THE FIRST ASSOCIATION OF CONCHODERMA VIRGATUM (SPENGLER) (CIRRIPIEDIA: THORACICA) WITH A EURYPHODID COPEPOD IN THE MOUTH OF A FISH

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Abstract. A specimen of Dysgamus atlanticus (Copepoda: Caligidae) was a new host for Conchoderma virgatum. The copepod occurred in the mouth of a whale shark, Rhincodon typhus (Chondrichthyes: Rhincodontidae), from Okinawa, Japan. This was also the first report of the barnacle on a parasitic copepod in the mouth of a fish, on a euryphorid copepod, and on a rhincodontid. The copepod has not previously been reported from Japan, nor in the mouth of its host. The barnacle may not be rare on non-permanently attached parasites, and may not be fatal to the parasites.

Williams (1978) reported the first association of Conchoderma virgatum (Spengler, 1790) (Cirripedia: Thoracica) with a copepod which was not permanently attached to a fish host, and the first report of this barnacle from elasmobranchs (Carcharhinidae and Lamnidae). The present paper describes the first report of C. virgatum on a parasitic copepod in the mouth of a fish, the first on a euryphorid copepod, and the first from a whale shark (Rhincodontidae). The copepod also has not previously been reported from Japan or from the mouths of fishes.

A whale shark, Rhincodon typhus Smith (Chondrichthyes: Rhincodontidae), 4.2 m in total length was examined 12 July 1985 after the specimen died 40 hours after being placed in the Okinawa Expo Memorial Park Aquarium, Motobu-cho, Okinawa, Japan. One hundred thirty of an estimated 500-600 Dysgamus atlanticus Steenstrup and Lutken (Copepoda: Caligidea) (deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A., USNM) were collected from the mouth of the shark during a hurried post-mortem examination and dismemberment. No copepods were found on the body, fins, gill chambers or gills. One of the copepods was host to a specimen of Conchoderma virgatum (USNM 228513) (The specimen of Williams (1978) was also deposited in the USNM). The barnacle was attached just right of center near the first antenna on the dorsal anterior carapace of the copepod, oriented at a 90° angle to the body plane of the copepod (Fig. 1). The barnacle was 6.0 mm in capitular length, 9.5 mm in total length, and the associated copepod 5.9 mm in total length. All measurements were made from preserved materials.

Williams (1978) suggested that Conchoderma virgatum developing on non-permanently attached copepods eventually cause the loss of the copepod host due to increased water resistance. Benz (1984) reiterated this idea with four more examples of pandarids on carcharhinid and lamnid sharks. The present specimen

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Fig. 1. *Conchoderma virgatum* (Spengler) attached to a female of *Dysgamus atlanticus* Steenstrup and Lutken from a whale shark, *Rhincodon typus* Smith.

of *C. virgatum* which is larger (161%) than its host (largest reported from a non-permanently attached copepod) would seem to contradict this explanation for the rarity of these associations. The mouth of a filter feeder should be as turbulent for *Dysgamus atlanticus* as the exterior of a shark was for the copepods considered by Williams (1978) and Benz (1984).

Hastings (1972) first reported the association of this barnacle with a non-permanently attached crustacean parasite (*Nerocila acuminata* Schioedte and Meinert) (Isopoda: Cymothoidae) and suggested the association was rare because the barnacle probably caused the detachment of the isopod. Brusca (1978) reported *C. virgatum* from *Nerocila californica* Schioedte and Meinert, and later (Brusca, 1981) noted the barnacle was frequently found attached to this isopod. Benz (1984) has shown pandarid copepod- *C. virgatum* associations are also common. The apparent rarity of non-permanently attached crustacean fish parasites and *C. virgatum* associations may be an artifact of insufficient data.

Williams (1978) reported *C. virgatum* associated with the shortfin mako, *Isurus oxyrhynchos* Rafinesque (Lamnidae), and the tiger shark, *Galeocerdo cuvieri* (Peron and Lesueur) (Carcharhinidae). The whale shark is the fifth species and third family of sharks with which this barnacle is known to associate (Table 1). *Conchoderma virgatum* has been reported on the external surfaces of fishes, whales, turtles and sea snakes (Roskell, 1969). It has not previously been reported in the mouths of marine vertebrates.

*Dysgamus atlanticus* has previously been reported from plankton or on the skin of the whale shark (as summarized by Yamaguti, 1963). It has not been reported from the mouth of the whale shark, and has not previously been reported from Japanese waters.

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Table 1. *Conchoderma virgatum* (Spengler) attached on sharks.

<table>
<thead>
<tr>
<th>Copepod hosts</th>
<th>Sharks*</th>
<th>Locality</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pandaridae</strong></td>
<td>Lamnidae</td>
<td>Caribbean</td>
<td>Williams, 1978</td>
</tr>
<tr>
<td><em>Dinemoura latifolia</em> (Steenstrup &amp; Lutken)</td>
<td>Shortfin mako</td>
<td>St. Croix</td>
<td></td>
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<tr>
<td>(shark tag, no copepod)</td>
<td>Carcharhinidae</td>
<td>Caribbean</td>
<td>Williams, 1978</td>
</tr>
<tr>
<td></td>
<td>Tiger shark</td>
<td>Puerto Rico</td>
<td></td>
</tr>
<tr>
<td><strong>Pandarus satyrus</strong> Dana</td>
<td>Blue shark</td>
<td>Atlantic</td>
<td>Benz, 1984</td>
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<td></td>
<td></td>
<td>New England</td>
<td></td>
</tr>
<tr>
<td><strong>Perissopus dentatus</strong> Steenstrup &amp; Lutken</td>
<td>Sandbar shark</td>
<td>Atlantic</td>
<td>Benz, 1984</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New England</td>
<td></td>
</tr>
<tr>
<td><strong>Euryphoridae</strong></td>
<td>Rhincodontidae</td>
<td>Pacific</td>
<td>Present paper</td>
</tr>
<tr>
<td><em>Dysgamus atlanticus</em> Steenstrup &amp; Lutken</td>
<td>Whale shark</td>
<td>Japan</td>
<td></td>
</tr>
</tbody>
</table>


** Permanently attached to shark.

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REFERENCES


