PARASITES OF THE TIDE POOL FISH *Liparis atlanticus* (OSTEICHTHYES: LIPARIDAE)*

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Abstract: Of 128 sea snails (*Liparis atlanticus*) collected from tide pools along the New Hampshire coast, over 90% were infected with the cestode *Spathebothrium simplex* and with one or both of the trematodes *Podocotyle reflexa* and *Podocotyle atomon*. Additional helminths found included *Echinorhynchus gadi*, *Prosorhynchus crucibulum*, and larval *Thynnascaris* sp. in 21, 12, and 9 percent of the hosts, respectively. All fish were infected with a species of *Eimeria*, and almost 30% had *Trichodina* sp. on their gills. The microscopic lesions associated with these infections are described, and the possible effects of these parasites on populations of *L. atlanticus* are discussed.

INTRODUCTION

Knowledge of the parasites of tide pool fish of the New England coast is very incomplete. *Liparis atlanticus*, commonly known as the sea snail, is found along rocky shores from Newfoundland to southern New England. Fish are found adhering to the undersides of rocks and clinging to vegetation in littoral tide pools and in the sublittoral.

MATERIALS AND METHODS

Over a 2 year period 128 sea snails were collected by dip net from tide pools at Odiorne's Point and Rye Ledges, Rye, New Hampshire. Most fish were killed and examined immediately upon return to the laboratory. The remainder were held in aquaria for several days to allow removal of undigested food from the intestine.

Excised intestines were either fixed unopened with the parasites in situ, or were placed in saline, opened, and the individual worms were removed and fixed. Trematodes, cestodes, and acanthocephalans were relaxed, fixed in alcohol-formalin-acetic acid, and stained with either borax carmine or chrome alum-galloycyanin. Nematodes were fixed in glacial acetic acid and cleared in 5% glycerine in 70% alcohol which was subsequently evaporated to pure glycerine. Unopened intestines were fixed in either neutral buffered formalin or Bouin's fixative and embedded in paraffin. Sections were cut at seven microns and stained with either Ehrlich's hematoxylin and eosin or Gomori's trichrome stain.

Fecal smears and gill scrapings were examined from each fish.

RESULTS AND DISCUSSION

Table 1 lists the parasites found in *Liparis atlanticus* during this investigation.

Protozoa

*Eimeria* sp.—Every fish was infected with this coccidian. Parasites were distributed throughout the length of the intestine, but the heaviest infections were in the posterior intestine where much of the mucosa was often invaded and destroyed (Fig. 1). This parasite caused the

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TABLE 1. Parasites of 128 *Liparis atlanticus* from New Hampshire tide pools.

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Number of Fish Infected</th>
<th>Percent Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protozoa:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Eimeria</em> sp.</td>
<td>128</td>
<td>100.0</td>
</tr>
<tr>
<td><em>Trichodina</em> sp.</td>
<td>38</td>
<td>29.7</td>
</tr>
<tr>
<td>Trematoda:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Proserpina crucibulum</em></td>
<td>15</td>
<td>11.7</td>
</tr>
<tr>
<td><em>Podocotyle reflexa, P. atomon</em></td>
<td>117</td>
<td>91.4</td>
</tr>
<tr>
<td>Cestoda:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Spathebothrium simplex</em></td>
<td>119</td>
<td>93.0</td>
</tr>
<tr>
<td>Acanthocephala:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Echinorhynchus gadi</em></td>
<td>27</td>
<td>21.1</td>
</tr>
<tr>
<td>Nematoda:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Thynnascaris</em> sp.</td>
<td>12</td>
<td>9.4</td>
</tr>
</tbody>
</table>

FIGURE 1. Section through the posterior intestine of *L. atlanticus* showing heavy infection of *Eimeria* sp. in the mucosa. Note section through *Podocotyle* sp. in the lumen of the intestine. Bouin's, H and E. X100
most serious histopathological damage seen during this study, sometimes occupying large areas of the intestinal mucosa in a given microscopic section. There was no evidence of preference for specific epithelial regions. Cells from the tips of the villi to the depths of the crypts of Lieberkühn were parasitized with equal frequency. Heavily infected villi appeared slightly flattened, but there was no accompanying infiltration of the lamina propria with lymphocytes or other inflammatory cells. The submucosa was not invaded. Several species of this genus have been reported from marine fish, among them E. gadi from cod, E. sardiniae from sardines, E. brevoortiana from menhaden, and E. clupearum from herring and mackerel.

Trichodina sp.—This ciliate was observed on the gills of 38 fish. No apparent injury was associated with this organism, all infections being relatively light. More than 90 species of trichodinids have been described from marine and freshwater fish.

Trematoda

Prosorhynchus crucibulum—Fifteen fish were parasitized by this gasterostome. All worms were located deep in the intestinal ceca where their spinous teguments caused light abrasion of the mucosa. Dawes states that the three most commonly reported species of Prosorhynchus in marine fish are P. aculeatus, P. squama tus, and P. crucibulum, and believes the first two species may be synonymous with the last. Liparis spp. have been reported as definitive hosts or P. crucibulum in Asian waters and for P. squamatus in the Baltic Sea. Cercariae of P. squamatus are found in Mytilus edulis. If the three species of Prosorhynchus are synonymous, then Mytilus edulis, also found in tide pools with L. atlanticus, may serve as an intermediate host for P. crucibulum along the New England coast.

Podocotyle reflexa and Podocotyle atomon—Only 11 sea snails were not parasitized by a species of Podocotyle. P. reflexa was more prevalent than was P. atomon. These trematodes were distributed throughout the length of the intestine when the cestode Spathebothrium simplex was absent, but were located in the mid- and posterior intestine when the tapeworm occupied the anterior end. Histopathological damage caused by these parasites was limited to the ingestion of small areas of the mucosa with their suckers.

Seventeen species of Podocotyle are parasitic in marine fish of the colder waters of the Atlantic and Pacific Oceans. P. reflexa has been reported from Cyclopterus lumpus (a fish related to L. atlanticus) in the Baltic Sea, and from Onas mustelus, a British tide pool fish. In Asian waters Liparis spp. are hosts for both P. reflexa and P. atomon. Cercariae of P. atomon are found in Littorina rudis (= L. saxatilis) and metacercariae occur in Gammarus sp. These invertebrates are present in the tide pools with L. atlanticus.

Cestoda

Spathebothrium simplex—This tapeworm was present in all but nine hosts. Worms were always located in the anterior intestine and their scolecis often protruded deep into the ceca. Little tissue damage was caused by the undifferentiated scolex of S. simplex, but in heavy infections the worm mass flattened the mucosa and eroded the brush border (Fig. 2). The number of goblet cells appeared constant in both light and heavy infections, contrasting with the disappearance of goblet cells seen in the intestine of the marine fish Synodus intermedius when heavily infected by the cestode Acromonoplos cerphilum tortum. S. simplex has been reported from several hosts including Liparis liparis at Woods Hole, Liparis fuscescens from the west coast of North America, Crystal lias matshushima from the Sea of Japan, and Liparis spp. in Asian waters.

Acanthocephala

Echinorhynchus gadi—This parasite was found in 27 fish. All specimens were immature, indicating that L. atlanticus may not be a normal definitive host for the parasite. Grossly, the infected intestine
FIGURE 2. Section through the anterior intestine of L. atlanticus showing flattening of the mucosa due to a heavy infection of Spathebothrium simplex. Bouin's, Trichrome. X 250

Nematoda

Thynnascaris sp.—Larval stages of this nematode were entwined in the mesenteries of 12 fish. No apparent lesion was associated with the parasite. A closely related genus, Contraeacum, has been reported from Liparis sp. at Woods Hole.¹

All fish examined appeared normal. None were emaciated or showed signs of sickness or malnutrition. However, the relative confinement of a tide pool does increase the possibility for reinfection which could result in severely pathogenic massive infections. This would be especially true of parasites with direct life cycles such as Eimeria and Trichodina. The pathogenicity of Trichodina in aquaria and hatcheries is well known, and fishes with small opercular openings such as L. atalanticus would be especially susceptible to respiratory impairment due to a heavy infection with this ciliate. The destruction of intestinal epithelium by Eimeria sp. would certainly have a deleterious effect on intestinal absorption and glandular secretion, and this parasite is...
FIGURE 3. Longitudinal section through the proboscis of *Echinorhynchus gadi* showing total destruction of seasnail intestinal epithelium at the point of proboscis penetration. Bouin's, H and E. X 250

FIGURE 4. Cross section of the proboscis of *E. gadi* in the lamina propria of seasnail intestine. Note the loosely arranged fibroblasts and lymphocytic infiltration located around the proboscis. H and E. X250.
capable of a rapid build up in population. Both of these protozoans could have serious effects on a population of seasnails in a given tide pool. The distortion and flattening of the mucosa by *S. simplex* would also affect intestinal absorption. The life cycle of this tapeworm is unknown, but related cestodes utilize amphipods as intermediate hosts. *Gammarus oceanicus* is commonly found in tide pools and may serve as intermediate host for this parasite. If this were true, it would certainly increase the possibility of the occurrence of heavy cestode infections. Because *L. atlanticus* is apparently an abnormal definitive host for *E. gadi*, the chances of heavy parasitism by this acanthocephalan appear minimal, even though the probable amphipod intermediate host is readily available. The other helminths found apparently have little, if any, effect on populations of *L. atlanticus*.

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LITERATURE CITED


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