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A SPECIES OF TRICHOPHRYA (SUCTORIA: DENDROSOMIDAE) FROM CATOSTOMUS COMMERSONI LACEPEDE IN NOVA SCOTIA

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A species of *Trichophrya* (Suctoria: Dendrosomidae) is described from the gills of *Catostomus commersoni* Lacepede taken in a Nova Scotian river. The material resembles specimens referred to as *T. catostomi* Heckmann and Carroll, 1985 *nomen nudum* from the gills of *Catostomus catostomus* in the midwestern United States. Specimens in both localities similarly attach to the broad face of the secondary lamellae, causing significant epithelial necrosis and erosion, and they noticably avoid the lamellar tips. These striking morphological, behavioural and pathological traits support the idea that published reports from fishes throughout North America include an unidentified species complex which is not referable to *T. piscium* Butschli, 1889.

Une espèce de *Trichophrya* (Suctoria: Dendrosomidae) provenant des branchies du poisson *Catostomus commersoni* Lacepede pris d'une rivière en Nouvelle Ecosse est décrite. Ce spécimen ressemble à ceux appelés *T. catostomi* Heckmann and Carroll, 1985 *nomen nudum* provenant des branchies de *Catostomus catostomus* de la region du mi-ouest des États-Unis. Les spécimens des deux localités s'attachent à la face large des lamelles secondaires provoquant une nécrose épitheliale et de l'érosion. Ils évitent les bouts des lamelles. Ces caractéristiques, soit morphologiques, pathologiques ou du comportement, appuient l'idée que les rapports publiés des poissons à travers l'Amérique du Nord incluent une espèce complexe non-identifiée qui ne peut pas être rapporté à *T. piscium* Butschli 1889.

Introduction

Species of *Trichophrya* (Suctoria: Dendrosomidae) have been reported from a wide variety of North American freshwater fishes (Culbertson and Hull, 1962), including salmonids (Hare and Frantsi 1974; Heckman 1970, 1971; Heckman and Carroll 1985; Sandeman and Pippy 1967; Wood 1979), centrarchids (Davis 1937, 1942; Hoffman 1967; Lefeux and Meyer 1972), ictalurids (Davis 1947; Dechtiar 1972a; Meyer 1966), an etheostomid (Lom 1971), a percichthyid (Dechtiar 1972b), a percid (Culbertson and Hull 1962), a catostomid (Heckman 1970; Heckman and Carroll 1985) and a cyprinid (Muzzall and Peebles 1987). There are presently two incompatible taxonomic schemes used in the classification of these suctorians. One, initiated by Davis (1942, 1943, 1947), and partially accepted by Hoffman (1967, 1978) and Heckman and Carroll (1985), is based on the belief that there are numerous host specific species or races, which presently include *T. micropteri* Davis, 1942, *T. ictaluri* Davis, 1947, *T. catostomi* Heckman and Carroll, 1985 (*nomen nudum*), and *T. clarki* Heckman and Carroll, 1985 (*nomen nudum*). The other system, proposed by Culbertson and Hull (1962) and accepted by Lom (1971), is founded on the premise that all *Trichophrya* populations represent one globally distributed species referred to as *T. piscium* Butschli, 1889.

During a survey of freshwater Nova Scotian fish parasites, a previously unreported species of *Trichophrya* was found on gills of the eastern white sucker, *Catostomus commersoni*. Using both taxonomic schemes, the present study describes the specimens recovered and compares them to other described forms from fishes in North America.

Materials and Methods

Seven juvenile *C. commersoni* 11 to 15 cm long, were collected from a Nova Scotian government fish counting fence on the South River, Saint Andrews, Antigonish County, Nova Scotia, immediately downstream from the Fraser's Mills Fish Hatchery. The fish were fixed immediately after collection in phosphate-buffered 10% formalin at pH 7.4 Histological sections of gill arches were stained with Delafield's haematoxylin and eosin. Photomicrographs were prepared using Kodak Professional Pan film rated at 100 ASA and developed for 4 min in Kodak D-19 high contrast developer. During the summers of 1984-1986 the gills from 500 *Salvelinus fontinalis* at the Fraser Mills hatchery were also examined for suctorian parasites as part of a larger parasite study of this host species.

Results

Three of seven *C. commersoni* were infected. By systematic examination of sections of the gill apparatus, intensities were estimated to range from about 50 to 100 suctorians per infected fish. Parasites occurred mostly on the broad surfaces of secondary lamellae and were noticably absent from lamellar tips.

Fully-developed, tentacled individuals measured 16 to 49 μm long (n=8, mean=34.1, standard deviation = 10.9). Most specimens were flattened against the lamellar epithelium and in places where gill issue was eroded they made direct contact with capillary walls (Fig 1). Ciliated embryos were produced by endogenous budding (Fig 1). The macronucleus was sausage-shaped and 8 to 14 μm long (n=8, mean=12.0, standard deviation = 2.3). The micronucleus was round, 2 to 3 μm in diameter, and invariably positioned alongside the macronucleus. The cytoplasm contained prominent vacuoles which measured up to 10 μm long. At opposite ends of the cells there were two separate bundles of tentacles composed of 9 to 11 and 4 to 7 organelles, respectively. Tentacles measured 8 to 14 μm long and ended in flared spathulate tips

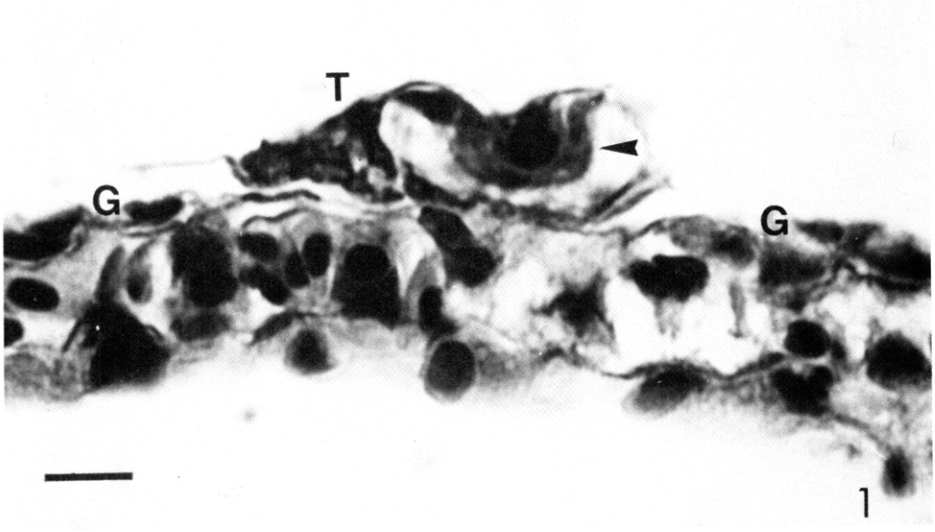

Fig 1. Mature, tentacled trophozoite phase (T) in the life cycle of *Trichophrya* sp. on the gill epithelium (G) of *Catostomus commersoni* in Nova Scotia. A ciliated embryo (arrow) is contained within the trophozoite. Scale bar is 10 micrometres.

1.5 μm wide. In many specimens they were entangled in necrotic remains of host epithelial cells. Conjugating forms were typically embedded in the epithelium and contiguous to capillary walls. None of the 500 *S. salvelinus* specimens examined from the Fraser Mills hatchery were infected with *Trichophyrya*.

Discussion

Difficulties encountered with the two incompatible taxonomic schemes led us to evaluate information in an unpublished doctoral dissertation (Heckman 1970). This work throws important light on our understanding of the confused systematics of *Trichophyra* on fish gills. By electron microscopy, Heckman (1970) compared specimens from *Salmo clarki* to those from *Catostomus catostomus* in a Wyoming watershed. Specimens from *Salmo clarki* were 41 to 113 μm long (average 80.7), with a macronucleus 8 to 40 μm long (average 24.7) and tentacles 12 to 48 μm (average 26.0); 38% of the organisms had tentacles grouped in two bundles at opposite ends of the cell body. Within the tentacles were two rings of microtubules, an outer one of 84 to 86 and an inner one of 110 to 112. Most specimens occurred either near or at the lamellar tips. They caused no discernible tissue damage. In contrast, individuals from *C. catostomus* were only 21 to 68 μm long (average 43.6), with a macronucleus 10 to 24 μm long (average 14.7) and tentacles 12 to 27 (average 18.0); 94% of the organisms had tentacular bundles at opposite cell body poles. There was an outer ring of 50 to 58, and an inner one of 58 to 64 microtubules within the tentacles. The parasites occurred along the whole length of secondary lamellae except for the tips. Extensive epithelial cell disruption and necrosis was evident along the secondary lamellae. Heckmann (1970) concluded that antomical differences, especially the tentacular microtubule numbers, were significant enough to consider the samples from the two host types as distinct species of *Trichophrya*. His other observations, namely that whereas the larger form on *S. clarki* frequented lamellar tips and caused no tissue damage, the smaller one from *C. catostomi* attached more basally and was associated with severe epithelial destruction, suggest a significant behavioural difference between the two species. These results are inconsistent with the existence of one non-host specific and circumpolar species (*T. piscium*) as proposed by Culbertson and Hull (1962). However, they are compatible both with the occurrence of separate species and the idea of physiological races as suggested by Hoffman (1967, 1978).

Our specimens from *C. commersoni* in Nova Scotia resemble "*T. catostomi*" of Heckman (1970) and Heckman and Carroll (1985). Although we did not study the number of tentacular microtubules in our material, we believe that the same species occurs in Nova Scotia and Wyoming on species of *Catostomus* because specimens from both localities have similar morphological and behavioural characteristics. Individuals from both groups are relatively small in size, caused similar pathologies and avoided the lamellar tips. If the non-host specific and circumpolarly distributed entity *T. piscium* is real, and our material is of this species, then we would expect the parasite on *C. commersoni* to be capable of infecting *Salvelinus fontinalis, Salmo gairdneri* and *Salmo salar* stocks in the hatchery because suckers regularly get into its holding ponds. However, no fish infected with *Trichophrya* was detected by the detailed three year histological study of over 500 gills from specimens of all ages representing the three salmonid species being kept at the hatchery. Nevertheless, outbreaks of trichophryiasis involving a form that is much larger and of different behaviour than the organism from *C. commersoni*, and that resembles the "*T. clarki*" of Heckman (1970) and Heckman and Carroll (1985) have occurred at local trout farms in recent years. This information suggests that *C. commersoni* is not serving as a wild reservoir host, and that it is probably a host instead for a distinctly different form

which Heckman and Carroll (1985) referred to as *T. catostomi nomen nudum*. We conclude that the apparent inability of this *Trichophrya* population to infect salmonid stocks at the Fraser Mills hatchery, when added to its distinct morphological, behavioural and pathological characteristics, shows that it is a species specific to *C. commersoni*. This conclusion is consistent with the taxonomic approach to *Trichophrya* on North American fishes which was initiated by Davis in the 1940's.

References

Culbertson, J.R. and **Hull, R.W.** 1962. Species identification in *Trichophrya* (Suctorida) and the occurrence of melanin in some members of the genus. *J. Protozool.*, 9: 445-459.

Davis, H.S. 1937. A gill disease of the smallmouth black bass. *Prog. Fish Cult.*, 27: 7-11.

Davis, H.S. 1942. A suctorian parasite of the smallmouth black bass, with remarks on other suctorian parasites of fishes. *Trans. Am. Microsc. Soc.*, 61: 309-327.

Davis, H.S. 1947. Studies of the protozoan parasites of fresh water fishes. *Fish. Bull. U.S.*, 51: 1-29.

Davis, H.S. 1967. *Culture and diseases of game fishes*. 3rd. edition. University of California Press, Berkeley.

Dechtiar, A.O. 1972a. Parasites of fish from Lake of the Woods, Ontario. *J. Fish. Res. Board. Can.*, 29: 275-283.

Dechtiar, A.O. 1972b. New parasite records for Lake Erie fish. *Great Lakes Fish. Comm. Tech. Rep.*, 12: 20 pp.

Hare, G.M. and **Frantsi, C.** 1974. Abundance and potential pathology of parasites infecting salmonids in Canadian Maritime hatcheries. *J. Fish. Res. Board. Can.*, 31: 1031-1036.

Heckman, R.A. 1970. Comparative morphology and host-parasite studies of *Trichophrya clarki* (n. sp.) on cutthroat trout (*Salmo clarki*). Ph.D. Thesis. Montana State University, 69 pp.

Heckman, R.A. 1971. Parasites of cutthroat trout from Yellowstone Lake, Wyoming. *Prog. Fish Cult.* 33: 103-107.

Heckman, R.A. and **Carroll, T.** 1985. Host-parasite studies of *Trichophrya* infesting cutthroat trout (*Salmo clarki*) and longnose suckers (*Catostomus catostomus*) from Yellowstone Lake, Wyoming. *Great Bas. Nat.*, 45: 255-265.

Hoffman, G.L. 1967. *Parasites of North American Freshwater Fishes*. University of California Press, Berkeley.

Hoffman, G.L. 1978. Ciliates of freshwater fishes. In *Parasitic Protozoa Vol. II.*, ed. J.P. Kreier. Academic Press, New York. pp. 583-632.

Lefeux, F., and **Meyer, F.P.** 1972. Mixtures of malachite green and formalin for controlling ichthyophthirius and other protozoan parasites of fishes. *Prog. Fish Cult.* 34: 21-26.

Lom, J. 1971. *Trichophrya piscium*: a pathogen or an ectocommensal? An ultrastructural study. *Folia Parasitol.* (Prague) 18: 197-205.

Meyer, F.P. 1966. Parasites of catfishes. U.S. Dept. of the Interior, Fish and Wildlife Service FDL-5: 1-7.

Muzzall, P.M. and **Peebles, C.R.** 1987. Parasites of the emerald shiner, *Notropis atherinoides*, from two localities in the St. Mary's River, Michigan, with emphasis on larval trematodes. *Proc. Helminthol. Soc Wash.* 54: 105-110.

Sandeman, I.M. and **Pippy, J.H.C.** 1967. Parasites of freshwater fishes (Salmonidae and Coregonidae) of insular Newfoundland. *J. Fish. Res. Board Can.* 24: 1911-1943.

Wood, J.W. 1979. *Diseases of Pacific Salmon: their prevention and treatment*. 3rd. ed. State of Washington, Department of Fisheries, Hatchery Division.

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