

Morphological Identification of Parasites Found in Ducks (Family Anatidae) Along the Mississippi River

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Abstract

Ducks (Anatidae) can be found across much of the United States and are hosts to a variety of parasites such as nematodes, trematodes, or cestodes. This study focused on identifying the species of parasites found within ducks based on their morphological features. The morphological structures consisted of body shape, internal organs, mouthparts, and length. The ducks used in this study were legally harvested and donated by hunters from areas across the Mississippi River in Buffalo County and Trempealeau County Wisconsin. A total of 108 ducks have been analyzed for parasites. It is important to identify the types of parasites that use ducks as a host to see if they are harmful to the ducks so that they can be better managed. Necropsy was performed on different species of ducks to extract endo and ectoparasites. The extracted parasites were stained using carmine borax so they could be viewed using microscopy. While examining the parasites under the microscope, length and width measurements were taken as well as identifying key features like hold fast organs. A published key was used as a guide to identify parasites based on the measurements and key features present. The identified parasites were compared with DNA analysis from another research group to help ensure that the identification of the parasites was correct. Finally, identifications were compared to published articles containing past research found on parasites in ducks.

Introduction

When foraging for food, ducks (Anatidae) use their beaks to sift through mud, allowing sediment within the lake to become disrupted. During this process, a variety of different parasite infected invertebrates within the water get ingested either intentionally or unintentionally by the duck. Parasites such as nematodes, trematodes, and cestodes were found to be infecting dabbling ducks in Trempealeau County and Buffalo County Wisconsin in this study. Ducks were donated by local hunters to Winona State University to be dissected, observed, and further studied. The parasites identified were mainly found in the gastrointestinal tract as endoparasites, but they can also be found in the feathers as ectoparasites. Endoparasites live inside the duck's body and can cause anemia, weight loss, or other damage. Ectoparasites live on the outside of the duck's body or feathers, which can cause irritation or feather loss. Both endo and ectoparasites can be detrimental to a duck's health as they are hard to manage, making identification of duck parasites important. This study focuses on identifying parasites in ducks found along the Mississippi River using morphological features.

Materials and Methods

The hunters that donated the ducks removed the breast meat before donation. Ducks were processed following the ecto and endoparasite protocols by Orlofske Lab^{8,9}. The feathers were ruffled for ectoparasites, and individual organs were removed and examined for endoparasites. All specimens obtained were placed in labeled vials containing ethanol for preservation. The carmine staining protocol by Orlofske Lab and Tkach Lab³ was followed. Once stained, the specimen was repositioned on a microscope slide and underwent a dehydration process that consisted of 5-minute soaks from 70% to 100% ethanol (EtOH). After being dehydrated, the specimens were placed in a 50/50 mixture of clove oil and 100% EtOH for 3-5 minutes and transferred to pure clove before being mounted on a slide using a Canada balsam dilution mixture. Pictures were obtained using an AmScope Dissecting microscope camera and software (AmScope Corp, Irvine CA). Obtained trematodes were identified using *Key to Trematodes Reported in Waterfowl*⁷. Obtained cestodes were identified using *Keys to the Cestode Parasites of Vertebrates*⁶.

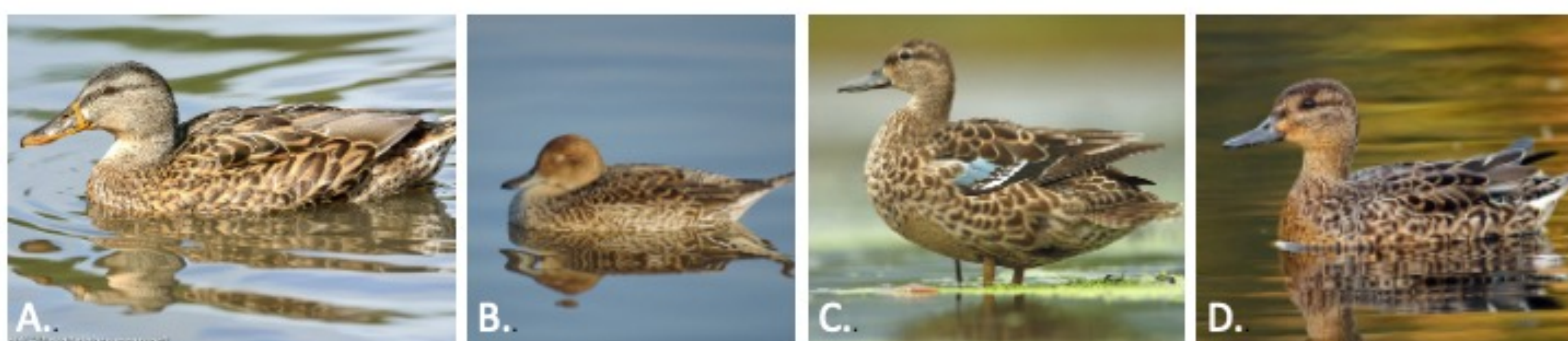


Figure 1. Duck species (Family Anatidae), sex, and duck number used to analyze parasites. A: Mallard (F) (#52). B: Northern pintail (F) (#59). C: Blue-winged teal (F) (#87). D: Green-winged teal (F) (#108).

Results

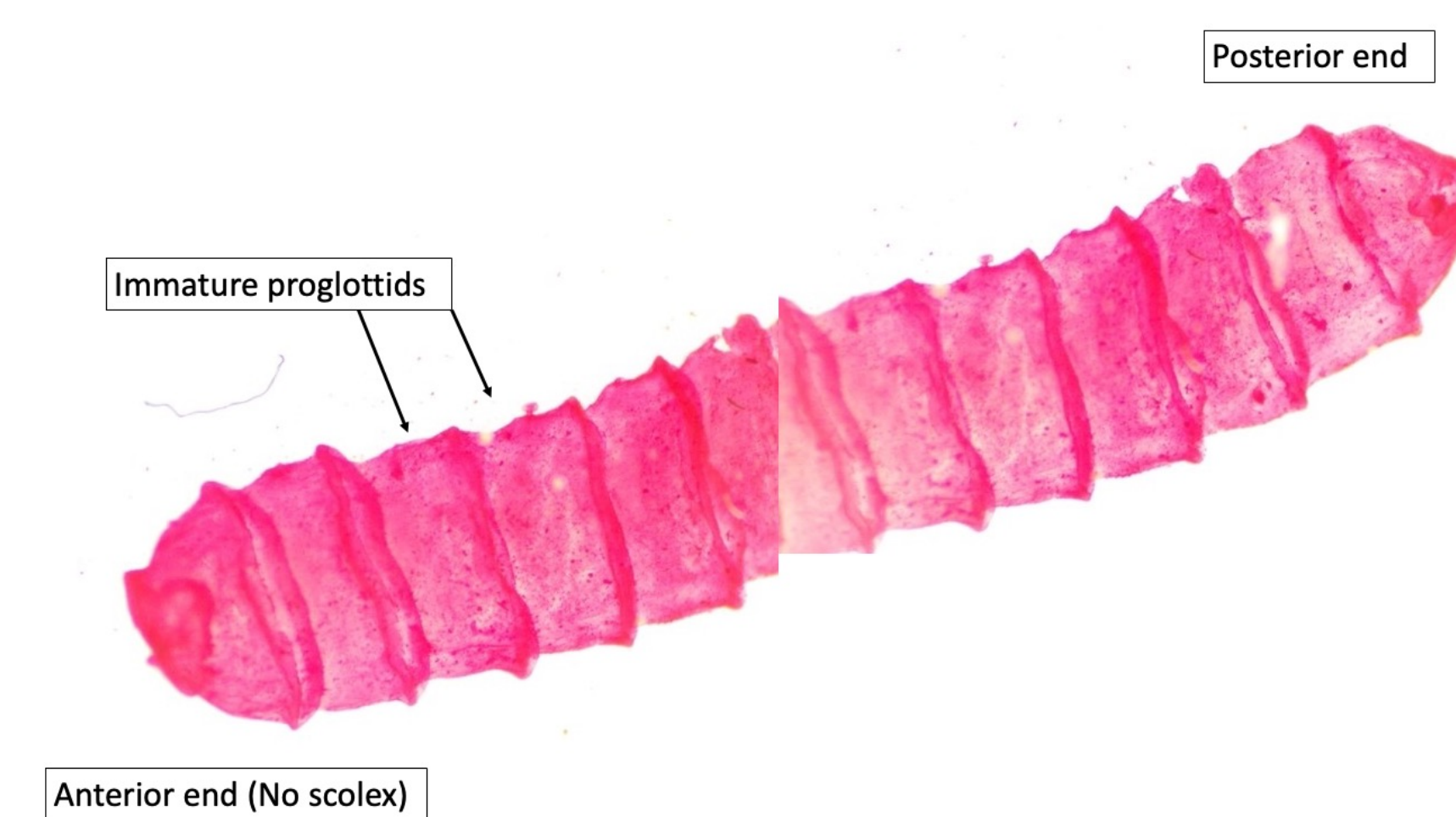


Figure 2. Cestode obtained from Green-winged teal (F) (#108) (Figure 1D). Identified as family Hymenolepididae, species *Drepanidotaenia lanceolata*.

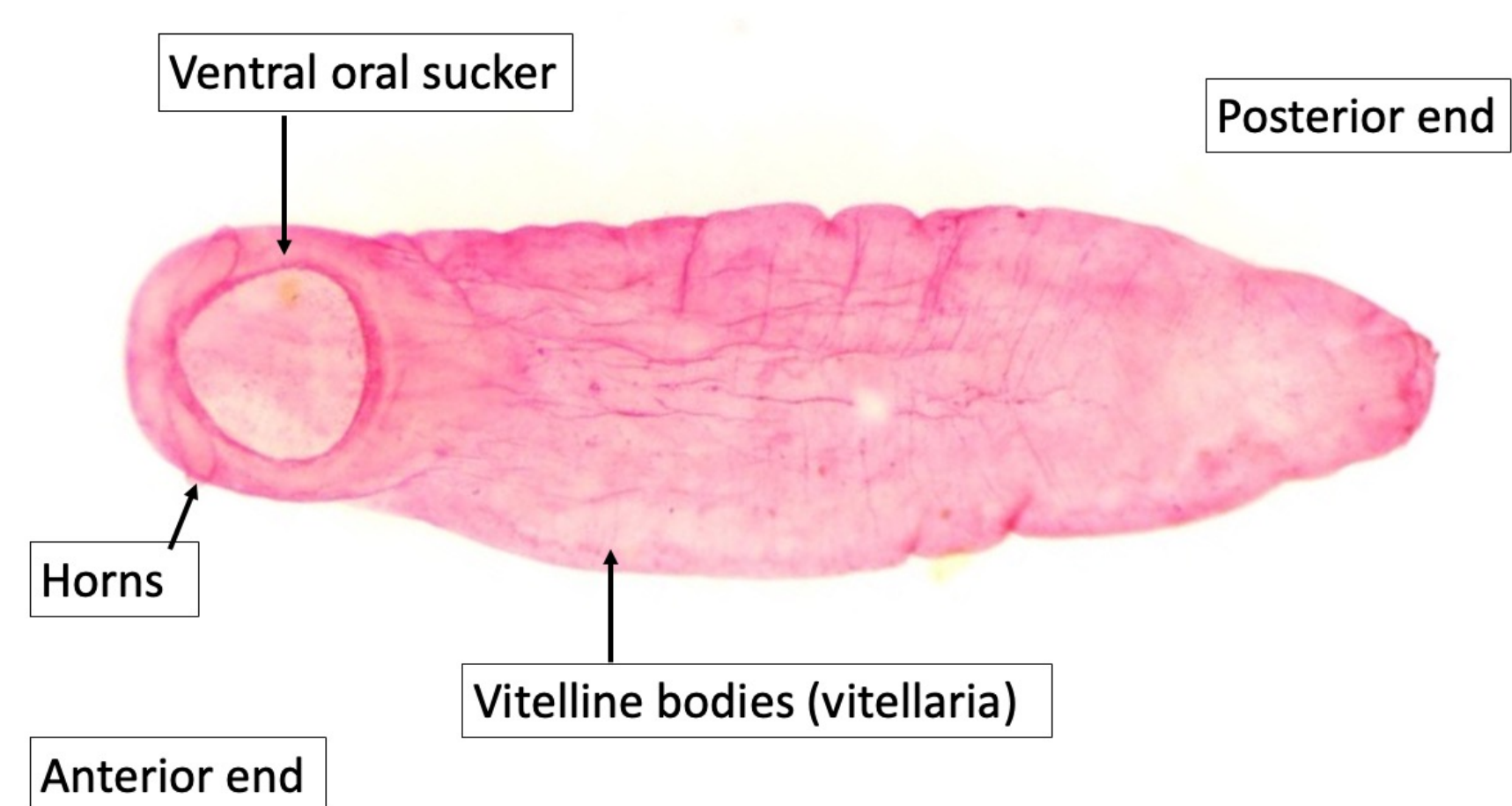


Figure 3. Trematode obtained from Mallard (F) (#52) (Figure 1A) and Blue-winged teal (F) (#87) (Figure 1C). Identified as family Paramphistomatidae, species *Zygocotyle lunata*.

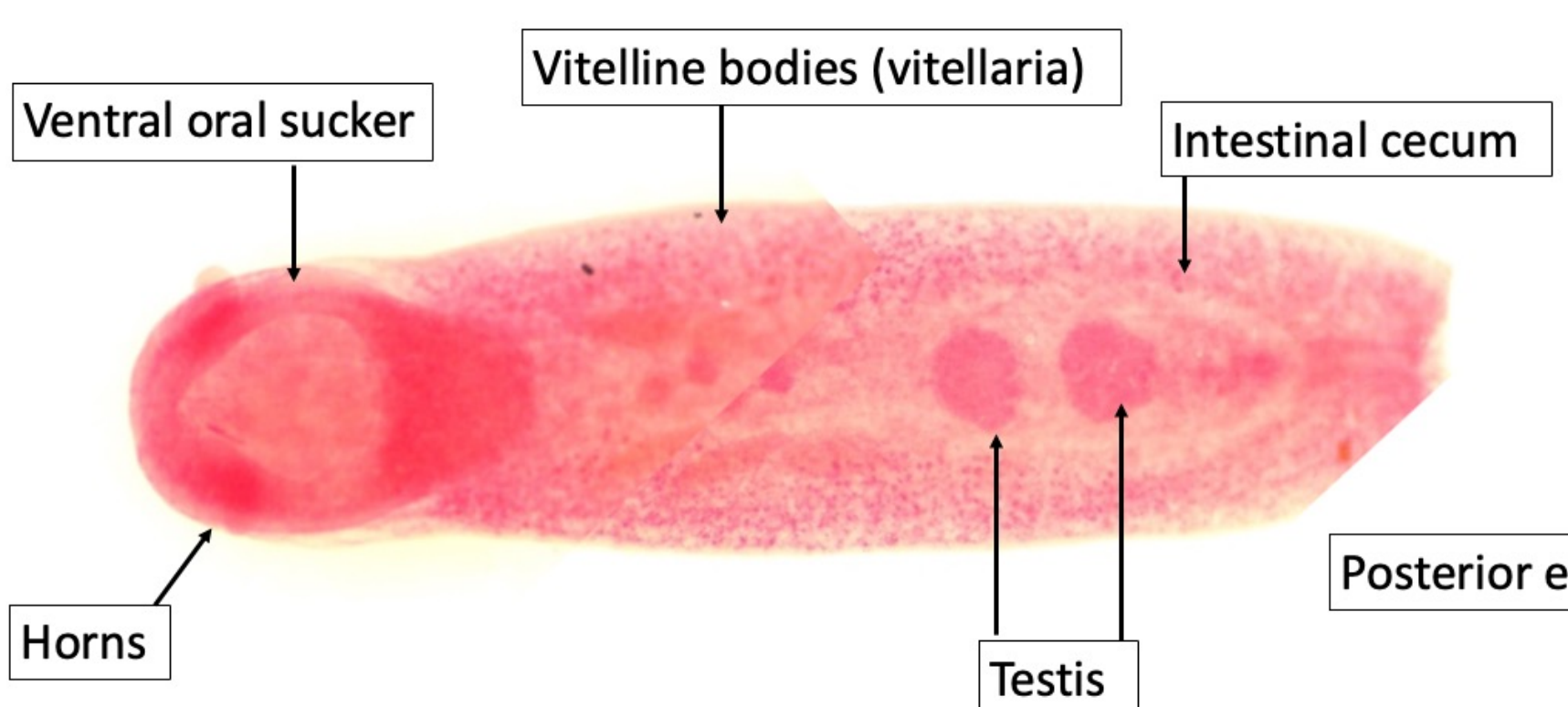


Figure 6. Trematode obtained from Mallard (F) (#52) (Figure 1A) and Blue-winged teal (F) (#87) (Figure 1C). Identified as family Paramphistomatidae, species *Zygocotyle lunata*.

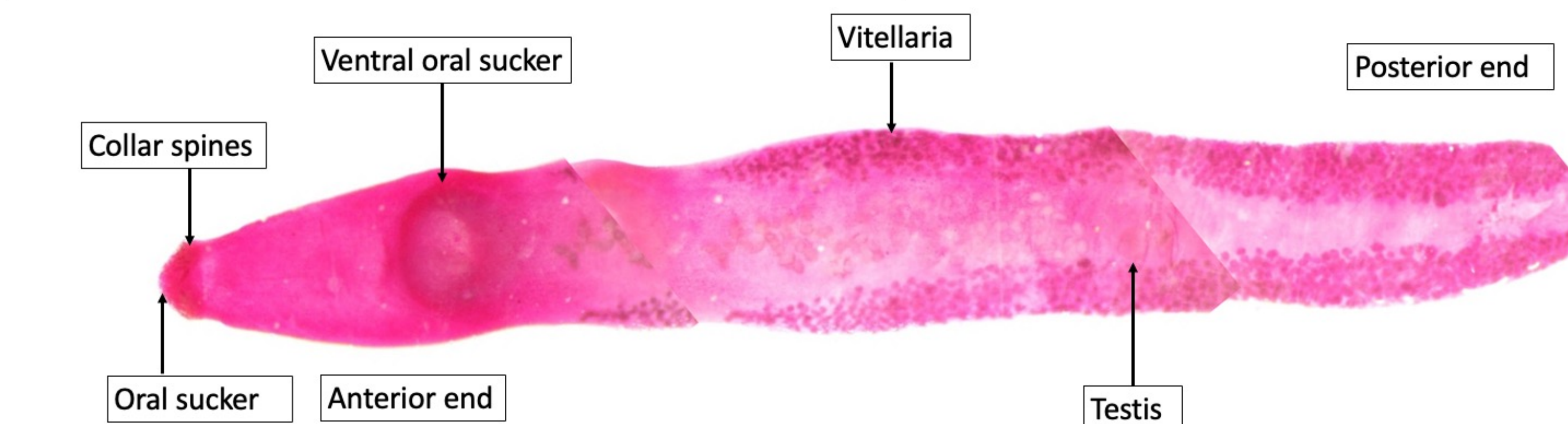


Figure 4. Trematode obtained from Northern pintail (F) (59) (Figure 1B). Identified as family Echinostomatidae, genus *Echinostoma*.

Four ducks; a female Mallard (*Anas platyrhynchos*) labeled #52 (Figure 1A), a female Northern pintail (*Anas acuta*) labeled #59 (Figure 1B), a female Blue Winged Teal (*Anas discors*) labeled #87 (Figure 1C), and a female Green-winged teal (*Anas carolinensis*) labeled #108 (Figure 1D) were dissected and inspected. Through inspection three representative parasites were obtained. The parasites obtained from ducks #52 and #87 were trematodes that closely matched those of the Paramphistomatidae family. Ducks only harbor one species within this Family, therefore the specimen could be further identified as *Zygocotyle lunata* (Figure 3). Parasites obtained from duck #59 were found to have originated from the Echinostomatidae family with the genus being identified as *Echinostoma* (Figure 4). The parasites obtained from duck #108 were cestodes classified under the Hymenolepididae family and further identified as *Drepanidotaenia lanceola* (Figure 2).

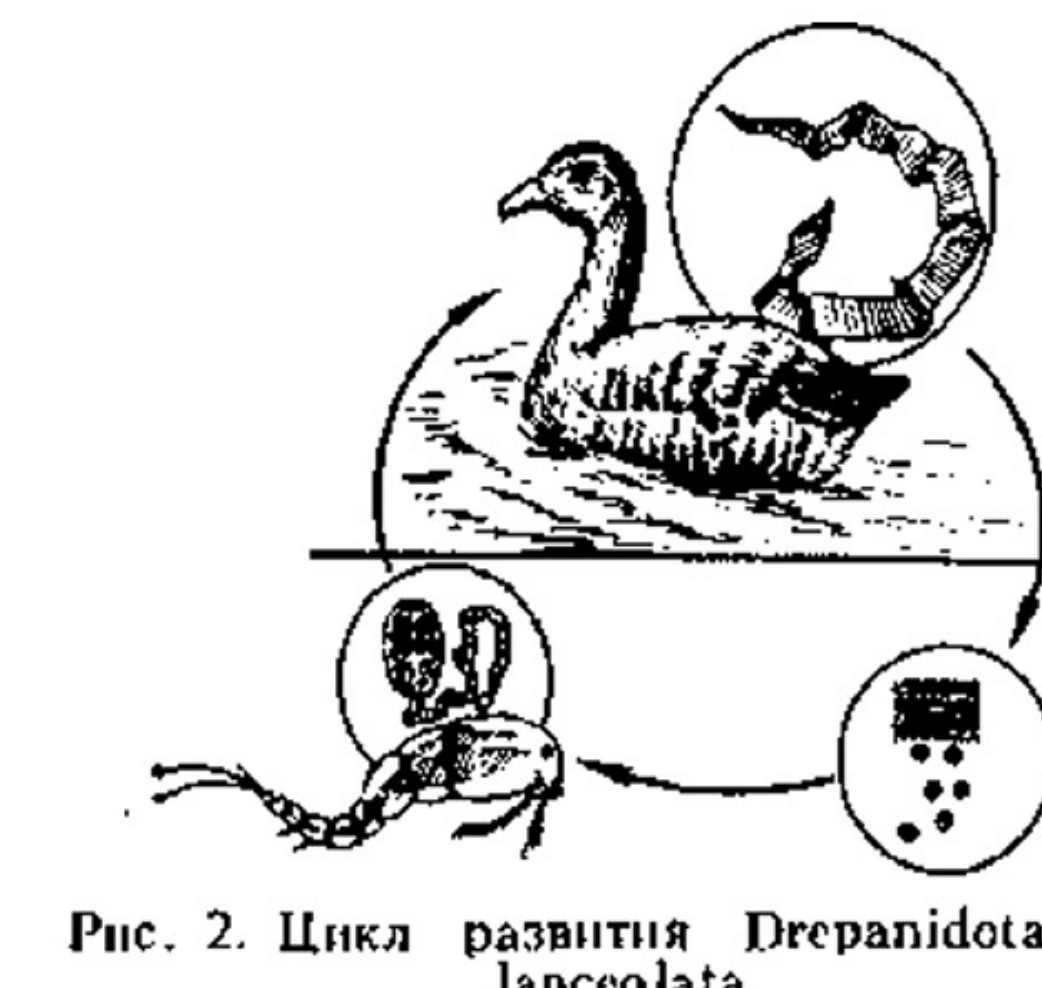


Рис. 2. Цикл розвитку *Drepanidotaenia lanceolata*.

Figure 5. Life cycle of cestode identified as family Hymenolepididae, species *Drepanidotaenia lanceolata*. (Figure 2).

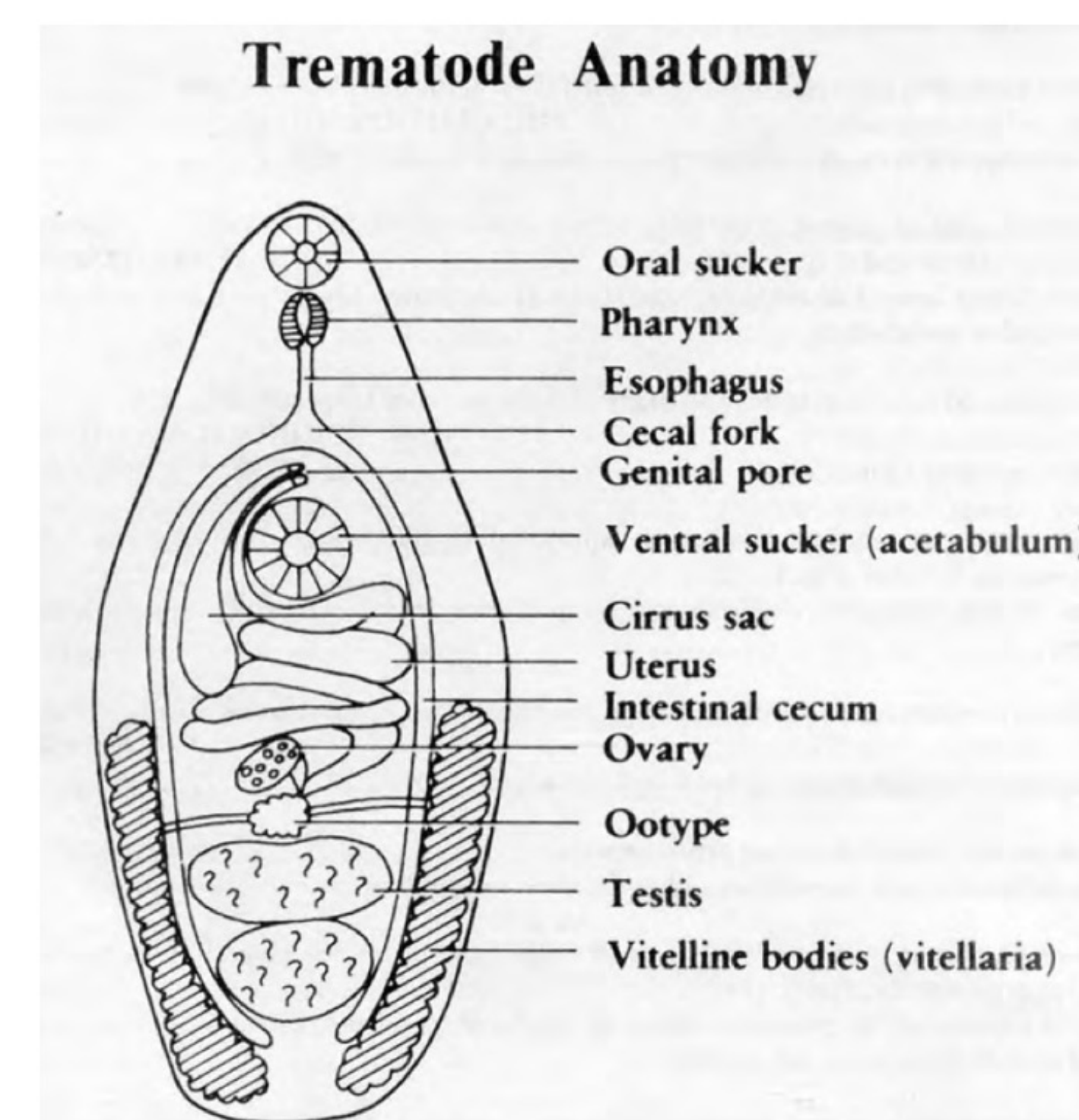


Figure 7. Morphological key used to identify trematode of family Paramphistomatidae, species *Zygocotyle lunata* (Figure 3, 6), and trematode of family Echinostomatidae, genus *Echinostoma* (Figure 4).

Discussion

Zygocotyle lunata was identified by the morphological features it contains; a ventral oral sucker and anterior horns as seen in Figure 3 and Figure 6. Being a globally distributed parasite among avian and mammalian communities, it was not uncommon to find *Z. lunata* inhabiting two of the waterfowl that had been collected. *Z. lunata* presents itself in an aquatic, two host life cycle. Adult worms can be found in the cecum of ducks where eggs will be released through the feces. Contamination of freshwater will allow miracidia to hatch where it will infect snails, as the intermediate host. At this point, sporocysts and rediae will develop before cercariae leaves the snail and will encyst on either aquatic vegetation or the surfaces of shells, where it will develop into metacercaria. The infective stage occurs when the encysted metacercariae are ingested. Although infections do occur in mammalian and numerous avian hosts, the studies done to fully understand the pathology of this specific trematode is limited. However, species falling under the Paramphistomatidae family do mutually appear to cause diseases referred to as paramphistomiasis. In ruminants such as weight loss and decreased nutrient conversion can prove detrimental, which may be a contributing factor limiting the lifespan of ducks.

When identifying *Echinostoma* only the genus was identified with 100% identity through DNA analysis, the species came up as a 70% match of *E. revolutum*. The morphological features of *E. revolutum* were compared to the obtained parasite. The parasite was identified based off the matching of the morphological features; collar spines, ventral oral sucker, vitellaria, and testes (Figure 4) as well as the knowledge that *E. revolutum* is the most common species of *Echinostoma* in our geographical area. *E. revolutum* is a parasite mostly found in freshwater habitat such as ponds, lakes, marshes, and swamps. The intermediate host is *Lymnaea stagnalis*, a small snail. The definitive hosts are ducks, swans, and geese (waterfowl). *E. revolutum* develops from egg to miracidium, cercariae, metacercaria, then finally to an adult in the definitive host. Once in the definitive host *E. revolutum* invades the digestive system and therefore is found in the stomach and intestines as an adult. The intermediate hosts ingest miracidium from the water. Most waterfowl birds have a diet that consists of small snails, like the intermediate host. The infective stage of *E. revolutum* in the definitive host is metacercaria, where it grows into an adult parasite once it reaches the digestive tract.

To identify *Drepanidotaenia lanceolata*, immature proglottids (Figure 2) were a characteristic morphological feature matching the family Hymenolepididae. Then, DNA identification was used to further identify the parasite as *Drepanidotaenia lanceolata*. *D. lanceolata* is an intestinal parasite that is found in waterfowl and can cause mechanical damage and symptoms (Gao et al, 2015¹⁴). Waterfowl acquire many different parasite species that move across broad geographic areas due to migratory movements. *D. lanceolata* uses its intermediate hosts such as copepod crustaceans to ultimately pass the parasite on to its definitive hosts of ducks, geese, and swans (Figure 5).

Conclusions

From this study two trematodes and one cestode were identified from a total of four ducks. The trematodes were identified as *Echinostoma revolutum* and *Zygocotyle lunata* through morphological features and DNA identification. The cestode was identified as *Drepanidotaenia lanceolata* by morphological features, DNA identification, and the life cycle.

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