Chapter 32

Gizzard Worms

Synonyms

Stomach worm, ventricular nematodiasis, amidostomiasis

Cause

Gizzard worms are comprised of several species of parasitic nematodes or roundworms of birds. Severe infections can result in birds becoming unthrifty and debilitated to the extent that they are more susceptible to predation and to infection by other disease agents. The two gizzard worms that are emphasized here are trichostrongylid nematodes that belong to the genera *Amidostomum* sp. and *Epomidiostomum* sp. These long (10–35 millimeter), sometimes coiled, threadlike roundworms are found just beneath the surface lining and the grinding pads of the gizzard, and they are most frequently found in waterfowl. Other species of gizzard worms are found in upland gamebirds such as grouse, in psitticine birds such as parakeets, and in passerine or perching birds such as robins in various parts of the world.

Life Cycle

Amidostomum sp. and *Epomidiostomum* sp. have a direct life cycle in which the infective parasite larvae invade a single host animal for development to reproductive maturity (Fig. 32.1). Embryonated eggs are passed in the feces of an infected host bird. First-stage larvae hatch from the eggs into the surrounding environment in about 24–72 hours, depending on the ambient temperature. These larvae molt twice after they hatch, and the time between molts also depends on the temperature. Larvae are quite resilient, surviving low temperatures and even freezing; they do not, however, survive drying.

After a bird ingests the larvae, most commonly when a bird feeds or drinks, they enter the gizzard and burrow into its surface lining where they molt again before they become adult worms. Adult worms become sexually mature in about 10–15 days after the final molt, and females shed eggs within 15–20 days. The development from egg to adulthood may take as few as 20 days or as many as 35 days depending on environmental conditions. Once a bird is infected, it can harbor gizzard worms for several years.

In contrast to the direct parasite life cycle, other gizzard worms such as *Cheilospirura spinosa* have indirect life cycles (Fig. 32.2) in which they undergo one or more stages of development in an arthropod (insect) intermediate host. *C. spinosa* is a common gizzard worm of North American ruffed grouse that also infects partridges, pheasants, quail, and wild turkey. Embryonated *C. spinosa* eggs that are discharged in the feces of grouse and other infected upland gamebirds are

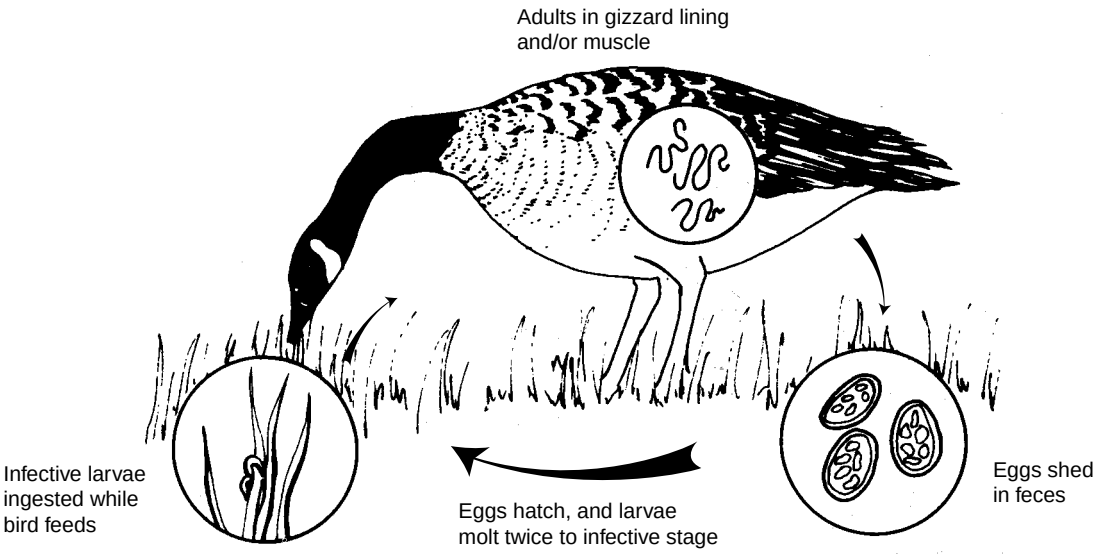


Figure 32.1 *Direct life cycle of gizzard worms such as* ***Amidostomum*** *sp. and* ***Epomidiostomum*** *sp.*

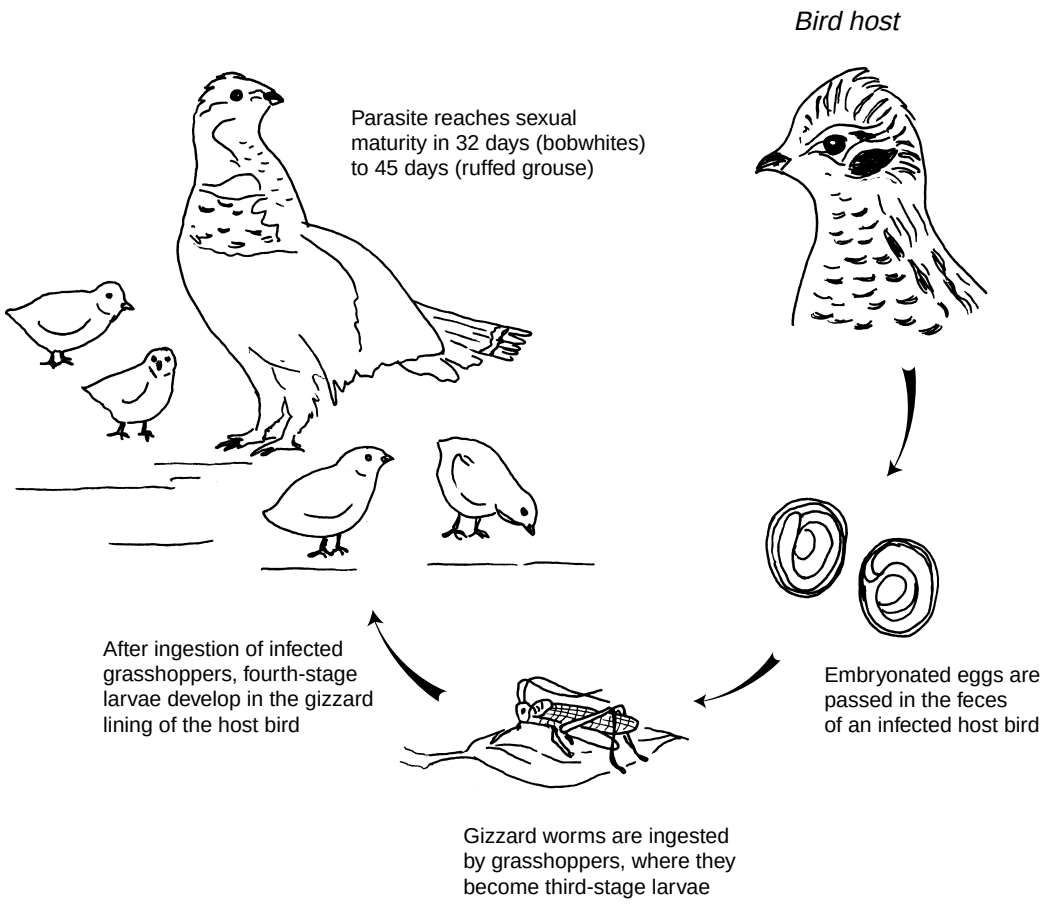


Figure 32.2 *Indirect life cycle of gizzard worms such as* ***Cheilospirura spinosa****.*

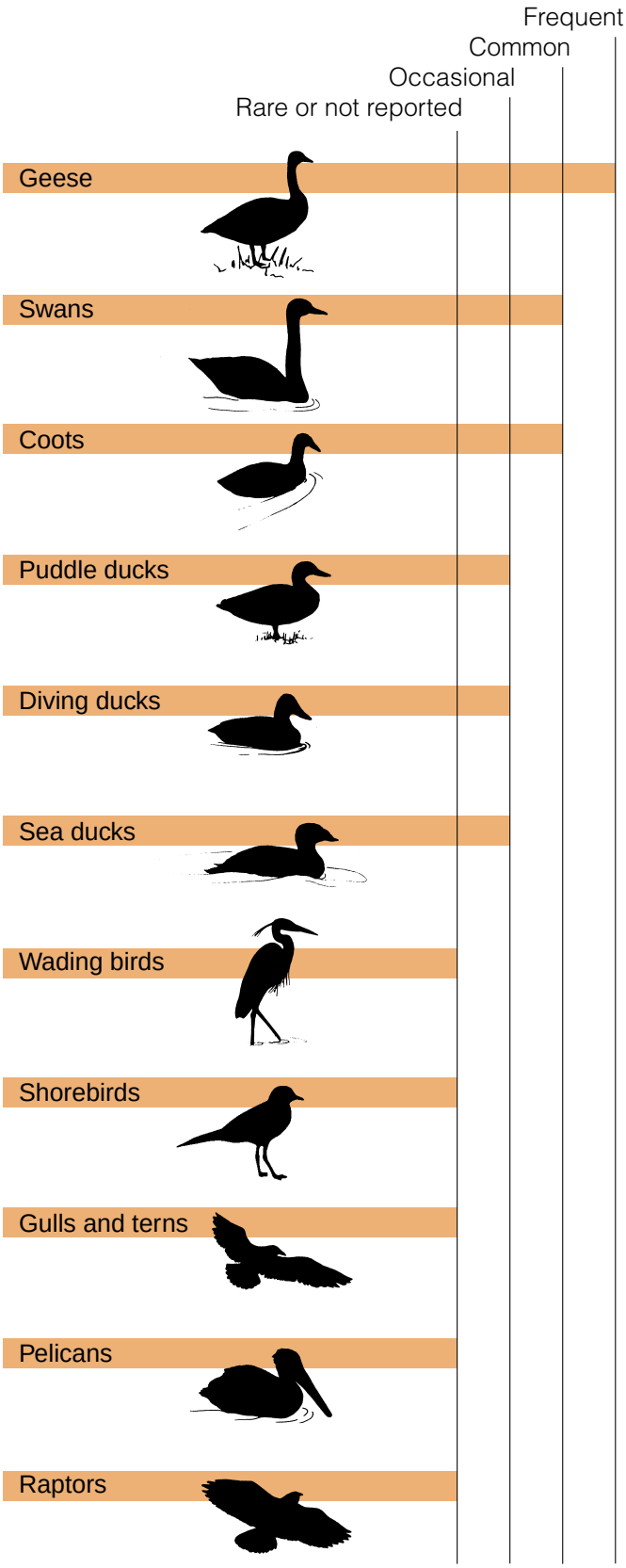
ingested by grasshoppers, the intermediate host, and the eggs hatch within the body of the grasshopper. Experimental studies indicate that the larvae then migrate into the body cavity of the grasshopper, where they become loosely encysted or where they invade the muscles. They then become third-stage larvae that are infective for birds; this infective stage is reached about three or three and one-half weeks after the grasshopper ingests the parasite eggs. Fourth-stage larvae (immature adult worms) have been found underneath the gizzard lining of bobwhite quail 14 days after ingestion of infected grasshoppers. Sexual maturity of the parasite is reported to be reached in bobwhites 32 days following ingestion of infected grasshoppers and in 45 days for ruffed grouse

Species Affected

Amidostomum sp. and *Epomidiostomum* sp. can be found in a variety of migratory birds, and gizzard worms have been reported in ducks, geese, swans, American coot, grebes, and pigeons (Fig. 32.3). Birds can die from gizzard worm infection, and death of very young birds is more common than death of adult birds. These worms are among the most common parasites of waterfowl, and they generally are more common in geese than in ducks or swans. However, a very high prevalence of infection of canvasback ducks with *Amidostomum* sp. (80 percent) was reported in one study. Infection is most severe in snow geese and Canada geese.

Seasonality

Migratory birds first become exposed to gizzard worms on breeding grounds, and they can continue to be exposed throughout their lives. Therefore, no seasonality is associated with this parasitism. The loss of young birds may be particularly high during the fall and winter months because of the combined effects of large worm burdens, the stresses of migration, and competition for food.



Field Signs

There are no field signs that indicate gizzard worm infection. Heavy worm burdens can result in poor growth of young birds, and birds of all ages are subject to emaciation and general weakness. Severe infections can interfere with food digestion by the bird as a result of extensive damage to the gizzard lining and muscle.

Gross Lesions

Obvious changes from the normal appearance of the gizzard result from the development, migration, and feeding of gizzard worms in that organ. The gizzard lining can slough off, become inflamed, hemorrhagic, and become ulcerated as a result of erosion of the grinding pads (Fig. 32.4). Large numbers (greater than 35) of worms can denude the surface lining of the gizzard, causing the edges of the grinding pads to degenerate and separate the pads from the underlying tissue (Fig. 32.5). In geese, portions of the gizzard muscle can die due to the presence of variable numbers of *Epomidiostomum* sp., which migrate through the tissue. Oblong tissue cavities 1–4 centimeters long can also be present (Fig. 32.6), and they can contain granular material that results from tissue reaction to worm migration through the muscle.

Diagnosis

Gizzard worm infection can be determined in live birds by finding and identifying gizzard worm eggs in the feces. The eggs of *Amidostomum* sp. and *Epomidiostomum* sp. are similar in size and appearance, and they require speciation by trained personnel.

Large numbers of worms and lesions in the gizzard lining or gizzard muscle of carcasses are highly suggestive of death caused by gizzard worms. Submit whole carcasses to disease diagnostic laboratories for more thorough evaluation. If it is not possible to submit a whole carcass and you suspect gizzard worms as the cause of mortality, then remove the gizzard (see Chap. 2) and ship it chilled or frozen. If the gizzard has been opened, remove with forceps as many whole worms as possible and place them in a 10 percent formalin solution or a 70 percent ethanol solution; do not freeze these worms. Submit the opened gizzard with the worms or preserve slices of the gizzard muscle in 10 percent formalin and forward them for microscopic examination (see Chap. 2).

Figure 32.3 *Relative frequency of gizzard worms in selected groups of North American migratory birds.*

Photo by James Runningen

Figure 32.4 *Canada goose gizzard showing ulcerations in the gizzard lining caused by gizzard worm (**Amidostomum** sp.) infection.*

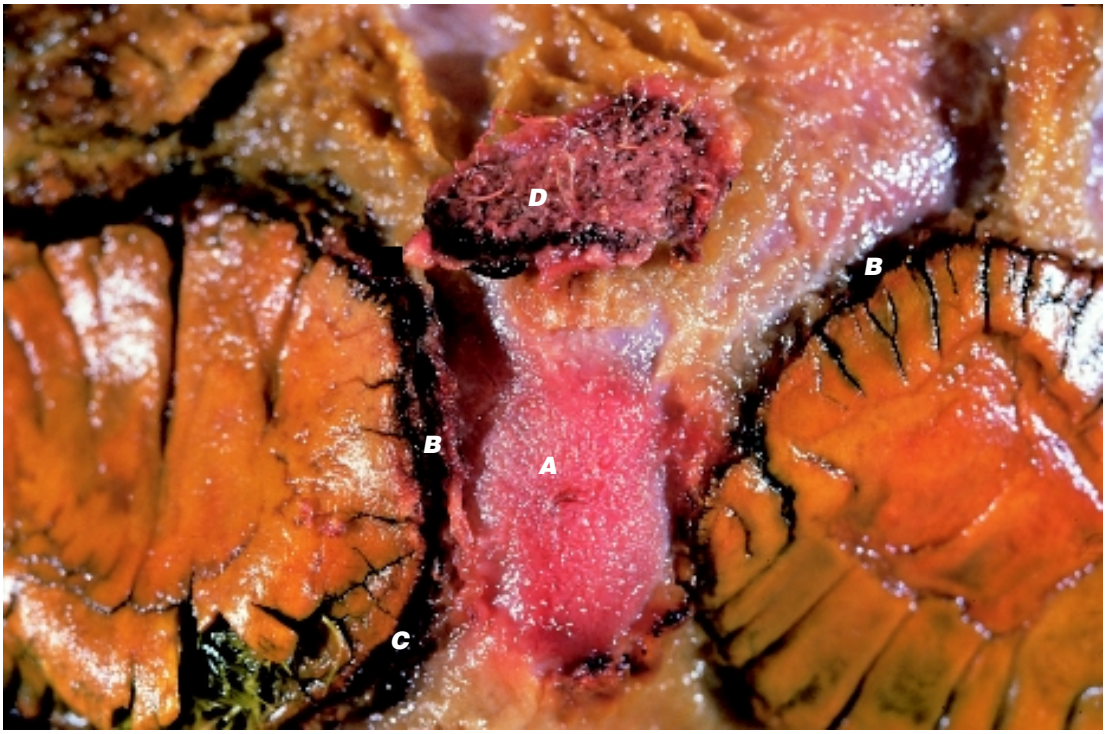


Photo by James Runningen

Figure 32.5 *Closeup of Canada goose gizzard showing **A**, denuded surface lining, and **B**, degeneration of the edges of the grinding pads. Note also **C**, the separation of the pads from the gizzard lining and **D**, the presence of worms.*

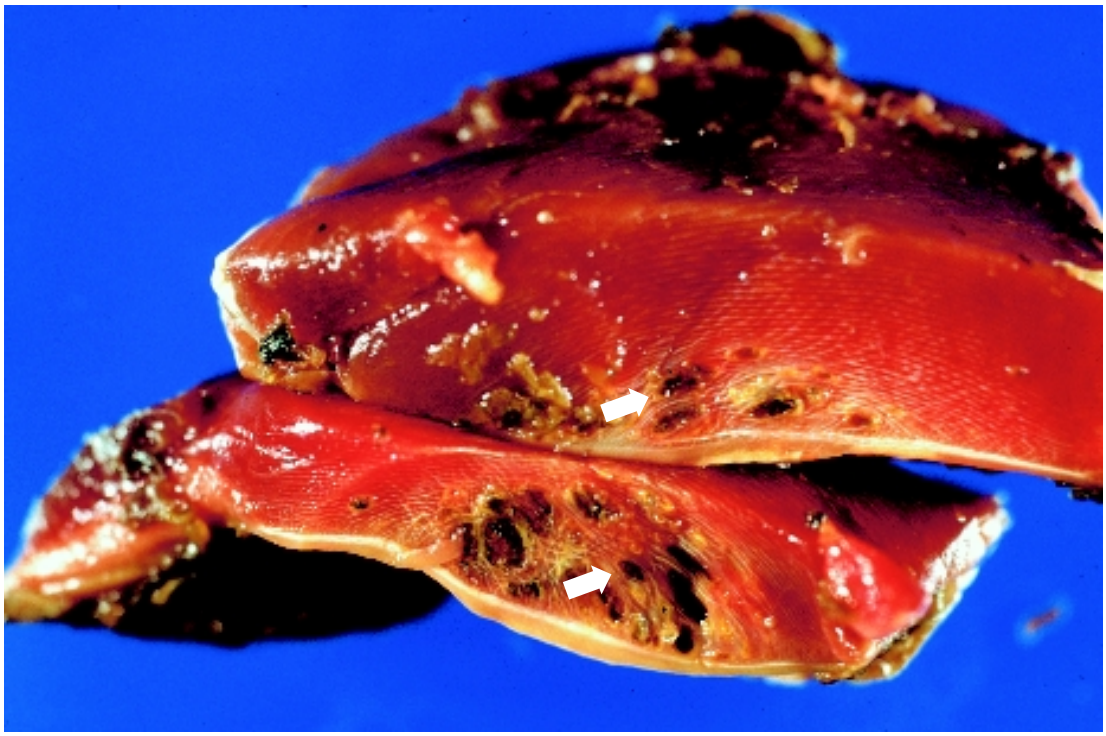


Photo by James Runningen

Figure 32.6 *Areas of tissue destruction and reaction to migrating* ***Epomidiostomum*** *sp. in the gizzard muscle of a snow goose.*

Control

Methods of controlling gizzard worms in free-ranging birds have not been developed. Attempts to do so would involve disruption of the parasite's life cycle. *Amidostomum* sp. and *Epomidiostomum* sp. have a direct life cycle (Fig. 32.1), and this suggests that transmission potential is greatest in crowded and continuously used habitat because of accumulative fecal contamination, provided that ambient temperatures are warm enough (68–77 °F) for larval development. Newly hatched birds are least resistent to infection, and birds of all ages are susceptible to reinfection.

Gizzard worms such as *C. spinosa* that have indirect life cycles could, theoretically, be controlled by reducing the availability of intermediate hosts to a number that is less than that which would allow transmission to be frequent enough to maintain the parasites. However, such actions, which would require habitat control or the use of insecticides, are generally not warranted because the parasite does not cause a significant number of bird deaths. Also, intermediate hosts, such as grasshoppers, have high food value for birds.

Human Health Considerations

Gizzard worms are not a threat to humans. Nevertheless, people who eat waterfowl gizzards should cook them thoroughly and should discard those that appear unhealthy because other infections may also be present.

Benjamin N. Tuggle and Milton Friend
(Modified from an earlier chapter by Benjamin N. Tuggle)

Supplementary Reading

Bump, R., Darrow, R.W., Edmister, F.C., and Crissey, W.F., 1947, The ruffed grouse, life history, propagation, management: Buffalo, N.Y., New York State Conservation Department, 915 p.

Herman, C.M., and Wehr, E.E., 1954, The occurrence of gizzard worms in Canada geese: Journal of Wildlife Management, v. 18, p. 509–513.

Herman, C.M., Steenis, J.H., and Wehr, E.E., 1955, Causes of winter losses among Canada geese: Transactions of the North American Wildlife Natural Resources Conference, v. 20, p. 161–165.

Leiby, P.D., and Olsen, O.W., 1965, Life history studies on nematodes of the genera Amidostomum and Epomidiostomum occurring in the gizzards of waterfowl: Washington, D.C., Proceedings of the Helminthological Society, v. 32, p. 32–49.

Tuggle, B.N., and Crites, J.L., 1984, The prevalence and pathogenicity of gizzard nematodes of the genera *Amidostomum* and *Epomidiostomum* (Trichostrongylidae) in the lesser snow goose (*Chen caerulescens caerulescens*): Canadian Journal of Zoology, v. 62, p. 1,849–1,852.