

カワマスとイワナの口腔における寄生性カイアシ類Salmincola carpionisの分布

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Distribution of *Salmincola carpionis* (Copepoda: Lernaepodidae) in the Buccal Cavity of Salmonids

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The lernaepodid copepod *Salmincola carpionis* (Krøyer, 1837) was found in the buccal cavity of brook trout (*Salvelinus fontinalis*) and whitespotted charr (*Salvelinus leucomaenis*) reared at the Nikko Branch, National Research Institute of Aquaculture, in Tochigi Prefecture, central Japan. There was a significant difference in attachment sites of *Salmincola carpionis* in the buccal cavity between these two salmonids. The copepods showed a preference for the gill arches and their neighboring branchial region in brook trout, whereas the preference was for the more anterior oral region in whitespotted charr.

Key words: attachment site, parasite, *Salmincola carpionis*, salmonids, *Salvelinus fontinalis*, *Salvelinus leucomaenis*

Introduction

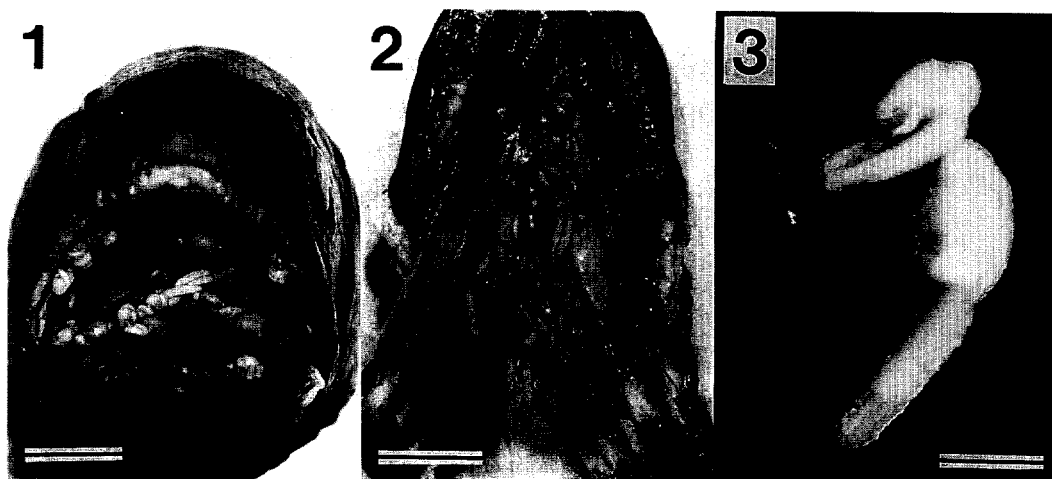
Infection with parasitic copepods was found in the buccal cavity of salmonids reared at the Nikko Branch, National Research Institute of Aquaculture, in the Nikko District, Tochigi Prefecture, central Japan (Figs. 1–2). The copepods were identified as *Salmincola carpionis* (Krøyer, 1837) (Fig. 3). Nagasawa *et al.* (1995) recently redescribed *S. carpionis* based on Japanese specimens. They reported that this species occurs on salmonids in central and northern Honshu and possibly also in Hokkaido. This note deals with the difference in distribution of *S. carpionis* in the buccal cavity between different hosts.

Materials and Methods

A total of 47 brook trout (*Salvelinus fontinalis*) and 30 whitespotted charr (*S. leucomaenis*) was collected on several occasions at the Nikko Branch from 1993 to 1996. The fish were measured to the nearest millimeter (body length [BL]), weighed to the nearest gram, and examined for *Salmincola*

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Figs. 1–3. Whitespotted charr (262 mm BL) infected with *Salmincola carpionis*. 1. Frontal view of the head of an infected fish. Scale bar: 1 cm. 2. *S. carpionis* on the floor of the buccal cavity. Scale bar: 1 cm. 3. *S. carpionis* taken from whitespotted charr. Scale bar: 2 mm.

carpionis. To facilitate examination of the roof and floor of the buccal cavity, an incision was made at each jaw hinge. When copepods were found, their positions of attachment were recorded. The floor and roof of the buccal cavity were each divided into three regions: oral, branchial, and pharyngeal regions (Figs. 4–5). The gill arches were included in the branchial region. The copepods found were fixed and stored in 70% alcohol.

Voucher specimens of adult female *S. carpionis* from the buccal cavity of brook trout collected on July 4, 1995, have been deposited in the National Science Museum, Tokyo (NSMT-Cr 11739).

Table 1. Distribution of *Salmincola carpionis* in the buccal cavity of brook trout and whitespotted charr from the Nikko Branch

	Brook trout	Whitespotted charr
Roof of the mouth	98 (45.4)*	21 (43.7)
Oral region	35 (16.2)	18 (37.5)
Branchial region	61 (28.2)	3 (6.2)
Pharyngeal region	2 (0.9)	0 (0)
Floor of the mouth	116 (53.7)	26 (54.2)
Oral region	26 (12.0)	11 (22.9)
Branchial region	89 (41.2)	15 (31.3)
Pharyngeal region	1 (0.5)	0 (0)
Opercula	2 (0.9)	1 (2.1)
Total	216 (100)	48 (100)

* Number of copepods (percentage of occurrence)

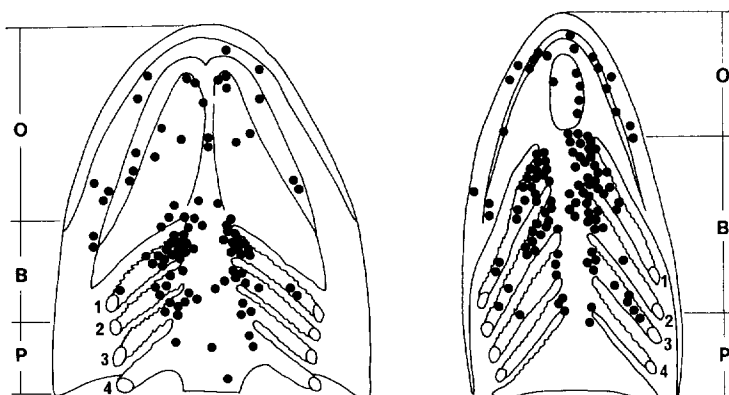


Fig. 4. Attachment sites (solid circles) of *Salmincola carpionis* ($n=214$) on the roof (left) and floor (right) of the buccal cavity of brook trout ($n=25$) from the Nikko Branch. Abbreviations: O, oral region; B, branchial region; P, pharyngeal region; 1–4, number of each gill arch.

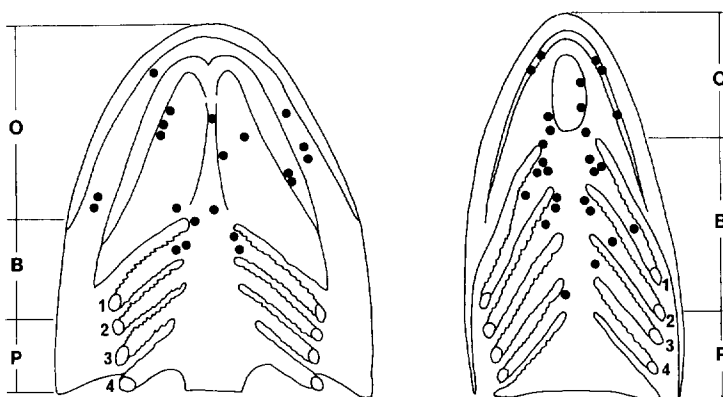


Fig. 5. Attachment sites (solid circles) of *Salmincola carpionis* ($n=47$) on the roof (left) and floor (right) of the buccal cavity of whitespotted charr ($n=10$) from the Nikko Branch. Abbreviations are as in Fig. 4.

Results

Twenty-five (53%) brook trout (245–370 mm BL) and 10 (33%) whitespotted charr (219–294 mm BL) carried 216 (mean: 8.6) and 48 (4.8) *S. carpionis*, respectively.

Except for three copepods found on the external surface of the lower jaw of these salmonids (2 on brook trout and 1 on whitespotted charr), all other copepods ($n=261$) were found attached in the buccal cavity of the fish. Although the copepods were widely distributed on the walls of the mouth, they were a little more abundant on the floor (54% for both salmonids) than on the roof. Within these areas, there was a significant difference in attachment sites between the two salmonids (G -test [Sokal and Rohlf, 1981], $G_{adj}=22.537$, d.f.=5, $P<0.001$). In brook trout, the branchial region was most heavily infected, followed by the oral and pharyngeal regions (Table 1, Fig. 4). Nearly 70% of the copepods were

attached to the branchial region, especially the first and second gill arches and their neighboring skin. In whitespotted charr, however, approximately 60% of the copepods were found in the oral region, although the branchial region of the floor was a little more heavily infected (Table 1, Fig. 5). No copepods were found in the pharyngeal region of whitespotted charr.

Discussion

The present report is the third of *S. carpionis* from salmonids raised at artificial facilities. Two previous records were from the Iwate Prefectural Inland Fisheries Experimental Station and the Asamushi Aquarium, which are both in northern Honshu, Japan (Nagasawa *et al.*, 1995). There have been no records of *S. carpionis* from salmonids reared in other countries, where all records were from wild fish. At the Nikko Branch, only brook trout and whitespotted charr were infected with *S. carpionis* but no other salmonid species carried this parasite. Nagasawa *et al.* (1997) provided data on the prevalence and intensity of *S. carpionis* on various salmonids from the Nikko Branch and discussed its host specificity.

The buccal cavity is the most preferred site of attachment for *S. carpionis* (Nagasawa *et al.*, 1995). The present study shows that there was a difference in attachment sites of *S. carpionis* within the buccal cavity between brook trout and whitespotted charr. Nagasawa *et al.* (1995) previously found a similar difference in distribution of *S. carpionis* in the buccal cavity of brook trout and other salmonids (whitespotted charr, Dolly Varden *Salvelinus malma*, Miyabe charr *S. malma miyabei*) from the Asamushi Aquarium but did not discuss this observation. Nagasawa *et al.* (1995) also suggested slight displacement in the attachment site of *S. carpionis* with increased intensity of infection. In the present case, however, it seems unlikely that the copepods on whitespotted charr selected the more anterior oral region due to crowding in the branchial region, since only a small number of *S. carpionis* (1–5 copepods per fish) was found in the branchial region of whitespotted charr. In other words, *S. carpionis* shows a different preference for attachment site in the buccal cavity between brook trout and other salmonids.

The mechanisms responsible for this host-related difference in distribution of *S. carpionis* in the buccal cavity of salmonids remain unknown. All of the salmonids examined in the present study had been fed artificial pellets, and it is unlikely that eaten food has some effects on the distribution of *S. carpionis* in the buccal cavity of salmonids. On the other hand, if there are some differences in water current and space in the buccal cavity of brook trout and others, it may be possible that *S. carpionis* selects different attachment sites between these salmonids. More study, including experimental infections, is required to clarify the basis for this difference.

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カワマスとイワナの口腔における寄生性カイアシ類 *Salmincola carpionis* の分布

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養殖研究所日光支所で飼育されているカワマスとイワナの口腔にカイアシ類の *Salmincola carpionis* の寄生を認めた。本種の口腔での寄生部位はカワマスとイワナで統計学的に有意に異なり、カワマスでは鰓弓とその周辺部に多かったが、イワナでは口腔の前部に多かった。本種は両魚種の咽頭部にはほとんど寄生しなかった。