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The Juvenile Cresthead Flounder (*Pleuronectes schrenki*): An Occasional Cleaner Occurring in Lake Noto, Hokkaido

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Abstract

The stomach contents of seven juvenile cresthead flounder [*Pleuronectes schrenki* (Schmidt)] from Lake Noto in Hokkaido reported by Takatsu et al. (1999) as containing parasitic copepods were restudied. The results show some juvenile cresthead flounder behaved like a cleaner and picked the chalimus larvae of *Lepeophtheirus* sp. (Caligidae, Siphonostomatoida) off their fish hosts.

Key words: Parasitic copepods, *Lepeophtheirus*, Caligidae, Cleaner fish, Juvenile cresthead flounder, *Pleuronectes schrenki*, Lake Noto, Hokkaido

Introduction

Some species of the remoras (Echeneididae) and wrasses (Labridae) are known to pick (eat) the parasitic copepods off the fish that carrying the parasites (Cressey, 1970; Treasurer, 1993), but similar phenomenon has not been reported for any species of the righteye flounders. In their studies on the food and feeding of the juvenile cresthead flounder [*Pleuronectes schrenki* (Schmidt)] occurring in Lake Noto, Hokkaido, Takatsu et al. (1999) found specimens of two families of parasitic copepods, Taeniacanthidae (Poecilostomatoida) and Caligidae (Siphonostomatoida), in the stomach contents of some fishes that they were studying. This would imply that some juvenile cresthead flounder had behaved like a cleaner fish in Lake Noto.

The poecilostomatoid copepods of the taeniacanthids are parasites of sea urchins and fishes (Dojiri and Cressey, 1987). While most taeniacanthids occurring on the fish are found in the gill cavities, some of them are parasitic on the fins of flatfish (Ho, 1972). In other words, while the former taeniacanthids are not easily accessible to the putative cleaner like the juvenile cresthead flounder, but the latter taeniacanthids are. Also, while most caligids are parasitic on the teleosts, either on the body surface or inside the gill cavities, a few species are also known to occur in plankton (Heegaard, 1972; Pillai, 1985). On the other hand, if the attached larvae of the caligids, the four stages of chalimus, are found in the stomach content of a fish, then, it is certain that the

fish is a cleaner. Thus, in order to ascertain if the juvenile cresthead flounder occurring in Lake Noto behaved like a cleaner, it is necessary to study again the parasitic copepods reported by Takatsu et al. (1999).

Materials and Methods

The stomach contents of the seven juvenile cresthead flounder (*Pleuronectes schrenki*) reported by Takatsu et al. (1999) to contain parasitic copepods were reexamined under the dissection microscope. The specimens of copepod were removed from the samples and soaked in lactic acid for 3 to 5 minutes. Afterwards, the hanging-drop method devised by Humes and Gooding (1964) was employed to study the cleared specimens under the compound microscope.

The parasitic copepods studied in this report have been deposited in the National Science Museum in Tokyo (NSMT-Cr 13638 and 13639).

Results

The specimens of the parasitic copepods found in the stomach contents of the juvenile cresthead flounder are rather intact, except for missing some setae on the appendages. The results of our reexamination of the parasitic copepods are given in Table 1.

The stomach contents of the first two fishes, #69 and #74 in Table 1, were reported to contain in each case a specimen of taeniacanthid by Takatsu et al. (1999).

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However, our reexamination of the samples revealed that they are not taeniacanthid. The taeniacanthid copepods are characteristic in bearing a pair of tooth-like processes (maxillary hooks) on certain part of the cephalothorax (Ho, 1967), but this characteristic feature is lacking on those poecilostomatoids present in the stomach contents of #69 and #74. They are free-living and not parasitic poecilostomatoids.

The remaining five specimens of copepod parasites show the characteristic features of the caligid, with a short and broad cephalothoracic shield, 2-segmented antennule, prehensile antenna and maxilliped, uniramous leg 1 and leg 4, and apron-like leg 3. Due to the lack of a lunule on the frontal plate, they are identified as *Lepeophtheirus*.

Based on the works of Lewis (1963), Boxshall (1974), and Johnson and Albright (1991) the specimens in the stomach contents of #50, #54, and #58 are identified the female larvae in the stage of chalimus IV. Their general morphology resembles the two adult males found in #35 and #47 but differs from them in bearing an antenna with single terminal claw, an incompletely developed leg 4, and an immature genital-double somites. Thus, they are identified as the female larvae in the fourth chalimus stage (♀ C4).

Discussion

So far, two species of *Lepeophtheirus* are known from Hokkaido, *L. elegans* Gusev, 1950 reported by Ho and Kim (1996) and *L. bychowskyi* Gusev, 1950 reported by Shiino (1954) [Note: it was called "*Lepeophtheirus watanabei* n. sp." in Shiino's original description, but Ho and Kim (1996) relegated it to the synonym of *L. bychowskyi*]. The two adult males from the stomach contents of #35 and #47 resemble *L. bychowskyi* in having 3-toothed terminal claw on the antenna. However, they differ from *L. bychowskyi* in carrying an armature of I-I-III (instead of I-III) on the exopod of leg

4. Although their leg 4 resembles that of *L. elegans*, the terminal claw on the antenna shows great difference. Therefore, the two specimens of male *Lepeophtheirus* from the stomach contents of the juvenile cresthead flounder belong to a species yet to be reported from Hokkaido. Nevertheless, it should be noted that they bear close resemblance to the male of *L. paralichthydis* Yamaguti and Yamasu, 1960 reported by Kim (1998) from Korea. Since identification of the species of *Lepeophtheirus* is based mostly on the morphology of the female, with the lack of female specimen, it is difficult, if not impossible, to attempt a species identification.

In general, the male caligids develop faster than the female and attempts to hold the female in amplexus even though she is still in the larval (chalimus) stage. Thus, it is not uncommon to find a caligid male in plankton sample because he is in the process of searching for a female and might have temporarily left the fish host (Heegaard, 1972). Accordingly, finding a caligid male in the stomach contents of a fish does not mean necessarily that the fish has behaved like a cleaner. The specimen of male caligid might have been caught while it is swimming in the water in the process of searching for a mate. However, the occurrence of chalimus larva of a caligid in the stomach contents of a fish is different.

Normally, the chalimus larva attaches to the fish host by a frontal filament. The filament extends from the frontal area of the chalimus larva with its free end attaching to the hard tissue (head skeleton, scale, fin rays, etc.) of the fish host. This attachment mechanism is kept throughout the four chalimus stages even at the time of molting. Then it breaks off at the frontal area when the chalimus develops into the preadult. Thus, having chalimus larvae in the stomach contents of a fish would indicate that the fish had removed a parasite from another fish.

Takatsu et al. (1999) examined the stomach contents of 197 juvenile cresthead flounder from Lake Notoro.

Table 1. Parasitic copepods recovered from the stomach contents of the juvenile cresthead flounder (*Pleuronectes schrenki*) in Lake Notoro, Hokkaido.

Fish	Collection Date	Fish length (mm)		Parasitic copepod
		Total	standard	
# 69	7-29-1992	33.6 mm	27.5 mm	(not found)
# 74	7-29-1992	25.3 mm	21.1 mm	(not found)
# 35	7-29-1993	29.0 mm	23.2 mm	<i>Lepeophtheirus</i> sp., 1 ♂
# 47	7-29-1993	36.7 mm	30.1 mm	<i>Lepeophtheirus</i> sp., 1 ♂
# 50	8-31-1993	46.7 mm	37.5 mm	<i>Lepeophtheirus</i> sp., 1 ♀ C4*
# 54	8-31-1993	43.0 mm	34.3 mm	<i>Lepeophtheirus</i> sp., 1 ♀ C4*
# 58	8-31-1993	41.8 mm	34.2 mm	<i>Lepeophtheirus</i> sp., 1 ♀ C4*

*: "C4" stands for the fourth chalimus stage.

Of which three were found to contain the chalimus larvae of *Lepeophtheirus* (Table 1). This indicates unquestionably that some juvenile crested flounder from Lake Noto, Hokkaido had behaved like a cleaner.

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