Reprinted from

Canadian Journal of Zoology

Réimpression du

Journal canadien de zoologie

Parasites of *Fundulus diaphanus* (LeSueur) (Pisces: Cyprinodontidae) in certain Nova Scotian freshwaters

MICHAEL WILES

Volume 53 • Number 11 • 1975

Pages 1578–1580

National Research Council Canada

Conseil national de recherches Canada

Parasites of *Fundulus diaphanus* (LeSueur) (Pisces: Cyprinodontidae) in certain Nova Scotian freshwaters

MICHAEL WILES

Department of Biology, Saint Mary's University, Halifax, Nova Scotia

Received June 16, 1975

WILES, M. 1975. Parasites of *Fundulus diaphanus* (LeSueur) (Pisces: Cyprinodontidae) in certain Nova Scotian freshwaters. Can. J. Zool. **53**: 1578–1580.

Over 90% of 829 banded killifish from three Nova Scotian locations were infected with at least one parasitic species. Protozoans, monogeneans, digeneans, cestodes, nematodes, acanthocephalans, and a crustacean and a molluscan species occurred in the fish. All species recovered are reported for the first time from *Fundulus diaphanus* in Nova Scotia and 12 are new host records. Five of the non-digenean larval genera found were probably accidental parasites.

WILES, M. 1975. Parasites of *Fundulus diaphanus* (LeSueur) (Pisces: Cyprinodontidae) in certain Nova Scotian freshwaters. Can. J. Zool. **53**: 1578–1580.

De 829 petits barrés provenant de trois endroits de Nouvelle-Ecosse, 90% portaient au moins une espèce de parasite. On y a trouvé des protozoaires, des monogènes, des digéniens, des cestodes, des nématodes, des acanthocéphales, une espèce de crustacé et une de mollusque. Toutes ces espèces sont citées pour la première fois chez les *Fundulus diaphanus* de Nouvelle Ecosse et 12 constituent de nouvelles mentions chez cet hôte. Cinq des genres trouvés à l'état de larves et ne faisant pas partie des digéniens sont probablement des parasites accidentels.

[Traduit par le journal]

Introduction

There are only three previous accounts of parasites from Nova Scotian killifish. Fantham *et al.* (1940) recovered the myxosporidan *Myxosoma diaphana* from *Fundulus diaphanus*. In *F. heteroclitus*, Fantham and Porter (1948) noted the protozoans *Eimeria* and *Sphaerospora* and the trematodes *Homalometron* and *Crepidostomum*, and Gowanloch (1927) recorded the monogenean *Gyrodactylus*. Although long lists of parasites from several *Fundulus* species were given by Dillon (1966) and Hoffman (1967), neither author added new information on Nova Scotian killifish.

The present paper includes the first parasite list for large collections of *F. diaphanus* from Nova Scotia. Many species are here reported for the first time from banded killifish in Atlantic Canada, and some new host records are established.

Materials and Methods

Fish were caught by either minnow seines of $\frac{1}{8}$-in. (3.2-mm) and $\frac{1}{4}$-in. (6.4-mm) mesh, or fine-mesh hand nets, or electrofisher. Localities sampled, in May–September 1968–1971, were Shubenacadie Lake (44°58′30″ N, 63°34′30″ W) and Ponhook Lake (44°55′10″ N, 64° 00′20″ W), Hants County, and several lakes around Five Islands Lake (43°40′00″ N, 63°48′30″ W), Halifax County, Nova Scotia. Fish were held at about 16 °C for up to 1 week before autopsy. Some 118 fish were examined in detail using a scheme combining those of Meyer (1954) and Hoffman (1967) and that of Wiles (1968) for gills. Viscera were examined just for the cestode *Parvitaenia* Burt, 1940 in 673 fish, and just for the nematode *Spiroxys* Schneider, 1866 in 38 fish. Skin of 38 fish was examined only for the digenean *Crassiphiala bulboglossa* Van Haitsma, 1935. Two fish were examined for protozoans only. Live specimens, whole mounts, and sections were studied by standard parasitological techniques. Standard reference works and many important research papers were used in identification of parasites recovered.

Observations

Over 90% of the 829 fish examined contained at least one parasitic species. In all, 27 species of parasites in 24 genera were recovered (Table 1). Infection incidences ranged from very low (<4%) for the identified myxosporidan species to very high (>90%) for *C. bulboglossa*, but most species had moderate levels (20–40%). Intensities tended to be very low (<4.0 parasites per infected fish) in most of the digenean and in all of the cestodan, nematodan, and acanthocephalan species. Moderate levels (4.0 to 6.0) occurred in only three species and high levels (>20.0) in only two.

TABLE 1

Parasites of *Fundulus diaphanus* from three locations in Nova Scotia

Parasite species	No. fish examined	No. (%) fish infected	No. (mean no.) parasites per infected fish	Site of infection
Protozoa: Myxosporida				
Myxobolus funduli Kudo, 1920	121	1 (0.8)	Not counted	Muscle
Myxobolus sp.	121	1 (0.8)	Not counted	Muscle
Myxobolus sp.	121	2 (1.7)	Not counted	Kidney
M. subtecalis Bond, 1938	121	4 (3.3)	Not counted	Skin
Unidentified myxosporidans	121	61 (50.4)	Not counted	Skin, body cavity
Trematoda: Monogenea				
Cleidodiscus angularis Mueller, 1934	118	27 (22.9)	130 (4.8)	Skin, gills, fins
Trematoda: Digenea				
Allocreadium sp.	118	3 (2.5)	5 (1.7)	Small intestine
Clinostomum sp.*	118	23 (19.5)	57 (2.5)	Muscle, viscera
Crassiphiala bulboglossa Van Haitsma, 1935*	38	35 (92.1)	215 (6.1)	Skin
Creptotrema funduli Mueller, 1934	118	27 (22.9)	607 (22.5)	Small intestine
Diplostomulum sp.*	118	12 (10.2)	25 (2.1)	Eye lens
Diplostomulum sp.*	118	5 (4.2)	19 (3.8)	Vitreous humor
Neacus sp.*	118	6 (5.1)	Not counted	Gills
Ornithodiplostomum ptychocheilus (Faust, 1917) Dubois, 1936*†	118	4 (3.4)‡	Not counted	Viscera
Posthodiplostomum minimum minimum (MacCallum, 1921; Dubois, 1936) Hoffman, 1958*	156	59 (37.8)	325+ (5.5+)	Viscera
Cestoda				
Bothriocephalus sp.*	118	12 (10.2)	30 (2.5)	Small intestine
Dilepis sp.*†	118	1 (0.8)‡	1 (1.0)	Body cavity
Hymenolepis sp.*†	118	1 (0.8)‡	1 (1.0)	Body cavity, liver
Parvitaenia sp.*†	829	338 (40.8)	569 (1.7)	Viscera
Proteocephalus sp.*	118	17 (14.4)	31 (1.8)	Small intestine
Nematoda				
Cucullanus sp.*†	118	21 (17.8)	48 (2.3)	Viscera
Cystidicola sp.*†	118	1 (0.8)‡	2 (2.0)	Body cavity
Hedruris sp.*†	118	1 (0.8)‡	2 (2.0)	Small intestine
Spiroxys sp.*†	156	27 (17.3)	68 (2.5)	Viscera
Acanthocephala				
Acanthocephalus sp.†	118	3 (2.5)	5 (1.7)	Small intestine
Octospiniferoides sp.	118	4 (3.4)	7 (1.8)	Small intestine
Crustacea: Copepoda				
Ergasilus lizae Krøyer, 1863	118	26 (22.0)	Not counted	Gills
Mollusca: Pelecypoda				
Elliptio complanatus (Solander, 1786)*†	118	34 (28.8)	716 (21.1)	Gills

*Immature forms.
†New host record.
‡Possible accidental infection.

Discussion

This paper is the most detailed study to date on cyprinodontid parasites from east of Ontario. New geographic records for Nova Scotian *F. diaphanus* are established for all the parasites in Table 1, and, as far as could be determined, new host records for 10 of the species listed. Linton (1901) noted a *Cucullanus* species in *F. heteroclitus* from near Woods Hole, but Stromberg and Crites (1972) regarded this as a misidentification of *Dichelyne bullocki*, which they had first described in *F. heteroclitus* from the same region. However, because in the present study *Cucullanus* was found in about 18% of the fish examined for nematodes, it is a consistently occurring parasite in the banded killifish of Nova Scotia.

Two *Myxobolus* species occurred in muscle. One was clearly *Myxobolus funduli* Kudo, 1920, the *nomen novum* of *M. musculi* Hahn, 1915, which is now a homonym of *Myxosoma funduli* Kudo, 1918. The other conformed to no published species descriptions of myxosporidans, but the available material was inadequate for determination of its specific identify. Similarly, a *Myxobolus* species from kidney cannot be identified to species level at this time.

Except for digeneans, most parasites reported in the literature from *Fundulus* species are adults, which contrasts with a predominance of immature forms in the present samples (Table 1). This difference may be due to accidental infections with five species recorded in the present study, for these occurred in only one to four fish each as immature forms, and they are new geographic records in *F. diaphanus*.

No parasites caused serious diseases in the fish populations studied here, although a few fish had kidneys damaged by a *Myxobolus* species. However, as blood was not examined, the possibility of pathogenic haematozoa existing in the localities sampled cannot be discounted.

Acknowledgments

This work was supported by grants from the National Research Council of Canada (A-4681) and the Senate Research Committee of Saint Mary's University. Facilities for the initial preparation of this paper were kindly provided in the Zoology Department, University College of North Wales, Bangor, U.K., by Professor J. M. Dodd.

DILLON, W. A. 1966. Provisional list of parasites occurring on *Fundulus* spp. Va. J. Sci. **17**: 21–31.

FANTHAM, H. B., and A. PORTER. 1948. The parasitic fauna of vertebrates in certain Canadian fresh waters, with some remarks on their ecology, structure and importance. Proc. Zool. Soc. London, **117**: 609–649.

FANTHAM, H. B., A. PORTER, and L. R. RICHARDSON. 1940. Some more myxosporidia observed in Canadian fishes. Parasitology, **32**: 333–353.

GOWANLOCH, J. N. 1927. Notes on the occurrence and control of the trematode *Gyrodactylus*, ectoparasitic on *Fundulus*. Trans. N.S. Inst. Sci. **16**: 126–131.

HOFFMAN, G. L. 1967. Parasites of North American freshwater fishes. Univ. Calif. Press, Berkeley and Los Angeles.

LINTON, E. 1901. Parasites of fishes of the Woods Hole region. Bull. U.S. Fish. Comm. **19**: 405–492.

MEYER, M. C. 1954. The larger animal parasites of the freshwater fishes of Maine. State Maine Fish. Res. Manage. Div. Bull. No. 1.

STROMBERG, P. C., and J. L. CRITES. 1972. A new nematode, *Dichelyne bullocki* sp. n. (Cucullanidae) from *Fundulus heteroclitus* (L.). Proc. Helminthol. Soc. Wash. **39**: 131–134.

WILES, M. 1968. The occurrence of *Diplozoon paradoxum* Nordmann, 1832 (Trematoda: Monogenea) in certain waters of northern England and its distribution on the gills of certain Cyprinidae. Parasitology, **58**: 61–70.