sented in TABLE I. For the purpose of presentation, the data for individual harvest times are not presented. Rather, all harvest are combined since, with one exception, there was little or no change from one harvest to the next. The exception was in the starved group where the OM : DW declined slightly but not significantly, with each harvest.

The OM : DW of crabs on the complete diets, whether or not they were yeast-supplemented, were significantly higher ($t$-test) than all others, but were not significantly different from each other. Field crabs and crabs fed yeast-supplemented B-vitamin-deficient diets did not differ from each other, but were significantly higher than starved crabs, crabs on B-vitamin-deficient diets, and crabs fed yeast only.

Of particular interest is the fact that crabs on the B-vitamin-deficient diet responded no better than those that were starved or fed yeast only. However, when crabs were fed the B-vitamin-deficient diet plus either yeast, their OM : DW's rose significantly and were comparable to those of field crabs. These data suggest that the two yeasts are capable of supplying one or more B vitamins to the crabs. Since both yeasts are abundant in the saltmarsh soils and both can be found in the mid-gut of feeding crabs, it is possible that they do play a role in the nutrition of fiddler crabs in their natural habitat.

LITERATURE CITED

1. **Chrzanowski, Thomas H., and G. T. Cowley.** 1977. Responses of *Uca pugilator* to diets of two selected yeasts. *Mycologia* **69**: 1062–1068.
2. **Pitts, G. Y., and G. T. Cowley.** 1974. Mycoflora of the habitat and midgut of the fiddler crab, *Uca pugilator*. *Mycologia* **66**: 669–675.
3. **Teal, John M.** 1968. Distribution of fiddler crabs in Georgia salt marshes. *Ecology* **39**: 185–193.

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## *SAPROLEGNIA AUSTRALIS* FROM NEWFOUNDLAND[1]

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Padgett (**1976**) isolated *Saprolegnia australis* Elliott in North Carolina, and this constituted the first report of the fungus since its initial isolation by Elliott (**1968**) in New Zealand. Padgett (**1976**) did not

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include field data, and Elliott (**1968**) only indicated the dates of collection for the 23 isolates examined: 20 March (7), July (2), 16 November 1953 (2), 18 January 1954 (9), and 10 October 1962 (3).

During a 1-yr quantitative study of the seasonal occurrence of representatives of the order Saprolegniales in Broadcove River (47°34'N, 52°51'W) near St. John's, 332 isolates of *S. australis* were obtained. Twenty liters of water were collected at each sampling time; of this, 5 liters were concentrated in a cooled, sterile continuous-flow plankton centrifuge (3,585 × *g*; Foerst Mechanical Co., Chicago, Illinois). This concentrate was aseptically plated out as 1-ml aliquots per Petri dish containing a modified version of the solid medium designed by Ho (**1975**) for isolation of representatives of the genus *Saprolegnia* and incubated at 13 C. After pure cultures were obtained, the isolates were grown at 13 C in a liquid medium (Nolan, **1975**) until adequate mycelial growth was obtained (usually 3 da). This growth was then transferred to sterile, distilled water; the development was followed during incubation at 13 C for 2 mo.

Eight collections were made during the sampling period, and *S. australis* occurred in the 1 December 1975, 22 March, 17 May, 14 July, 7 September, and 1 November 1976 samples. *Saprolegnia australis* isolates represented 22.9%, 1.1%, 31.0%, 40.2%, 20.7% and 10.6%, respectively, of the total number of isolates of aquatic fungi in each collection. The recorded water temperatures and *p*H values at the time of these collections were: 1.5 C (*p*H 6.6), 2.5 C (*p*H 5.5), 7.5 C (*p*H 5.9), 13 C (*p*H 6.2), 17 C (*p*H 6.6), and 8 C (*p*H 6.5), respectively. Thus, *S. australis* occurred locally on a year-round basis (being absent from only the 26 January and 31 December 1976 collections) and over the wide temperature range and the *p*H range characteristic of Broadcove River.

Elliott (**1968**) noted that oogonia of *S. australis* (isolate 359a) were larger in cultures incubated at 25 C than in cultures incubated at 20 C and that they contained more oospheres. Her isolate grew well at both of these temperatures in the laboratory, but it is not feasible to speculate on the importance of the choice of these two temperatures in relation to the pattern of development in nature because of the lack of field temperature data. All of the *S. australis* isolates from Broadcove River were able to grow vegetatively and to reproduce both sexually and asexually at 13 C in the laboratory. The 13-C-incubation temperature was selected because past results (Nolan and Lewis, **1974**; Nolan, **1975**; Nolan, **1976**) had indicated that it was suitable for growth and development of aquatic fungi collected throughout the year.

TABLE I

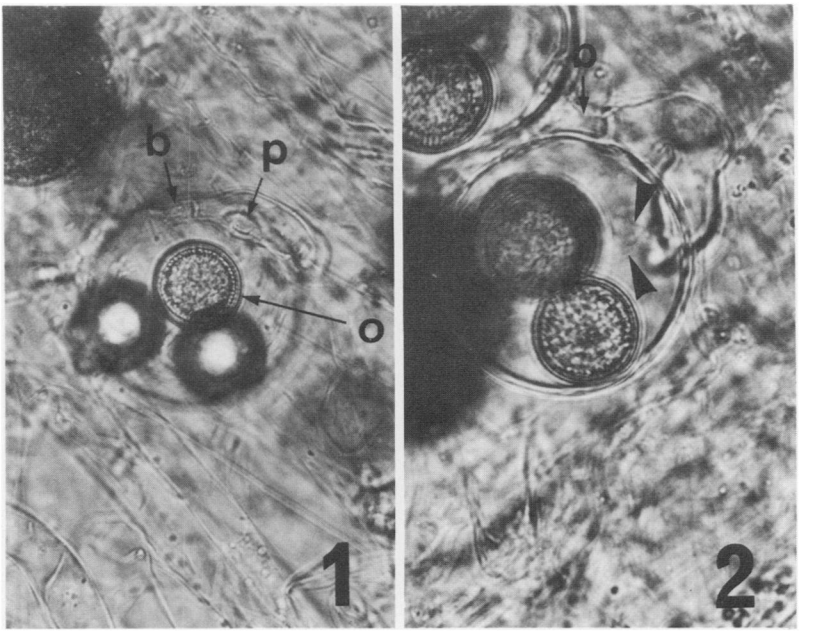
COMPARISON OF *Saprolegnia australis* ISOLATES

| Character | Elliott (1968) P.D.D. 25944 | Padgett (1976) W-10b | 7-16D 7-97D 7-35G |
|---|---|---|---|
| Main hyphal diam (base) | 30 μm | 33.7 μm | 31.3 μm |
| Gemmae | Filiform, clavate, spherical or irregular; may be abundant | —; abundant | Clavate, spherical, rarely irregular; terminal or intercalary; abundant |
| Sporangia | | | |
| Primary sporangium | | | |
| Shape | Filiform to clavate | — | Filiform to clavate |
| Dimensions | | | |
| Length | (20–)40–80(–100) μm | (84–)189–253(–460) μm | (95–)218(–418) μm |
| Width | —[a] | (15–)20–24(–31) μm | (19–)26(–33) μm |
| Exit pore (diam) | — | — | 8.5–9.7 μm |
| Secondary sporangia | | | |
| Length | Usually shorter than primary | Up to 600 μm | Usually slightly shorter than primary |
| Encysted zoospore (diam) | 10.5 μm | 11.7 μm | 10.7 μm |
| Type of zoospore discharge | — | Occasionally dictyoid | Occasionally dictyoid |
| Oogonia | | | |
| Location | Usually terminal; if lateral, stalk usually two to many times oogonium diam in length | Mostly terminal; if lateral, average stalk length 1.8 times oogonium diam in length, sometimes intercalary or sessile | Primarily terminal; if lateral, stalk generally more than twice the oogonium diam in length, never less than oogonium diam in length, can be intercalary |
| Shape | Pyriform to obovate | — | Spherical to pyriform |
| Size (diam) | (48–)60–80(–110) μm | (35–)59–74(–96) μm | (48–)59–80(–112) μm |
| Wall | Smooth with conspicuous pits; — | Pitted; — | Pitted; (4.8 μm diam) |
| Oospore | | | |
| Type | Subcentric type I or II, often not maturing | Subcentric type I, mostly not maturing or soon aborting | Subcentric type I or II, sometimes not maturing |
| Oospore | | | |
| Size (diam) | (10–)22–24(–27) μm | (18–)22–26(–31) μm | (19–)22–27(–36)) μm |
| Number per oogonium | (1–)6–12(–30) | (1–)4–8(–23) | (1–)5–10(–18) |
| Small oospores | Present in some isolates | Present | Rare |
| Antheridial branch | Well developed, branched, persistent | Well developed, not persistent | Well developed, persistent |
| Antheridial branch | | | |
| Origin | Usually diclinous, occasionally monoclinous or androgynous | Usually diclinous, variable | Usually diclinous, rarely androgynous |

TABLE I—(*Continued*)

| Character | Elliott (1968) P.D.D. 25944 | Padgett (1976) W-10b | 7-16D 7-97D 7-35G |
|---|---|---|---|
| Antheridial Cell type | Tubular to clavate, laterally appressed or attached by projections | Tubular or clavate, laterally appressed or attached by projections | Spherical, tubular or clavate, laterally appressed or attached in part, by projections |
| Antheridial cell size | — | — | Spherical, 9.6–14.4 μm diam; tubular: (26.4–)28.8–36.0 μm long × 12(–16.8) μm diam |
| Fertilization tubes | Not observed | Present; — | Present; 2.6–7.2 μm diam; cylindrical to fan-shaped |

[a] Data not given.




FIGS. 1–2. *Saprolegnia australis*. 1. Oogonium with pit (p) and type I oospore (o). Antheridium with persistent antheridial branch (b). × 1,100. 2. Oogonium with antheridium possessing a persistent antheridial branch (b) and a fan-shaped fertilization tube (double arrows). × 1,400.

A comparison of the characteristics observed for the isolates studied in our laboratory is made with the data from Elliott (**1968**) and Padgett (**1976**) (TABLE I). Seymour (**1970**) was consulted as he had examined Elliott's type material. Padgett's isolate W-10b (ATCC 32940) was studied after being grown under the same conditions used in the isolation and identification of the Newfoundland isolates. Our isolates 7–16D, 7–97D and 7–35G were felt to be characteristic of the isolates examined; however, the data given in TABLE I are a composite of the information obtained from the 332 isolates.

The Newfoundland isolates are very interesting not only from a biogeographical point of view but also because they show characteristics of each of the groups of isolates studied by Elliott (**1968**) and Padgett (**1976**) and, thus, serve to bridge the gaps between any differences previously noted. The Newfoundland isolates (TABLE I) have fertilization tubes present and sporangia which more closely approximate the size of those measured by Padgett (**1976**), but they have persistent antheridial branches (FIGS. 1, 2, b) and encysted zoospore diam which more closely approximate the data of Elliott (**1968**). One feature which has not been mentioned previously is the presence of "fan-shaped" fertilization tubes (FIG. 2, double arrows). Overall, however, the three groups of isolates display a reasonable degree of uniformity (TABLE I).

## LITERATURE CITED

**Elliott, R. F.** 1968. Morphological variation in New Zealand Saprolegniaceae. 2. *Saprolegnia terrestris* Cookson and *S. australis* sp. nov. *New Zealand J. Bot.* **6**: 94–105.

**Ho, H. H.** 1975. A selective medium for the isolation of *Saprolegnia* spp. from freshwater. *Canad. J. Microbiol.* **21**: 1126–1128.

**Nolan, R. A.** 1975. Physiological studies with the fungus *Saprolegnia megasperma* isolated from the freshwater nematode *Neomesomermis flumenalis*. *Canad. J. Bot.* **53**: 3032–3040.

——. 1976. Physiological studies on an isolate of *Saprolegnia ferax* from the larval gut of the blackfly *Simulium vittatum*. *Mycologia* **68**: 523–540.

——, **and D. J. Lewis.** 1974. Studies on *Pythiopsis cymosa* from Newfoundland. *Trans. Brit. Mycol. Soc.* **62**: 163–179.

**Padgett, D. E.** 1976. An isolate of *Saprolegnia australis* from southeastern North Carolina. *Mycologia* **68**: 1258–1260.

**Seymour, R. C.** 1970. The genus *Saprolegnia*. *Nova Hedwigia* **19**: 1–124.