Reports

Incidence of Marine Fungi in Relation to Wood-Borer Attack

The destruction of wood, when it is submerged continuously or intermittently in the sea, by isopod gribbles and teredine borers is well known. Various investigations have been made of the dynamics of attack and of the individual organisms involved. However, there is comparatively little information about the biological and physical agents that act upon the submerged wood substrate prior to the borer attack. One group of marine organisms that warrants serious consideration in this respect is that of the wood-inhabiting fungi, especially the Ascomycetes and the Fungi Imperfecti.

While our knowledge of marine fungi in general has increased considerably within the past 10 years, no intensive investigation has been made of the possible association of these fungi with the activity of wood-boring animals. However, it has been postulated that fungi may participate in a "conditioning" of the wood before attack by borers (*1*).

Since 1952, the Marine Laboratory of the University of Miami has been engaged in marine mycological studies (*2*), including numerous investigations of the distribution of fungi in Biscayne Bay, Florida, the Caribbean Sea, the Bahamas, the Gulf of Mexico, and at more than 63 stations throughout the United States, Canada, Alaska, Nova Scotia, Newfoundland, and the Canal Zone.

The collections and studies have involved different woods (primarily southern yellow pine and basswood), various seasons of exposure and lengths of submergence, and selected samplings within specific localities. The period of tests in boreal and northern temperate areas included the winter months, primarily from October through February, when borer activity is negligible and often completely absent. Hence, over this submergence period, with the factor of borer damage naturally limited, we have been able to examine the occurrence and extent of fungal infestation operating independently of marine borers. Two common gribbles, *Limnoria lignorum,* a boreal form, and *L. tripunctata,* an inhabitant of temperate areas, both have maximum activity at seasons of elevated temperature, usually beginning in the early spring (*3*). Similarly, the spawning of *Teredo navalis,* a widely distributed teredine borer, is activated at 11° or 12°C (*4*).

The following pertinent observations should be noted especially. (i) Fungal infestation of wood occurs at all our test localities, varying in intensity and in different genera and species involved. Species of *Lulworthia* and *Helicoma* are extremely abundant, colonizing wood at the majority of the stations. (ii) Vigorous attack upon submerged wood in boreal and northern temperate areas during winter months is accompanied by no, or very slight, borer damage. A similar situation occurs in subtropical localities, however, with a considerably shorter period of fungal attack prior to borer infestation. In Biscayne Bay, Florida, vigorous sporulation by ascomycetous fungi occurred on wood that had been submerged for approximately 2 to 3 weeks.

In addition to being manifested by the presence of surface and imbedded ascocarps and conidia, fungal infestation is also manifested through (i) softening and disintegration of the outer wood tissues, often to a depth of several millimeters, (ii) proliferation of the fungal hyphae throughout the wood, including ramification within the lumina of the tracheids and the wood rays, and (iii) direct penetration through the walls of the wood elements. In the latter process, a noticeable constriction of the hypha occurs as it passes through the cell wall, a condition common also among terrestrial wood-destroying fungi. Similar unsubmerged samples of yellow pine and basswood showed no fungal infestation.

Currently, it is not possible to evaluate completely the role of marine fungi in the deterioration of wood. However, the attack by these fungi upon the physical structure of wood is obvious. In our laboratory, pure culture studies of many marine genera indicate a definite growth-wise affinity for wood and wood products. Uniclonal attack upon wood, in standing and shaking sea-water aquaria, has been demonstrated repeatedly.

The vigorous fungal infestation of submerged wood prior to borer attack represents a biological phenomenon that investigators of marine wood destruction should not ignore. In northern areas, winter fungal infestation of wood is evident. Hence, in the early spring, when borer activity increases rapidly, the animals have available a wood substrate thoroughly infected by a variety of marine fungi. The interrelationships within this biota are being studied in our laboratory (*5*, *6*).

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References and Notes

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5. These studies were supported by contract Nonr 1811(00), Microbiology Branch, Office of Naval Research. This article is contribution No. 188 from the Marine Laboratory, University of Miami.
6. A complete summarization of the fungal infestation at all our test localities is in preparation.

29 July 1957

Coumestrol, a New Estrogen Isolated from Forage Crops

Natural estrogens in plants have assumed considerable importance since the demonstration of their presence in forages and the suggestion of their possible beneficial effects on milk production (*1*) and meat production (*2*) and of their probable responsibility for the infertility in sheep grazing on such pastures (*3*). Included among the forages from which estrogens have previously been isolated are subterranean clover (*4*) and red clover (*5*). Other forages which have also been reported to be estrogenic, but from which no estrogens have been isolated to date, include alfalfa, *Medicago sativa*; ladino clover, *Trifolium repens*; strawberry clover, *Trifolium fragiferum*; orchard grass, *Dactylis glomerata*; rye grass, *Lolium perenne*; and blue grass, *Poa pratensis* (*6*).

All the estrogens previously isolated from forage crops have proved to be isoflavones. These include genistein, biochanin A, and formononetin (*7*). Genistein and daidzein in the form of their glucosides have also been isolated from soybean oil meal, a generally used feed ingredient. The estrogenic activity of subterranean clover has been attributed to

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