SOME ASPECTS OF THE LARVAL DEVELOPMENT OF CYCLOCOELUM OBSCURUM (TREMATODA: CYCLOCOELIDAE)

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ABSTRACT: Eggs of Cyclocoelum obscurum are released into water, and emerged miracidia (each containing a redia) attach to aquatic snails. Rediae bore into the molluscan host leaving the empty miracidia behind. Encysted cercariae with poorly defined internal structures are seen within rediae as early as 14 days postexposure. From 14 days on, the number of metacercariae increases within the redia. C. obscurum larvae develop through the metacercarial stage in Gyraulus hirsutus of varying age. Attempts to infect laboratory-reared killdeers (Charadrius vociferus) with C. obscurum metacercariae failed.

Published works on cyclocoelid life histories include those by: Szidat, 1932, 1933; Stunkard, 1934; Johnston and Simpson, 1940; Ginetzinskaja, 1954; Timon-David, 1955; Palm, 1963; and Wootton, 1964. Previous aquatic cyclocoelid life histories have been described as follows: Eggs are released into water, and emerged miracidia (each containing a redia) attach to aquatic snails. Rediae bore into the molluscan host leaving the empty miracidia behind. Inside the snail, germinal masses within the redia produce cercariae which leave the redia and encyst within host tissue. Birds become infected by eating gastropods containing mature metacercariae. Eggs of Cyclocoelum elongatum Harrah, 1922 (= Cyclocoelum dollfusi, Timon-David, 1950) are passively ingested by land snails and metacercarial stages encyst within the rediae producing them (Timon-David, 1955).

Cyclocoelid classification is based on the revisions of Dubois (1959, 1965). The present paper describes larval development of C. obscurum Leidy, 1887, from the Wilson's snipe (Capella gallinago) and a marbled godwit (Limosa fedoa).

MATERIALS AND METHODS

Potential hosts, Wilson's snipes, marbled godwits (Catoptrophorus semipalmatus), and a Hudsonian godwit (Limosa haemastica), of C. obscurum were examined during 1966–71 by making an incision from the vent to the pectoral girdle. The host’s digestive tract, liver, kidneys, lungs, trachea, and bursa Fabricii were placed in separate containers of avian saline. Each organ was examined under a dissecting microscope for the presence of cyclocoelids. Carcasses of necropsied birds were soaked in saline for several hours to aid in the recovery of trematodes. Finally, the body cavity was flushed with a strong stream of water to dislodge any remaining cyclocoelids. Gravid helminths recovered from Wilson’s snipes and a marbled godwit were placed in previously boiled aquarium water and allowed to release eggs. Some miracidia from these eggs were observed and photographed, whereas others were placed in small shallow dishes with laboratory-reared aquatic snails. After exposure, the snails were transferred to small aquaria and examined periodically. Adults and larval stages were first examined live and either stained with paracarmine and counterstained with fast green or sectioned and stained using Heidenhain’s iron hematoxylin. All measurements in this paper were taken from living specimens, and are in microns. Cyclocoelid-free killdeers were raised from eggs using the methods of Malone and Proctor (1966). Birds were exposed by feeding them isolated rediae containing metacercariae.

RESULTS

Adults

Gravid adults recovered from air sacs in this study were morphologically identical to those described by Dubois (1959) as C. obscurum. This species was found in three of 40 specimens of Wilson’s snipe from central and northwestern Iowa with one, two, and three, respectively; none of 11 from Marathon County, Wisconsin; none from one Hudsonian godwit; one of three specimens of marbled...
godwits, with seven; and one of two willets with 180 all from Brown County, South Dakota. All the above cyclocoelids were gravid with the exception of those recovered from the willet.

Eggs

Eggs were operculate with light brown shells. Five unfixed eggs of *C. obscurum* obtained from a Wilson’s snipe averaged 173 by 93.

Miracidia

The miracidium filled the egg shell with the anterior end of the miracidium pressed against the operculum. Miracidia hatched approximately 30 min after oviposition. Five living miracidia, averaging 190 by 99, resembled others described in the family Cyclocoelidae. Cilia are nearly uniform in distribution and length except at the anterior end where they are approximately one and a half times as long as on the rest of the body. The anterior cilia, resembling a rotating wheel, arise from a collarlike structure surrounding the base of an elongated terebratorium (Fig. 1).

The miracidium is ocellate and contains a fully formed redia. The redia, located in the posterior two-thirds of the miracidium, is equipped with two posterior appendages, tail, pharynx, and saciform intestine. Miracidia are positively phototactic and negatively geotactic. They swim randomly until contact is made with the snail. Many times after contact they do not attach, but move about on the surface of the molluscan host and then swim away. In other instances, miracidia attach immediately to the foot, tentacles, mantle edge, or head. After attachment the enclosed redia penetrates the snail, leaving the miracidium behind.

The gravid *C. obscurum* obtained from an infected snipe contained eggs that lacked well-formed miracidia. Nevertheless, these eggs were placed in a stender dish with five laboratory-reared *G. hirsutus*. At 7 days postexposure these snails were dissected and found negative for rediae of *C. obscurum*. Three gravid *C. obscurum* containing well-developed miracidia were recovered from the abdominal air sacs of a third Wilson’s snipe and seven from a marbled godwit. Twenty *Stagnicola reflexa*, 20 *Physa gyrina*, and 10 *G. hirsutus* were exposed to miracidia of *C. obscurum* recovered from the Wilson’s snipe. Twenty *G. hirsutus* were exposed to miracidia of *C. obscurum* from the marbled godwit. All larval development discussed below refers to *C. obscurum* from the Wilson’s snipe unless stated otherwise.

Redia

Eight days postexposure one *G. hirsutus* was examined. Five rediae averaging 612 by 137 were recovered (Fig. 2). They all possessed a tail, posterior appendages, pharynx, saciform intestine, and germinal masses.

Fourteen days postexposure, two *G. hirsutus* were dissected. One snail harbored four rediae averaging 658 by 184 and the other had one. All rediae appeared similar to 8-day larvae except for their generally larger size and presence of cercariae (Fig. 3). One redia also contained metacercariae.

Twenty-one days postexposure, one *G. hirsutus* harbored four rediae averaging 997 by 236 (Fig. 4), one of which contained seven cercariae (183 by 71) and 16 metacercariae with an average diameter of 94. Rediae sectioned at this stage showed the same internal structures as did the 14-day-old rediae except for additional metacercariae.

Twenty-eight days postexposure, four rediae were recovered measuring 984 by 273 from one specimen of *G. hirsutus* (Fig. 5). These differed little from the 21-day-old rediae. As rediae developed, they usually became larger and contained more metacercariae.

All 20 *G. hirsutus* exposed to *C. obscurum* from the marbled godwit were examined 53 days postexposure, and only one snail was infected containing one redia measuring 1,030 by 253 with approximately five cercariae and 30 to 35 metacercariae (Fig. 6). This redia was fed to a laboratory-reared killdeer that was necropsied 90 days later. A thorough examination of this bird failed to reveal any cyclocoelids.

Ten remaining *G. hirsutus* infected with *C. obscurum* rediae from the Wilson’s snipe were kept under close observation. The small size of the snails and their transparent shells

greatly facilitated observation of redial migrations. Rediae with *G. hirsutus* moved actively from the region of the head-foot to the albumin gland. However, they are most frequently found in connective tissue surrounding the digestive tract.

Ninety days postexposure, two of 10 *G. hirsutus* remained alive. These were infected,
one with a single redia, the other with two. A laboratory-reared killdeer was exposed to these rediae. An accurate count of metacercariae within the rediae was not made for fear of damaging rediae or metacercariae prior to being fed to the bird. This bird, necropsied 90 days postexposure, was negative for cyclocoelids.

**DISCUSSION**

*C. obscurum* from Wilson's snipes and a marbled godwit show intramolluscan development similar to that of *C. elongatum* (Timon-David, 1955). Other cyclocoelid life cycles currently being studied include those of *C. brasillianum* from greater yellowlegs (*Totanus melanoleucus*) and lesser yellowlegs (*T. flavipes*) and *C. vanelli* from American avocets (*Recurvirostra americana*). *C. brasillianum* has an intramolluscan development like that of *C. obscurum*. However, the development of *C. vanelli* from American avocets differs from development in the above species in that miracidia hatch in utero and cercariae leave the rediae that produce them and encyst in snail tissue. *C. vanelli* is a common parasite in shorebirds, and inasmuch as its development differs from that of *C. obscurum* it is not surprising that killdeers were refractive to infection by *C. obscurum*. However, killdeers were the only shorebirds available to me in this study.

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**LITERATURE CITED**


