

Fimbriaria fasciolaris and *Cloacotaenia megalops* (Eucestoda, Hymenolepididae), Cestodes from Brazilian Waterfowl

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Two cestode species, *Fimbriaria fasciolaris* (Pallas, 1781) Frölich, 1802 *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) Wolffhügel, 1938 collected from *Anas bahamensis* Linné, 1758 and *Amazonetta brasiliensis* (Gmelin, 1758) in lagoons of the Maricá District, State of Rio de Janeiro, Brazil, are described. This is the first record of *F. fasciolaris* parasitizing *A. bahamensis*. The prevalence, intensity of infection, and mean intensity of infection for both species are given. Overdispersion distribution is reported for *F. fasciolaris* with 535 specimens collected in a single *A. bahamensis*. A key for the genera in the *Fimbriariinae* is presented. Anatomical features of *F. fasciolaris* and *C. megalops* are discussed.

Key words: *Fimbriaria fasciolaris* - *Cloacotaenia megalops* - Anatidae - key characters - overdispersion distribution - Brazil

The present work is the third of a series (Muniz-Pereira & Amato 1993, 1995) related to a survey of helminths parasitizing two species of Brazilian waterfowls, *Anas bahamensis* Linné, 1758 and *Amazonetta brasiliensis* (Gmelin, 1758). This series is scheduled to fulfil a broad field in Brazilian helminthology, started by Natterer, the 19th century Austrian naturalist, who capturing vertebrates, mainly mammals (12,293 specimens) and birds (1,146 specimens), also collected their parasites (2,000 samples). This parasites were later studied by outstanding helminthologists, such as Rudolphi, Diesing, Fuhrmann, Wolffhügel, Braun, among others. One of the first Brazilian helminthologists to make reference to waterfowl parasites was Magalhães (1899), who recorded digeneans and nematodes from ducks, collected by Natterer in the State of Rio de Janeiro. Subsequent papers on parasites of Brazilian waterfowl are non-periodical and the information is fragmentary, neither focusing on extensive surveys nor based on a specific group of avian host.

MATERIALS AND METHODS

The birds, 18 *Anas bahamensis* (L.) and 22 *Amazonetta brasiliensis* (Gmelin), and the helminths were collected as reported earlier (Muniz-Pereira & Amato 1993, 1995) at Maricá and Guarapina Lagoons, in Maricá District, State of Rio de Janeiro, Brazil. Birds were deposited as symbiotypes voucher specimens, *sensu* Brooks (1993), in the Ornithological Collection of the Museu Nacional do Rio de Janeiro. Histological sections were prepared following Luna (1968), stained with hematoxylin-eosin and mounted in Canada balsam. The terms prevalence, mean intensity of infection, and site of infection are used according to Margolis et al. (1982). Measurements are in micrometers, unless otherwise stated; the number inside parentheses is the mean value, and "n" is the number of specimens measured. Photomicrographs were obtained in a Zeiss mod. Axiophoto system. Voucher specimens were deposited in the Helminthological Collection of the Instituto Oswaldo Cruz (CHIOC), Rio de Janeiro, RJ, Brazil.

DESCRIPTIONS

Fimbriaria fasciolaris (Pallas, 1781)
Frölich, 1802 (Figs 1-2)

Description of studied specimen (based on 15 specimens mounted *in toto*, 15 measured and 136 histological sections): Hymenolepididae, *Fimbriariinae*: strobila internally and externally segmented, losing segmentation at the posterior end, 3.5 -104 mm (29.8 mm) long, 0.458-1.67 mm

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(0.776) greatest width; calcareous corpuscles conspicuous. Scolex, 18.3 (n=1) long, 58.6 (n=1) wide; four unarmed suckers, round to slightly oval, 38.4 (n=1) long, 34.8 (n=1) wide; rostellum armed with a single circle of ten hooks, 60.4 (n=1) long, 32.9 (n=1) wide; pseudoescolex triangular, conspicuous, no genital primordia present, with segmentation visible, becoming leaflike when mature, 586-970 (787) (n=12) wide; neck zone following as a continuation of pseudoescolex. Six osmoregulatory canals, joined in three pairs, 14.6-36.5 (30.8) (n=9) wide. Longitudinal muscular system with single circle of 67-105 bundles, 14.7-23.8 (19.6) in diameter.

Male reproductive system: testes spherical to oval, often in number of three per cirrus pouch, 36.5-95 (n=8) long, 21.9-51 (39.7) (n=7) wide; external seminal vesicle present; cirrus pouch clubshaped, 56.8-82.4 (66.7) (n=5) long, 9.2-16.5 (12.8) (n=5) wide; internal seminal vesicle poorly developed; cirrus with minute spines.

Female reproductive system: ovary transversely elongate, non-metameric; seminal receptacle spherical; vagina narrow, elongate; uterus reticulate non-metameric, numerous eggs released in short strings when mature; oncospheres, 16.5-23.8 (18.1) (n=10) in diameter, hooklets not seen; genital atrium, 12.8-14.6 (13.4) wide; genital pores unilateral, marginal, deeply embedded in the cortex region, apertures surrounded by very minute spines.

Taxonomic summary

Hosts: *Anas bahamensis* Linné, 1758, *Amazonetta brasiliensis* (Gmelin, 1758).

Site of infection: anterior intestine.

Locality: Lagoon of Maricá, Lagoon of Guarapina, mouth of the Mombuca river, Maricá District, State of Rio de Janeiro, Brazil.

Prevalence: *A. bahamensis* 55.6%, *A. brasiliensis* 4.5%.

Intensity of infection: *A. bahamensis* 2-535, *Amazonetta brasiliensis* 1.

Mean intensity of infection: *A. bahamensis* 60.8, *Amazonetta brasiliensis* 1.

Other hosts: AVES - ANSERIFORMES: *Anser anser*, *A. anser* (dom.), *A. caerulescens*, *A. cygnoides*, *A. cygnoides* (dom.), *A. erythropus*, *Cygnus olor*, *Branta sandvicensis*, *Alopochen aegyptiaca*, *Chloephaga picta*, *C. poliocephala*, *Cyanochen cyanoptera*, *Lophonetta specularioides*, *Tadorna ferruginea*, *T. tadorna*, *Anas platyrhynchos*, *A. platyrhynchos* (dom.), *A. acuta*, *A. castanea*, *A. clypeata*, *A. crecca*, *A. discors*, *A. falcata*, *A. formosa*, *A. penelope*, *A. poecilorhyncha*, *A. punctata*, *A. querquedula*, *A. rubripes*, *A. specularis*, *A. strepera*, *A. superciliosa*,

A. versicolor, *Somateria fischeri*, *S. mollissima*, *S. spectabilis*, *Aythya collaris*, *A. affinis*, *A. ferina*, *A. fuligula*, *A. marila*, *A. nyroca*, *A. valisineria*, *Netta erythrophthalma*, *N. rufina*, *Cairina moschata* (dom.), *Sarkidiornis melanotos*, *Bucephala clangula*, *Clangula hyemalis*, *Histrionicus histrionicus*, *Melanitta fusca*, *M. nigra*, *M. perpicillata*, *Mergus albellus*, *M. merganser*, *M. serrator*, *Oxyura leucocephala*, *Aix sponsa*. FALCONIFORMES: *Accipter gentilis*. GALLIFORMES: *Francolinus pintadeanus*, *Gallus gallus* (dom.). GRUIFORMES: *Fulica atra*. CHARADRIIFORMES: *Erolia maritima*, *Haematopus ostralegus*, *Larus canus*. PICIFORMES: *Dendrocopos medius*.

Geographical distribution: Europe (Germany, France, England, Poland, Russia); North America (USA, Canada); Africa; Asia (India, China, Russia); Central America (Cuba); South America (Brazil).

Specimens deposited: CHIOC 33916, 33917.

Specimens studied: CHIOC 23366 from "goose"; CHIOC 10477, 10478 from *Cairina moschata*.

REMARKS

López-Neyra (1931, 1943) considered *F. fasciolaris* as a teratological form of *Diorchis* and *Hymenolepis* species, inducing to consider this parasite as a "monster"; he concluded that it was the result of super-hydration and maceration processes. López-Neyra's works unfortunately did not include histochemical nor life cycle studies, and he failed to produce a reasonable, convincing argument in support of his conclusion. After López-Neyra (1943), methods to study the life cycle were improved (Jarecka 1958) and clearly indicated previous misinterpretations.

Fuhrmann (1932), based on personal observations and on the detailed work of Wolffhügel (1900), accepted this species as valid, because his specimens were mature and ovigerous, without any sign of maceration, and because the genera *Diorchis* and *Fimbriaria* are not closely related, as stated by Fuhrmann (1932). Fuhrmann (1932) in a final comment said: "*Nous sommes d'accord que Fimbriaria est une monstruosité, mais bien des formes dans le nature sont dans le même cas et appartiennent tout de même à des genres et à des espèces valables*". In our work we fully agree with Fuhrmann, in opposition to López-Neyra, because in our specimens we were able to see all of the anatomical structures that are essential to distinguish *Fimbriaria* and *Diorchis*, and to add more data to the description, enlarging the diagnosis of this species.

The specimens now studied agree with the descriptions of Wolffhügel (1900), Lühe (1910),

Fuhrmann (1914, 1932), Webster (1943), Czaplinski (1956), Beverley-Burton (1964), McLaughlin and Burt (1979), and with the generic diagnosis of Schmidt (1986), differing in some measurements probably influenced by the state of the development of the specimens. Those authors described the specimens belonging to species of *Fimbriaria* without external and internal segmentation. Beverley-Burton (1964) reported that the strobila were not clearly segmented. In the present work, we have actually observed, even in the histological sections, a process that generates the loss of segmentation from the immature to the mature portion of the strobila, depending on the development of the helminth. Earlier authors did not clearly describe the neck-zone as referred by Wolffhügel (1900) around the pseudoscolex, and also present in our material. The six osmoregulatory canals agree with those described by Fuhrmann (1932).

We were not able to observe the exact number of testes per proglottid, due to the loss of segmentation in fully developed specimens. Three testes per cirrus pouch were often observed and, although Fuhrmann (1914) stated that the number of testes in relation to the cirrus pouch was three or multiple of it, he also stated that when the cirrus pouch was in the growing process, six, seven or eight testes per cirrus pouch could be observed. The uterus in the specimens here considered was reticulate, in agreement with all of the authors previously cited.

The number of longitudinal muscular bundles showed great variation in our specimens, (67-105); Wolffhügel (1900) reported a similar variation, (60-120). The 136 histological sections examined in the present study allowed us to conclude that the muscular bundles observed on longitudinal sections are of unequal length. Therefore according to the section depth, the number of the bundles observed transversally will be different, even in a single specimen, justifying the range of this character in the descriptions, and suggesting that this feature is not of systematic value, if a broad range is considered.

For the reasons above discussed, the key to the genera in the Fimbriariinae, as stated by Czaplinski and Vaucher (1994), has been modified as follows:

- 1a. Pseudoscolex well developed, leaflike in mature worms; six osmoregulatory canals, joined in three pairs *Fimbriaria* Fröhlich, 1802
- b. Pseudoscolex poorly or moderately developed 2
- 2a. Pseudoscolex moderately developed; six osmoregulatory canals joined in three pairs; accessory sac present *Fimbriasacculus* Alexander & McLaughlin, 1996
- b. Pseudoscolex poorly developed; eight to eleven osmoregulatory canals 3

- 3a. Eight osmoregulatory canals *Fimbriariella* Wolffhügel, 1936
- b. Nine or eleven osmoregulatory canals *Fimbriarioides* Fuhrmann, 1932

Another genus, *Profimbriaria*, was erected by Wolffhügel (1936), to contain *P. multicanalis* (Baczynska, 1914), but considering that the scolex and pseudoscolex as well as the uterus are unknown, although eight osmoregulatory canals are present, we placed *Profimbriaria* as *incertae sedis*.

The cestode *F. fasciolaris* is recorded in *A. bahamensis* with a prevalence of 55.6% and a mean intensity of infection of 60.8%, being, so far, one of the highest percentages registered. The difference in prevalence of this worm recovered either from male or female hosts was not significant in this work, although Drobney et al. (1983) recorded females and males of *Aix sponsa* with 22.5% and 1.3%, respectively. This may be related to the different nutritional requirements of both sexes in various species of ducks, at the moment of the breeding season, as stated by Drobney et al. (1983).

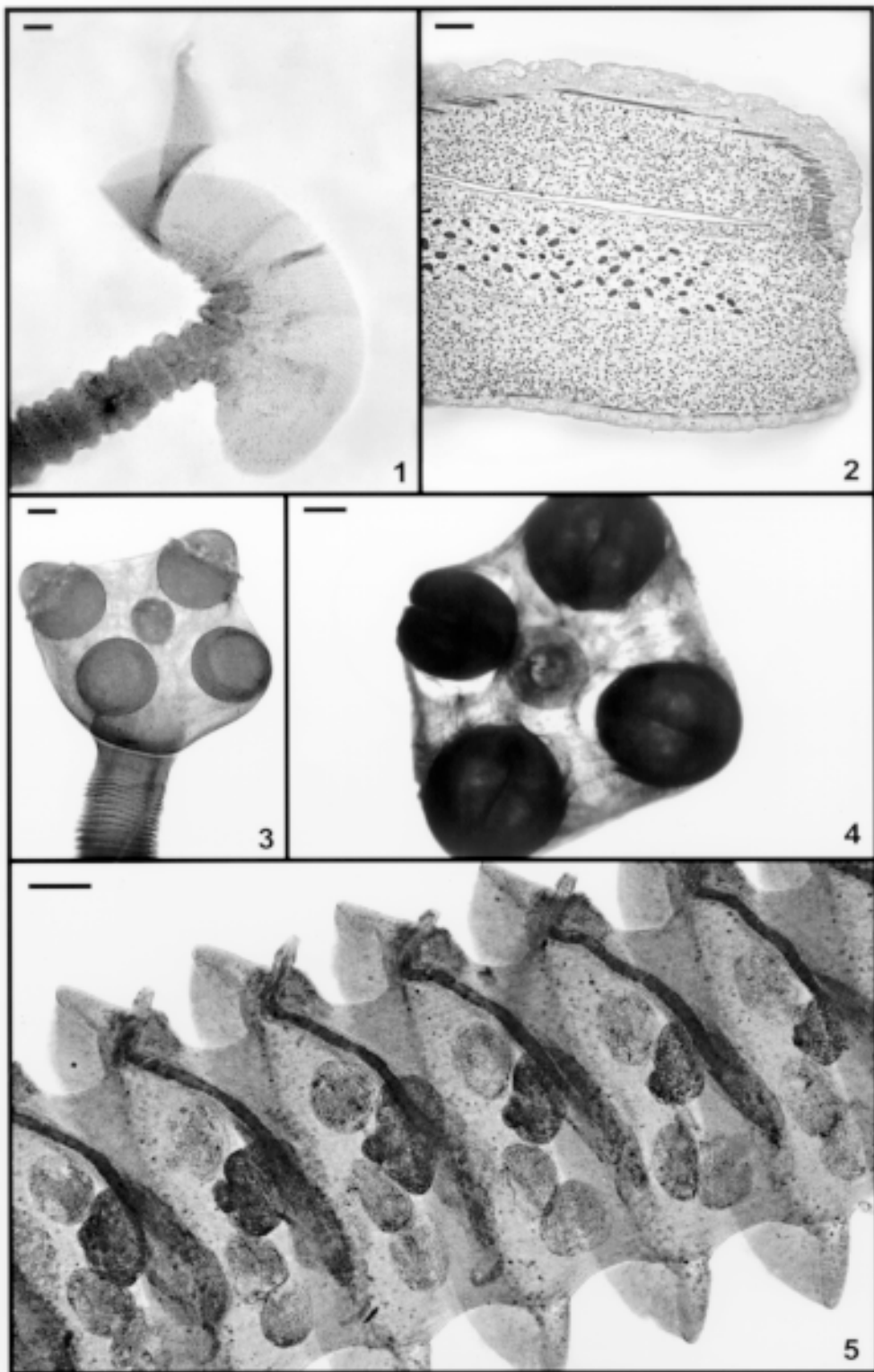
Eighty-seven per cent of the recovered specimens of *F. fasciolaris* were found parasitizing a single *A. bahamensis* host, showing an overdispersion distribution. Drobney et al. (1983), although reporting similar results (84% of the worms recovered in a single host) made no comments on their findings.

Alexander and McLaughlin's (1996) report of a single duck, *A. capensis*, parasitized by 1,412 cestode specimens of *Fimbriasacculus africanensis*, as well as our results with 535 parasites found in a single *A. bahamensis*, clearly demonstrate the crowding effect phenomenon. The significant differences in prevalence among various host species as reported by Alexander and McLaughlin (1996), were observed by us: *A. bahamensis* with 55.6% and 4.5% for *A. brasiliensis*.

This is the first report of *F. fasciolaris* parasitizing *A. bahamensis*. The present record of *F. fasciolaris* from *A. brasiliensis*, since Natterer, is being published for the first time. Three samples of this species collected from an undetermined goose (1) and from *Cairina moschata* (2) are also deposited in the Helminthological Collection of the Oswaldo Cruz Institute (CHIOC).

Cloacotaenia megalops
(Nitzsch in Creplin, 1829) Wolffhügel, 1938
(Figs 3-5)

Description of studied specimens (based on 18 specimens mounted *in toto*, 6 measured): Hymenolepididae, Hymenolepidinae: yellowish when alive. Strobila 22.7-48.7 mm (32.6) (n=5) long. Scolex massive *in vivo*, almost square when



Photomicrographs of cestode specimens. Fig. 1: *Fimbriaria fasciolaris* (Pallas, 1781) pseudoesoxel. Fig. 2: *Fimbriaria fasciolaris* (Pallas, 1781) longitudinal section. Fig. 3: *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) scolex. Fig. 4: *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) scolex *en face*. Fig. 5: *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) mature proglottid. Bars - Figs 1-3 = 0.3 mm; Figs 4-5 = 0.08 mm.

mounted *in toto*, 1.19-1.92 mm (1.59 mm) long, 1.34-2.38 mm (1.81 mm) wide; four muscular suckers, round, unarmed, directed forward, diameter 531-659 (604); rostellum rudimentary, unarmed; circular rostellar sac vestigial when mounted *en face*, elliptical *in toto*, 201-476 (390) long, 201-476 (384) wide; neck short, 275-787 (476) long, 512-915 (705) wide; proglottids wider than long, craspedote, velum long; immature proglottid 165-275 (223) long, 0.64-1.10 mm (0.86) wide; mature proglottid, 275-366 (320) long, 0.86-1.63 mm (1.13 mm) wide; gravid proglottids 366-549 (468) (n=5) long, 0.86-1.92 mm (1.29 mm) (n=5) wide; ventral osmoregulatory canals 27.5 (n=1) wide, 7.3 (n=1) wide; transversal osmoregulatory canals not observed.

Male reproductive system: three testes, spherical to ovoid, one poral, two antiporal, 102-175 (149) long, 117-183 (137) wide; external seminal vesicle present; cirrus pouch elongate, 0.59-1.02 mm (0.72) long; internal seminal vesicle saculiform; cirrus spined, each spine, 9.2-10.9 (9.5) long.

Female reproductive system: ovary median, transversely elongate, 95-146 (113) long, 175-241 (204) wide; vitelline gland compact, round, postovarian 44-110 (66), 51-117 (73) wide; vagina conspicuous, thin walled with spermatozoa in distal portion; seminal receptacle present; uterus sac-like, in anterior portion of the proglottids, filling all space when gravid; eggs 42-46 (44) (n=3) in diameter; onchosphere 18-33 (26) (n=3) long, 18-29 (19) (n=3) wide; genital atrium shallow; genital pores unilateral, dextral.

Taxonomic summary

Host: *Amazonetta brasiliensis* (Gmelin, 1758).

Site of infection: cloaca.

Locality: Lagoon of Maricá, Lagoon of Guarapina, mouth of the Mombuca river, Maricá District, State of Rio de Janeiro, Brazil.

Prevalence: 50%.

Intensity of infection: 1-15.

Mean intensity of infection: 5.09.

Other hosts: AVES - ANSERIFORMES: *Anser anser* (dom.), *A. caerulescens*, *A. brachyrhynchos*, *Aix sponsa*, *Anseranas semipalmata*, *Coscoroba coscoroba*, *Branta canadensis*, *Cygnus cugnus*, *C. olor*, *C. melanocoryphus*, *Lophonetta specularioides*, *Tadorna ferruginea*, *T. tadorna*, *Anas platyrhynchos*, *A. platyrhynchos* (dom.), *A. erythrorhynchos*, *A. castanea*, *A. acuta*, *A. americana*, *A. crecca*, *A. clypeata*, *A. cyanoptera*, *A. discors*, *A. georgica*, *A. penelope*, *A. platalea*, *A. rubripes*, *A. querquedula*, *A. sibilatrix*, *A. spinicauda*, *A. strepera*, *A. superciliosa*, *A. versicolor*, *A. bahamensis*, *Aythya africana*, *A.*

valisneria, *A. ferina*, *A. fuligula*, *A. marila*, *A. nyroca*, *Netta erythrophthalma*, *N. peposaca*, *N. rufina*, *Cairina moschata*, *Clangula hyemalis*, *Melanitta fusca*, *Dendrocygna autumnalis*, *Oxyura leucocephala*. GALLIFORMES: *Gallus gallus* (dom.). GRUIFORMES: *Fulica americana*.

Geographical distribution: wide geographic distribution.

Specimens deposited: CHIOC 33918, 33919.

Specimens analysed: CHIOC 30700a-b, 30706 from *A. bahamensis*.

REMARKS

Cloacotaenia megalops, a species of a monotypic genus, has a wide geographic distribution, parasitizes the cloaca and anus of Anseriformes, and of rarely Galliformes and Gruiformes. In relation to the taxonomic position of this species, we prefer to follow Schmidt (1986), and to consider *Cloacotaenia* as a valid genus. The specimens herein studied extend the range of the measurements known for this species of parasite. McLaughlin and Burt (1979) registered specimens of *C. megalops* with a cirrus pouch reaching 800 mm. However, now we are dealing with specimens having cirrus pouch measuring up to 1.02 mm in a strobila 48.7 mm long, these measurements being among the greatest so far recorded for this species. In this same specimen, the greatest width of the testes was 182 mm, while McLaughlin and Burt (1979) registered testes with a maximum width of 180 mm. Established differences regarding the length of the cirrus pouch and the width of the testes are related to the stage of development of the helminths, and do not justify the description of a new species.

Czaplinski (1956) and Beverley-Burton (1964) observed transversal osmoregulatory canals, the former giving no measurements, but only describing them as a thin structure, and the latter reporting a width of 2-3 mm. The present authors and McLaughlin and Burt (1979) were unable to observe those canals. Ransom (1902) revealed the existence of a plexus in the osmoregulatory system, which has never been observed by the workers who reported on *C. megalops*.

Woodall (1977) collected *C. megalops* in Zimbabwe, and recorded it for the first from the Ethiopian region. In Brazil, this species has been listed by Travassos (1965). Rego and Santos (1972) gave a brief account of the morphology of the specimens deposited in the CHIOC.

The high prevalence and low mean intensity of infection of *C. megalops* found in *A. brasiliensis* are the same as those recorded in the literature (Woodall 1977). *Cloacotaenia megalops* showed different prevalences between male (40%) and fe-

male (83.3%) specimens in the hosts studied. Drobney (1980) stated that, in the period of egg-synthesis, the nutritional requirements of females are high. Drobney and Fredrickson (1979) reported that females in that period spend twice the time as do males on feeding grounds. The higher proportion of invertebrates in the diet increases the female's chances to become infected.

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