

Some Aspects of the Ecology of the Parasite Fauna of the Gills of Yellow Perch, *Perca flavescens*

SHIBRU TEDLA AND C. H. FERNANDO

*Department of Biology
University of Waterloo, Waterloo, Ont.*

TEDLA, S., AND C. H. FERNANDO. 1970. Some aspects of the ecology of the parasite fauna of the gills of yellow perch, *Perca flavescens*. J. Fish. Res. Bd. Canada 27: 1045-1050.

Three parasites, the monogenean *Urocleidius adspetus*, the copepod *Ergasilus confusus*, and the glochidia of *Lampsilis radiata*, were common on the gills of the yellow perch collected from the Bay of Quinte, Lake Ontario, from May 1967 to April 1968. No correlation was found between the incidences of infestation of these three parasites. Except for the glochidia, more parasites were found on the second and third gill arches than on the first and fourth. Other records from the gills were the glochidia of *Elliptia complanatus*, the myxosporidian *Henneguya* sp., and nonparasitic mites belonging to *Hydrozetes* sp.

TEDLA, S., AND C. H. FERNANDO. 1970. Some aspects of the ecology of the parasite fauna of the gills of yellow perch, *Perca flavescens*. J. Fish. Res. Bd. Canada 27: 1045-1050.

L'examen des branchies de perchaudes rassemblées dans la Baie de Quinte, Lac Ontario, de mai 1967 à avril 1968, a révélé la présence de trois principaux parasites, le monogène *Urocleidius adspetus*, le copepod *Ergasilus confusus*, et les glochidia de *Lampsilis radiata*. Il n'existe pas de corrélation entre les incidences d'infestation de ces trois parasites. A l'exception des glochidia, plus de parasites apparaissent sur les second et troisième arcs branchiaux que sur les premier et quatrième. Les branchies portaient aussi d'autres parasites et commensaux: des glochidia d'*Elliptia complanatus*, des myxosporidies *Henneguya* sp., et des acariens non-parasites *Hydrozetes* sp.

Received October 2, 1969

INTRODUCTION

VERY LITTLE INFORMATION is presently available on the rich and varied parasite fauna of the gills of fishes. In the study reported here two problems were investigated: the distributions on the various gills and the interaction by enhancement or antagonism of three common parasites of the yellow perch (*Perca flavescens* Mitchell): the copepod *Ergasilus confusus* Bere, the monogenean *Urocleidius adspetus* Mueller, and the glochidia of *Lampsilis radiata* (Gmelin). Some remarks are made on the relation between intensity of infestation of *U. adspetus* and the size of the host. The seasonal occurrence of the nonparasitic mite *Hydrozetes* sp., the only other common organism on the gills, is noted.

MATERIALS AND METHODS

A total of 3778 specimens of yellow perch were collected from the Bay of Quinte (an arm of Lake Ontario) by monthly sampling from May 1967 to April 1968 and by weekly sampling from May 1968 to September 1968. The fish were caught by angling and Windermere traps. All the fish were brought alive to the laboratory and examined within 12 hr after capture. Length was measured and the gills were removed and examined. In 568 of these specimens the numbers of the various parasites from the filaments of each of the four gills were individually recorded; in the rest, only total numbers of parasites per fish were recorded.

The monogeneans were studied unstained, in water mounts. Sometimes permanent slides were prepared as described by Chubb (1962) and mounted in equal parts of Turtox CMC-10 and Turtox CMC-S (Turtox Ltd., Chicago, Ill.). Some were stained in Harris' haematoxylin and Semichons' carmine and mounted in Canada balsam. Copepods and mites were mounted in ACS mountant (Edward Gurr Ltd., London, England) for study. Glochidia were examined in a fresh state and then fixed in 10% formalin and preserved in 70% ethanol for detailed examination.

The relation between the incidence of one parasite and that of another was evaluated by the method of Noble et al. (1963).

The terms *incidence* and *intensity of infestation* are used to denote the percentage of fish infested and the number of parasites per infested fish, respectively.

OBSERVATIONS

Three parasites, the copepod *Ergasilus confusus*, the monogenean *Urocleidius adspetus*, and the glochidia of *Lampsilis radiata*, were common enough for their numbers to be subjected to analysis for correlation and spatial distribution on the different gills.

INTERSPECIFIC RELATIONS

There are eight possible combinations in which the above three species of parasite may infest a fish. In a sample of 1305 fish the numbers of fish in each of these combinations were:

	<i>E. confusus</i>		No <i>E. confusus</i>	
	<i>U. adspetus</i>	No <i>U. adspetus</i>	<i>U. adspetus</i>	No <i>U. adspetus</i>
<i>L. radiata</i>	342	352	231	260
No <i>L. radiata</i>	33	39	23	25

In the above data 58.7% were infested with *E. confusus* and 90.8% with glochidia of *L. radiata*. If there were no correlation between the incidences of these two parasites, 53.3% (i.e. 0.587×0.908) should be infested with both parasites. Actually 53.2% were thus infested, showing a lack of correlation.

No correlation was evident between the incidences of infestation for any of the possible combinations of the three parasites:

Combination:	<i>U. adspetus</i>	<i>U. adspetus</i>	<i>L. radiata</i>	All three parasites
	and <i>E. confusus</i>	and <i>L. radiata</i>	and <i>E. confusus</i>	
Observed (%)	28.7	43.9	53.2	26.2
Expected (%)	28.3	43.8	53.3	25.7

SPATIAL DIST

The number of fish were appraised on the four gills (I-IV) were

The percentage of fish infested on various gills (I-IV) was as follows: Mean no. par

Gill
% of total
Fish infested
Mean no. par

The second most common parasite was *L. radiata*. The distribution on the four gills in case of *U. adspetus* was as follows: fewer parasites were found on the first gill area. Similar results were obtained for *E. confusus* from

The incidence of parasites related to size of fish in this study. The intensity of infestation was related to size of the fish. The intensity of infestation

OTHER GILL PARASITES

The only other parasite found on the three common gills was the mite being *Elleptio complanatus* found rarely, a species described by Cuvier

The three most common parasites and the glochidia interaction between them was studied by Noble et al. (1963) with the monogenean

SPATIAL DISTRIBUTION ON GILLS

The numbers of parasites on the gills of the right and left sides of the fish were approximately equal. However, their distribution on the different gills (I-IV) was uneven in both *U. adspetus* and *L. radiata*.

The percentages of the total number of parasites of each species on the various gills (the two gills on either side considered as a unit), the percentages of fish infested in the various gills, and the mean numbers of parasites per gill for 586 yellow perch collected from May to August 1968 were:

Gill	<i>L. radiata</i> (total 6054)				<i>U. adspetus</i> (925)			
	I	II	III	IV	I	II	III	IV
% of total	27.2	28.1	27.3	17.4	25.6	35.2	24.2	15.0
Fish infested (%)	25.9	26.1	25.6	22.4	42.1	49.8	37.8	26.8
Mean no. parasites	10.8	11.1	10.1	8.0	1.9	2.2	2.0	1.7

The second gill harboured the largest number of both *U. adspetus* and *L. radiata*. The fourth gill had the lowest infestation of both parasites. The distribution on these different gill arches was uneven ($P < 0.001$). In the case of *U. adspetus*, in addition to the above difference, the first gill harboured fewer parasites than the second, although the former gill has a greater surface area. Similar results have been reported by Tedla and Fernando (1970) for *E. confusus* from the same fish samples.

The incidence and intensity of infestation by *U. adspetus* were not clearly related to size of the host (Table 1). On the same fish used in the present study Tedla and Fernando (1970) have shown that both the incidence and intensity of infestation of *E. confusus* were positively correlated with the size of the fish. In the case of *L. radiata*, Tedla and Fernando (1969) found that the intensity of infestation was negatively correlated with host size.

OTHER GILL FAUNA

The only other organism recorded in appreciable numbers besides the three common parasites was the nonparasitic water mite *Hydrozetes* sp., the mite being most abundant in May and June (Table 2). The glochidia of *Elleptio complanatus* (Solander) and the myxosporidan *Henneguya* sp. were found rarely, and on one occasion a statoblast of the ectoproct *Cristatella mucedo* Cuvier was found on the gills.

DISCUSSION

The three common parasites, *Ergasilus confusus*, *Urocleidius adspetus*, and the glochidia of *Lampsilus radiata*, feed directly on host tissue and any interaction between them must be direct, unlike the instance noted by Noble et al. (1963) who found a positive correlation between *Trichodina* sp. and the monogenean *Gyrodactylus elegans*, the former feeding on bacteria from

TABLE 1. Occurrence of *Urocleidus adspetus* on different size groups of 1491 yellow perch collected from the Bay of Quinte, Lake Ontario, from May to November 1968.

Size group (length) (mm)	No. fish examined	Incidence	Intensity of infestation	
			Mean	Max
>116	12	50.0	5.8	25
116-120	10	50.0	1.8	3
121-125	14	21.4	3.7	8
126-130	29	51.7	3.5	15
131-135	70	45.7	2.7	23
136-140	88	45.4	4.2	25
141-145	118	46.6	2.7	21
146-150	107	51.4	4.1	18
151-155	154	41.5	4.1	26
156-160	156	47.4	2.9	14
161-165	136	55.8	3.7	18
166-170	106	41.5	3.3	22
171-175	111	45.9	3.2	16
176-180	86	54.6	5.2	51
181-185	67	47.7	2.5	8
186-190	54	61.1	4.9	30
191-195	46	71.7	3.3	15
196-200	33	54.5	3.1	10
201-205	39	56.4	4.2	25
206-210	24	75.0	3.3	9
211-215	15	86.6	2.5	10
216-220	4	100	2.5	5
221-225	3	66.6	1.5	2
>225	9	66.6	5.7	12

secondary infestation of gills damaged by hooks of the latter. Hence the lack of positive correlation between the three common parasites in the present study is understandable.

The lack of any negative correlation between the three common parasites in the present study must be considered against the background of relatively few other gill parasites and the low level of infestation. Antagonistic relations have been noted previously by Dogiel (1962) between the copepod *Clavella devastrix* and the monogenean *Octobothrium merlangi* on the gills of *Gadus merlangus*, and by Kabata (1960) between the copepod *Clavella adunca* and the monogenean *Diclidophora merlangi* on the gills of *G. merlangus*. In both these instances the infestation by one of the parasites, as observed by Kabata (1960), was very high.

TABLE 2. Sea

Period of
May
June
July
Aug.
Sept.
Oct.*
Nov.

*The specimen since this species

The larger first and fourth Llewellyn and by *Discocoryle* by *Diplozoen p* (1963) and in

The number in the habitat. on the mites in mites found in feeding on pla feeding in host tissue i

TABLE 2. Seasonal occurrence of the mite *Hydrozetes* sp. on the gill filaments of 1963 yellow perch collected from the Bay of Quinte in 1968.

Period of collection	No. fish examined	Incidence	Intensity
May 1-7	20	5.0	1.0
8-15	12	-	-
16-23	15	6.7	2.0
24-31	61	24.6	2.2
June 1-7	69	17.4	1.9
8-15	78	15.4	1.5
16-23	-	-	-
24-30	147	6.1	1.2
July 1-7	151	3.7	1.3
8-15	134	3.7	1.0
16-23	132	3.8	1.0
24-31	125	3.2	1.5
Aug. 1-7	113	-	-
8-15	120	0.8	1.0
16-23	118	0.8	1.0
24-31	121	0.8	1.0
Sept. 1-7	123	1.6	1.0
8-15	110	0.9	1.0
16-23	129	1.6	1.0
Oct.*	110	1.8	1.0
Nov.	75	-	-

*The specimens obtained in October were encysted in host tissue and were probably dead since this species is nonparasitic.

The larger number of parasites on the second and third gills than on the first and fourth has not been noted previously. Contrary to these findings Llewellyn and Owen (1960) and Slinn (1963) have reported a preference by *Discocotyle sagittata* for the first gill. A similar preference for the first gill by *Diplozoon paradoxum* has been reported in roach (*Rutilus rutilus*) by Owen (1963) and in bream (*Abramis brama*) by Wiles (1968).

The numbers of *Hydrozetes* sp. on the gills probably reflect their abundance in the habitat. According to Dubinin (1959), who has reviewed the literature on the mites infesting fishes, *Hydrozetes* is not a parasite unlike certain other mites found in fishes. He states that they settle in large numbers on algae, feeding on plants and organic debris. The encystment of some *Hydrozetes* in host tissue is problematical. Is this a case of incipient parasitism?

ACKNOWLEDGMENTS

This research was supported by grant A-3478 made to C.H.F. by the National Research Council of Canada, and a grant from the National Sportsmen's Show, for which grateful acknowledgment is made for both. Appreciation is also extended to the personnel of the Glenora Fisheries Station, Department of Lands and Forests, Picton, Ont., especially to the Director, Mr W. J. Christie.

REFERENCES

- CHUBB, J. C. 1962. Acetic acid as a diluent and dehydrant in the preparation of whole, stained helminths. *Stain Technol.* 37: 179-182.
- DOGIEL, V. A. 1962. General parasitology. Oliver and Boyd Ltd., Edinburgh and London. 516 p. (Transl. from Russian by Z. Kabata, 1964)
- DUBININ, V. B. 1959. Mites parasitising fish, p. 183-186. *In* Proceedings of the conference on fish diseases, Leningrad, 1957. (Transl. from Russian by Israel Program for Sci. Transl., Jerusalem, No. 620, 1963)
- KABATA, Z. 1960. Observations on *Clavella* (Copepoda) parasitic in some British gadoids. *Crustaceana* 1: 342-352.
- LLEWELLYN, J., AND I. L. OWEN. 1960. The attachment of the monogenean *Discocotyle sagittata* Leuckart to the gills of *Salmo trutta* L. *Parasitology* 50: 51-59.
- NOBLE, E. R., R. E. KING, AND B. L. JACOBS. 1963. Ecology of the gill parasites of *Gillichthys mirabilis*. *Ecology* 44: 295-305.
- OWEN, I. L. 1963. The attachment of the monogenean *Diplozoan paradoxum* to the gills of *Rutilus rutilus* L. Micro-habitat and adhesive attitude. *Parasitology* 53: 463-468.
- SLINN, D. J. 1963. Occurrence of *Discocotyle sagittata* on sea trout. *Nature (London)* 197: 306.
- TEDLA, S., AND C. H. FERNANDO. 1969. Observations on the glochidia of *Lampsilis radiata* (Gmelin) infesting yellow perch, *Perca flavescens* (Mitchill) in the Bay of Quinte, Lake Ontario. *Can. J. Zool.* 47: 705-712.
1970. On the biology of *Ergasilus confusus* Beré, infesting yellow perch (*Perca fluviatilis* L.) in the Bay of Quinte, Lake Ontario, Canada. *Crustaceana*. (In press.)
- WILES, M. 1968. The occurrence of *Diplozoan paradoxum* Nordmann, 1832 (Trematoda: Monogenea) in certain waters of Northern England and its distribution on the gills of certain Cyprinidae. *Parasitology* 58: 61-70.

Distri

O

De
PacificFOWLER, S. W.
in the
1958.

Autoradi
showed the iso
the eye mainly
the exoskeleto
radiographic e
dissected tissue
the same as th
directly from s
marine crustac
of uptake. The
upon mode of t
not intracellular
needs and is a

Received Febru

UNTIL RECENTLY
has been done
gradov, 1953; 1

¹Based on a
degree of Doctor
²This work v
1830, PHS grant I
³Present addre
graphique, Monaco
⁴Present addre
Carolina, Columbia

Printed in Canada