through genes, hormones, cytokines, antigens, receptors, antibodies, and metabolic pathways of both the host and the parasite (Morales-Montor and Larralde, 2005); thus, they modulate the outcome of infection. As a consequence of such complexity, the sexually dimorphic profile in a given parasite infection may also vary in its form of expression (i.e., prevalence, intensity, severity, or mortality), and with the time and anatomical location of the infection, the developmental stage of the infecting parasite, the effectiveness of the host immune response, and environmental factors (e.g., stress, concomitant infections, nutrient availability, or predators) acting upon both host and parasite in laboratory or natural conditions (Klein, 2004; Morales-Montor and Larralde, 2005).

We are confident that other host–parasite interactions are governed by similar factors and in different ways, but with comparable complexity. If so, claims of an inflexibly biased sexual dimorphism affecting all host–parasite interactions should be narrowed to the particular infection under consideration.

LITERATURE CITED


The Association of Zygocotyle lunata and Echinostoma trivolvis with Chaetogaster limnaei, an Ectosymbiont of Helisoma trivolvis

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ABSTRACT: Helisoma trivolvis snails collected from a lake in Warren County, New Jersey, in June 2007 possessed the ectosymbiont Chaetogaster limnae (Annelida). Some of these snails were also infected with larval stages of Zygocotyle lunata and Echinostoma trivolvis. Chaetogaster limnaei associated with the infected snails fed on the cercariae of both digeneans. Zygocotyle lunata cercariae were observed in the stomach of C. limnae and whole cercariae were loosely attached to the ventral surface of the chaetogasters. Cercariae in the stomachs were digested within 48 hr and probably served as a source of nutrient for the annelid. Whole cercariae and 1 nviable metacercaria of E. trivolvis were seen in the stomachs of the chaetogasters. The protective action of the chaetogasters on the transmission of the cercariae of E. trivolvis and Z. lunata to second intermediate hosts in the wild awaits further study.
The purpose of the present paper is to describe our observations on the association of Zygocotyle lunata and Echinostoma trivolvis cercariae with Chaetogaster limnaei, an ectosymbiont of Helisoma trivolvis. On 23 June 2007, 100 H. trivolvis snails, 10–20 mm in shell diameter, were collected at Oxford/Furnace Lake, in Warren County, New Jersey (40°47’6.5”N, 75°00’41.9”W), as described by Klockars et al. (2007). The snails were each isolated in individual wells (3.5 cm in diameter) of a multiwell chamber. Examination of the wells with a dissecting scope at 2 hr postisolation revealed the presence of C. limnaei, an ectosymbiont of H. trivolvis, in most of the cultures. Chaetogaster limnaei did not consume E. trivolvis cercariae. However, cercariae of Z. lunata were observed in the stom- achs of C. limnaei; some cercariae were also attached to the anterior ventral surface of the chaetogasters in wells containing snails releasing Z. lunata cercariae.

Approximately 10 chaetogasters were present in wells in which Z. lunata cercariae were seen. Six of the C. limnaei in one well each contained 1 cercaria, and 4 each contained a cercaria (body and tail) attached to the anterior ventral surface. Penetration of the cercaria into the body of the chaetogaster did not occur. In the other well, 5 of 10 C. limnaei each contained a single cercaria in the stomach. Several C. limnaei that had ingested cercariae of Z. lunata were fixed in hot 5% neutral buffered formalin and mounted on glass microscope slides in glycerin jelly. The cercaria in the stomach distended the anterior region of the chaetogaster. The cercaria was heavily pigmented with melanin and appeared as a dark body at low magnification. Under higher magnification, some details of the cercaria were apparent, including the eyespots, excretory ducts, and dispersed pigment granules. The cercarial morphology conformed to earlier descriptions of this larval stage by Willey (1936, 1941). No release of cystogenous material was observed at the junction of the stomach and the cercaria, indicating the inability of the larval stage to encyst in this site. For 48 hr, we observed a C. limnaei that had ingested a Z. lunata cercaria to see if the parasite would be digested. At 24 hr, there was clear-cut lysis of the cercaria and, by 48 hr, digestion was complete and minimal residue of the body was seen. Our observations indicated that the cercaria was digested and absorbed in the gut of the chaetogaster, thereby serving as a nutrient source for the oligochaete.

We attempted to see if chaetogasters isolated from snails would also feed on Z. lunata cercariae. To accomplish this objective, Z. lunata cercariae were attached to a 3.5-cm diameter plastic petri dish containing artificial sea water (ASW) (Ulmer, 1970), along with 2–4 chaetogasters. No evidence of cercarial ingestion was seen at 2 hr, but some cercariae had formed a loose association with the ventral surface of the annelids. By 4 hr, the attached cercariae detached and became motionless at the bottom of the dish. Whether the surface of the chaetogaster serves as an attachment site for encystment and allows for possible transmission of this trematode to vertebrate hosts remains to be determined.

The snails infected with Z. lunata were removed to a mason jar containing 1 L of ASW in an attempt to collect cercariae. Unfortunately, released less than 10 cercariae into the cultures. Further attempts to collect cercariae from snails in the wild awaits further study.

In summary, our observations showed that Z. lunata and E. trivolvis cercariae released from H. trivolvis were ingested by C. limnaei, an ectosymbiont of the snail. The effect of E. trivolvis cercariae on the transmission of these parasites in the wild awaits further study.

LITERATURE CITED


