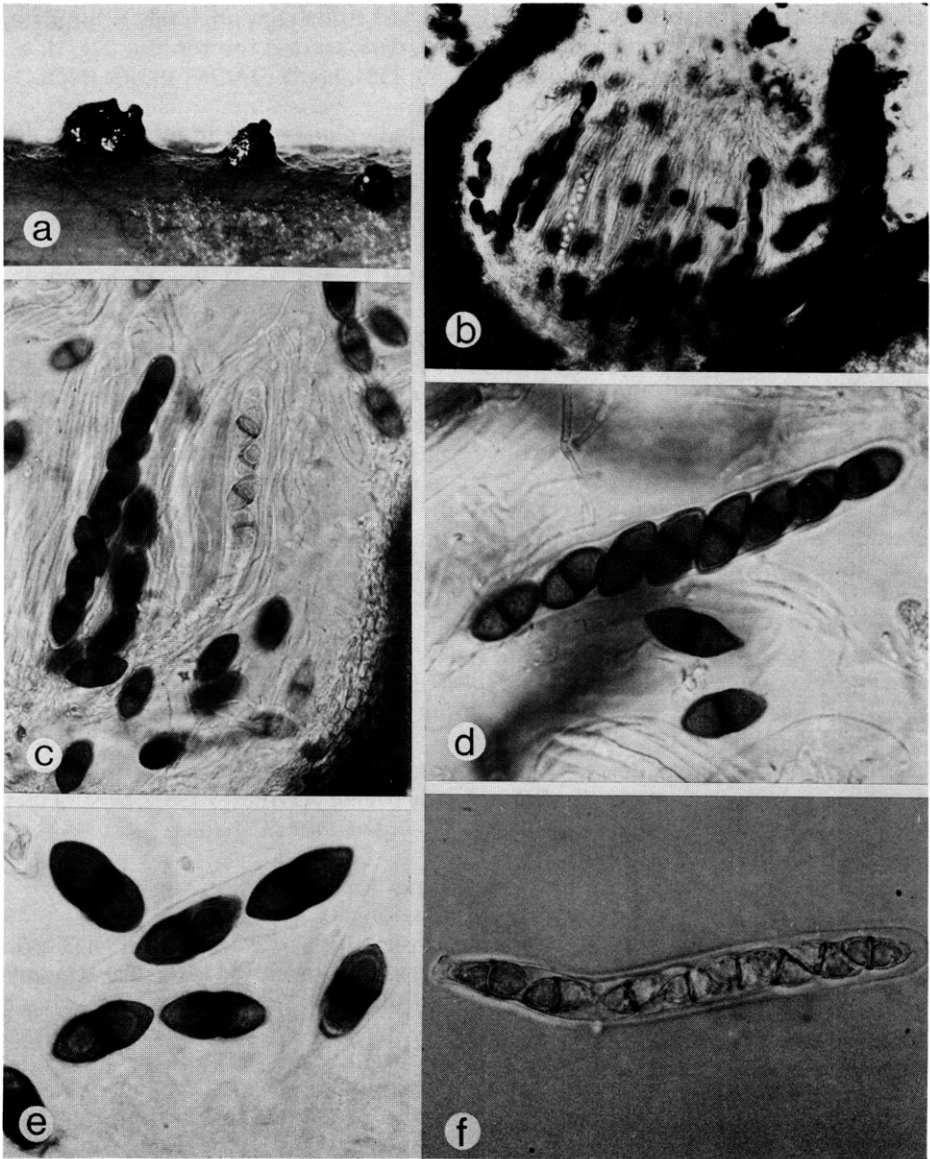
12. *Sphaerulina oraemaris* Linder, in Barghoorn and Linder, *Farlowia* 1:413, 1944.

Ascospores 28.6-33.8 x 7.8-10.4  $\mu\text{m}$ .

Habitat: submerged panels (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Neish 1970).

13. *Didymosphaeria lignomaris*, Strongman and Miller, sp. nov. Fig. 1, a-f.

ASCOCARPI: (187.5) 220-312.5  $\mu\text{m}$  in diametro, 225-250  $\mu\text{m}$  alti, subglobosi, partim aut totaliter immersi, ostiolati, papillati, nigri. PERIDIUM: 30-70  $\mu\text{m}$  crassum, prosenchymaticum, superficie verruculosa emergentibus crassitunicatis et orbicularibus cellis, nigrum ad superficiem, hyalinum prope venter. PAPPILLAE absentes aut curtae, 35  $\mu\text{m}$  altae, 100-120  $\mu\text{m}$  in diametro; ostiolatus canalis 30-45  $\mu\text{m}$  in diametro. PSEUDOPARAPHYSES 1-2  $\mu\text{m}$  in diametro, filiformes, affixae ad ambas fines. ASCI 120-135  $\mu\text{m}$ , octospori, cylindrici, bitunicati, crassitunicati, sine acroapparatus, crescentes in strato ad fundamentum ascocarpi ventris. ASCOSPORAE 24.7-26 x 10-11.7  $\mu\text{m}$ , uniseriatae, ellipsoeidae, uniseptatae in medio, colligatae ad septum, subtiliter echinulatae, crassitunicatae, phaeoincrassatae circum apices, luctuosae circum septum. HABITAT in ligno. TYPUS: Herb DAOM 193904 (HOLOTYPE). ASCOCARPS (187.5) 220-312.5  $\mu\text{m}$  diameter, 225-250  $\mu\text{m}$  high, subglobose, partly or totally immersed, ostiolate, papillate, black (Fig. a). PERIDIUM 30-70  $\mu\text{m}$  thick, prosenchymatous, surface verruculose by emerging round thick-walled cells, black at the surface, hyaline near the venter (Fig. b,c). PAPPILLAE absent or short, 35  $\mu\text{m}$  high, 100-120  $\mu\text{m}$  in diameter, ostiolar canal 30-45  $\mu\text{m}$  in diameter. PSEUDOPARAPHYSES 1-2  $\mu\text{m}$  in diameter, filiform, attached at both ends. ASCI 120-135  $\mu\text{m}$ , eight spored, cylindrical, bitunicate thick walled, without apical apparatuses, developing in a layer at the base of the ascocarp venter (Fig. b, e, f). ASCOSPORES 24.7-26 x 10-11.7  $\mu\text{m}$ , uniseriate,



- Fig. 1a Ascocarps. (30x).  
 Fig. 1b Cross section of an ascocarp. (200x).  
 Fig. 1c Cross section of an ascocarp showing characteristics of the peridium. (450x).  
 Fig. 1d Ascus containing mature ascospores showing uniseriate arrangement. (700x).  
 Fig. 1e Spore characteristics. (850x).  
 Fig. 1f Ascus containing immature ascospores. (700x).

ellipsoidal one-septate in the middle, constricted at the septum, finely echinulate, thick walled, thickenings around the apices, dark around the septum (Fig. d, e). SUBSTRATE submerged birch blocks. Oct. 10, 1984. Herb. DAOM 193904 (HOLOTYPE).

Eymology: from the Latin, *lignum* = wood and - *maris* = -sea, in reference to the substrate of the species.

Habitat: submerged blocks (b) at site 1.

#### *Deuteromycetes*

1. *Cirrenalia macrocephala* (Kohlm.) Meyers et Moore, Am. J. Bot. 47:347, 1960.

Conidia: spirals 19.5-22  $\mu\text{m}$  wide, 18-19.5  $\mu\text{m}$  high; terminal cells 8-12  $\mu\text{m}$  in diameter, 5-10  $\mu\text{m}$  high; basal cells 6.5-8  $\mu\text{m}$  in diameter, 4  $\mu\text{m}$  high.

Habitat: submerged panels (sp, p) at site 1 and (sp) at site 2; blocks (sp, p) at site 1 and (sp) at site 4. This fungus colonized the entire surface of most spruce blocks submerged at sites 1 and 4 and was associated with heavy attack by wood-boring organisms. The only possible report of this fungus in eastern Canada is a symbol on a global distribution map (Hughes 1974). There was no reference to the source of this observation and Hughes could not provide the information (Hughes, pers. com.). We consider this the first report of *C. macrocephala* from the Atlantic Provinces.

2. *Dendryphiella salina* (Sutherland) Pugh et Nicot, Trans. Brit. mycol. Soc. 47:263, 1964.

Conidia: 13-22 x 6.5-8  $\mu\text{m}$ .

Habitat: submerged panels (sp) at site 1; blocks (p) at site 4; intertidal wood at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981).

3. *Humicola alopallonella* Meyers et Moore, Am. J. Bot. 47:346, 1960.

Conidia: apical cell 11.5-13 x 13-18  $\mu\text{m}$ .

Habitat: submerged panels (sp, p, b) at site 1; blocks (p, b) at site 1; intertidal wood at site 5. Previously reported in the Bay of Fundy (Miller & Whitney 1981), Nova Scotia (Boland & Grund 1979) and Nfld. (Hughes 1968). The other Canadian report is from British Columbia (Hughes 1969).

4. *Monodictys pelagica* (Johnson) Jones, Trans. Brit. mycol. Soc. 46:138, 1963.

Conidia: 28.5-39  $\mu\text{m}$  in diameter; 27-36.5  $\mu\text{m}$  long.

Habitat: submerged panels (b) at site 1 and (sp, p, b) at site 2; blocks (b) at site 1; driftwood and intertidal wood at sites 3 and 5. Previously reported in the Bay of Fundy (Miller & Whitney 1981), Nova Scotia (Neish 1970) and Nfld. (Hughes 1968). Other Canadian reports are noted in Booth (1981).

5. *Papulaspora halima* Anastasiou, Nova Hedwegia 6:266, 1963.

Habitat: submerged blocks (b) at site 1. Previously reported in the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Neish 1970). Other Canadian reports noted in Booth (1981).

6. *Trichocladium achrasporum* (Meyers et Moore) Dixon in Shearer et Crane, Mycologia 63:244, 1971.

Conidia: 28.5-31 x 13-18  $\mu\text{m}$ .

Habitat: submerged blocks (b) at site 1. Previously reported in Nfld. (Meyers & Reynolds 1959) as *Culcitalna achraspora*. Other Canadian reports are noted in Booth (1981).

7. *Zalerion varium* Anastasiou, Can. J. Bot. 41:1136, 1963.

Conidia: 21-41.5 x 23-41.5  $\mu\text{m}$ .

Habitat: submerged panels (sp, p) at sites 1, 2 and 4; blocks (p, b) at site 1, (p) at site 4; intertidal wood at sites 3 and 5. This fungus colonized the entire surface at most pine blocks submerged at sites 1 and 4. Previously reported from the Bay of Fundy (Miller & Whitney 1981) and Nova Scotia (Neish 1970). Other Canadian reports noted in Booth (1981).

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