A Species of *Trichodina* (Ciliophora: Mobilida: Trichodinidae) Infesting Channel Catfish (*Ictalurus punctatus*) from the Verdigris River, Oklahoma

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Abstract: A Channel Catfish (*Ictalurus punctatus*) from the Verdigris River, Oklahoma, was found to harbor a ciliate, *Trichodina* sp., on its gills. There are three previously reported species of *Trichodina* from North American *I. punctatus*, but none from fish hosts in Oklahoma. We therefore document a new geographic record for a trichodinid from any fish in the state.

Introduction

Trichodina Ehrenberg, 1838, is the largest genus within the family Trichodinidae Raabe, 1959. Over 100 species have been described, but a further 69 species have been inadequately described (Van As and Basson 1989; Lom and Dyková 1992). They are protistan peritrichous ciliated parasites of marine, brackish, and freshwater species of fish and amphibians (Lom 1958). In large numbers they can often potentially cause skin and gill disease, leading to the death of the host (Hoffman 1999). These organisms are saucer-shaped and possess a prominent denticular internal cytoskeleton ring or aperture. Reproduction is by simple binary fission and most species are host specific. They infest fish and spread to others by incidental contact between infested fish and a susceptible host fish or through contact with the parasite in the water column. *Trichodina* spp. feed on the epithelium covering the surface of the skin and gills of the fish and heavy loads can directly result in abrasions, lesions and ulcers which allow for secondary bacterial infections to develop at the affected site (Lom 2006; Smith and Schwarz 2009). The clinical signs of the infestation usually present as superficial white lesions on the body and the fins can become frayed. Scales eventually loosen and opportunistic microorganisms may lead to secondary bacterial infection causing ulceration and erosion. In the end, fish may have respiratory compromise from gill damage.

The Channel Catfish, *Ictalurus punctatus* (Rafinesque) is native to the Mobile, Rio Grande, and Mississippi drainages of the United States and northeastern México (Page and Burr 2011). In Oklahoma, *I. punctatus* occurs over most of the state except for the western part in the Panhandle (Miller and Robison 2004). It is a piscivorous predator found in lakes, rivers, and large streams, and may enter brackish waters. In recent decades it has been widely introduced along the Atlantic Slope and western drainages for sport and commercial fish management (Glodek 1980; Jackson 1999).

The parasites of this catfish are fairly well known (Hoffman 1999); however, only three valid species of *Trichodina* have been previously reported from the gills of North American *I.*

punctatus as follows: *T. discoidea* Davis, 1947, from five species of hosts from Illinois, Iowa, and West Virginia (Davis 1947; Blecka 1972); *T. fultoni* Davis, 1947, on *I. punctatus* from West Virginia (Davis 1947); and *T. vallata* Davis, 1947, from *I. punctatus* from Iowa (Davis 1947). Another species, *Trichodina symmetrica* Davis, 1947, was described from *I. punctatus* from Iowa but was later considered to be a mixture of two species placed in different genera (*Trichodinella symmetrica* (Davis, 1947) Lom, 1959 (Lom 1959, Hoffman 1999) and *Tripartiella symmetricus* (Davis, 1947) Lom and Haldar, 1977 (Lom and Haldar 1977; Hoffman 1999). Because they were a mixture of two species, these three taxa are considered *nomina nuda* (Lom and Haldar 1977; Hoffman 1999). Trichodinids have also been reported from cultured *I. punctatus*, including *T. pseudoheterodentata* Fahui, Zhang, and Zhao, 2017 from China (Fahui et al. 2017) and *Trichodina heterodentata* Duncan, 1977 from Brazil (Martins et al. 2010). In the largest survey to date on trichodinids, Wellborn (1967) examined 936 fish of 46 species from 36 geographic locations in 10 states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee) but did not report any species from *I. punctatus*. Therefore, no trichodinid species have been reported from *I. punctatus* from Oklahoma. We document the first report of a species of *Trichodina* from a Channel Catfish of the state and, to our knowledge, from any fish in Oklahoma.

Methods

A single adult Channel Catfish was collected on 13 March 2017 by boat electrofisher from the Verdigris River at McClellan-Kerr lock and dam 17, Arkansas River Drainage, Cherokee County, Oklahoma (35°52'17.3712"N; 95°23'16.4184"W). We followed accepted guidelines for the use of fish in research (AFS 2014). The specimen was placed on ice and overdosed in a concentrated chloretone (chlorobutanol) solution; it was subsequently preserved in 10% formalin. Gills were removed and examined for ectoparasites under a stereomicroscope at 20–30×. Parasites, picked directly from the gills of their host with small needles, was placed in tap water and observed as temporary wet mounts or mounted in Grey and Wess medium stained with Gomori's trichrome (Kritsky et al. 1978). Observations were made from digital images taken with an Accu-scope Ecelis HDS camera mounted on an Accu-scope LED series phase-contrast microscope (Accu-Scope®, Commack, New York). Measurements were made to the nearest micrometer (μm) according to Wellborn (1967). A voucher specimen was deposited in the Harold W. Manter Laboratory of Parasitology (HWML), University of Nebraska, Lincoln, Nebraska.

Results

An unknown species of *Trichodina* was found on the gills of *I. punctatus*. We provide a description of its characteristics below.

Ciliophora: Mobilida: Trichodinidae

***Trichodina* sp. (Fig. 1)**

Description (*n* = 4): Small trichodinid, body diameter 21 (19–24). Number of denticles 21 (19–24), denticle ring diameter 14 (11–17), denticle length 20 (20–21). Rods (pins)/denticle 6 (5–6).

Specimens deposited: HWML 139864, slide of the monogenean *Ligictalurus pricei* (Mueller, 1936) Klassen and Beverley-Burton, 1985 with single *Trichodina* sp. near haptor.

Pathology: None observed.

Remarks: The body diameter (21 [19–24]) and number of rods/denticles (6 [5–6]) of *Trichodina* sp. are less than those of *T. discoidea* (35–50, 6–8), *T. fultoni* (75–90, 12–14), and *T. vallata* (38–48, 10), but were similar to those of the *nomen nudum Trichodina symmetrica* (= *Trichodinella symmetrica* and *Tripartiella symmetricus*) (24–35, 5) (Davis 1947). Unfortunately, because we did not use the impregnating silver staining method of Klein (1958), it was impossible to see some important morphological characteristics for a specific identification. Furthermore, morphological

Figure 1. Adhesive disk of *Trichodina* sp. on the gills of *Ictalurus punctatus* from the Verdigris River, Oklahoma. Scale bar = 10 µm.

characteristics are insufficient for identifying species of *Trichodina* and molecular and phylogenetic analyses are considered to be the most promising and useful tools for identifying these species.

Discussion

Further knowledge of parasites, including trichodinids, may be important in management of catfishes, especially under crowded culture conditions. For example, in addition to what has already been mentioned herein, trichodinids have been reported to cause other pathological conditions such as immunogenic alterations and inflammatory responses (increased il-1β expression and decreased il-8 and tgf-β expression) in some species of infested fish (Abdelkhalek et al. 2018). Knowing this information should help improve our understanding of the responses of teleost fish to trichodinid parasite infestation and will be helpful in the development of new control strategies.

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References

Abdelkhalek NK, El-Adl MA, Salama MF, Elmishmishy B, Ali MO, El-Ashram A, Hamed MF, Al-Araby MA**.** 2018. Molecular identification of *Trichodina compacta* Van As and Basson, 1989 (Ciliophora: Peritrichia) from cultured *Oreochromis niloticus* in Egypt and its impact on immune responses and tissue pathology. Parasitol Res 117:1907–1914.

Blecka LJ. 1972. A new locality and a new host record for *Trichodina discoidea* Davis, 1947 in southern Illinois. Amer Midl Nat 88:398.

Davis HS. 1947. Studies of the protozoan parasites of freshwater fishes. Fish Wild Serv Fish Bull 51:1–29.

Fahui T, Zhang Y, Zhao Y. 2017. Morphological and molecular identification of the new species, *Trichodina pseudoheterodentata* sp. n. (Ciliophora, Mobilida, Trichodinidae) from the Channel Catfish, *Ictalurus punctatus*, in Chongqing China. J Eukaryot Microbiol 64:45–55.

Glodek GS. 1980. *Ictalurus punctatus* (Channel Catfish). In: Lee, DS et al. Atlas of North American freshwater fishes. Raleigh (NC): North Carolina State Museum of Natural History. 446 p.

Hoffman GL. 1999. Parasites of North American freshwater fishes. Second edition. Ithaca (NY): Comstock Publishing Associates. 539 p.

Jackson DC. 1999. Flathead Catfish: Biology, fisheries, and management. Amer Fish Soc Symp 24:23–35.

Klein BM. 1958. The “dry” silver method and its proper use. J Protozool 5:99–103.

Kritsky DC, Leiby PD, Kayton RJ. 1978. A rapid stain technique for the haptoral bars of *Gyrodactylus* species (Monogenea). J Parasitol 64:172–174.

Lom J. 1958. A contribution to the systematics and morphology of endoparasitic trichodinids from amphibians, with a proposal of uniform specific characters. J Protozool 5:251–263.

Lom J. 1959. On the systematics of the genus *Trichodinella* Srámek-Husek (= *Brachyspira* Raabe). Acta Parasitol 7:573–590.

Lom J. 2006. Protozoan and metazoan infections. In: Woo PTK, editor. Fish diseases and disorders, Volume 1, Second Edition. Oxfordshire (UK): CABI Publishing. 800 p.

Lom J, Dykova I. 1992. Protozoan parasites of fishes. Developments in aquaculture and fisheries science, Volume 26. Amsterdam: Elsevier Science Publishing Company. 315 p.

Lom J, Haldar DP. 1977. Ciliates of the genera *Trichodinella*, *Tripartiella*, and *Paratrichodina* (Peritricha, Mobilina) invading fish gills. Folia Parasitol 24:193–210.

Martins ML, Marchiori N, Nunes G, Rodrigues MP. 2010. First record of *Trichodina heterodentata* (Ciliophora: Trichodinidae) from Channel Catfish, *Ictalurus punctatus* cultivated in Brazil. Brazilian J Biol 70:637–644.

Miller RJ, Robison HW. 2004. Fishes of Oklahoma. Norman: University of Oklahoma Press. 450 p.

Page LM, Burr BM. 2011. Peterson field guide to freshwater fishes of North America north of Mexico. Second edition. Boston (MA): Houghton Mifflin Harcourt. 663 p.

Smith SA, Schwarz MH. 2009. Dealing with *Trichodina* and *Trichodina*-like species. Virginia Coop Ext Publ 600–205:1–3.

Use of Fishes in Research Committee (joint committee of the American Fisheries Society, the American Institute of Fishery Research Biologists, and the American Society of Ichthyologists and Herpetologists). 2014. Guidelines for the use of fishes in research [online]. Bethesda (MD): American Fisheries Society. Available from: https://fisheries.org/docs/wp/Guidelines-for-Use-of-Fishes.pdf (Accessed September 30, 2019).

Van As JG, Basson L. 1989. A further contribution to the taxonomy of the Trichodinidae (Ciliophora: Peritrichia) and a review of the taxonomic status of some fish ectoparasitic trichodinids. Syst Parasitol 14:157–179.

Wellborn TL. 1967. *Trichodina* (Ciliata: Urceolariidae) of freshwater fishes of the southeastern United States. J Protozool 14:399–412.

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