

Morphological Variation in *Cephalogonimus americanus* (Trematoda: Cephalogonimidae) from Amphibians in Colorado

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A collection of western toads, *Bufo boreas* Baird and Girard, 1852, and neotenic tiger salamanders, *Ambystoma tigrinum* (Green) from Sheep Lake, Horseshoe Park, Rocky Mountain National Park, Colorado, were examined for helminths in the spring of 1966. *Oswaldocruzia subauricularis* (Rudolphi, 1819) was found in *Bufo boreas* and *Ophiotaenia filarioides* (LaRue, 1909) in *Ambystoma tigrinum*. In addition, both hosts harbored *Spironoura pretiosa* Ingles, 1936, *Phyllodistomum bufonis* Frandsen, 1957 and *Cephalogonimus americanus*. The last species differed greatly in appearance in the two hosts and these differences are reported herein.

METHODS

Amphibians were examined after their removal to the laboratory. A few parasites were crushed by coverslip pressure to better examine the cirrus sac and Mehlis' apparatus. The remainder were killed in hot water and stored in 70% ethanol. Specimens from alcohol were stained in Semichon's carmine, Meyer's acid carmine or combination stain (after Van Cleave), dehydrated, cleared in xylene and mounted in Piccolyte. Longitudinal and cross serial sections were prepared and stained in Meyer's acid carmine. Drawings were made by micro-projection and all measurements are in *microns* unless otherwise stated.

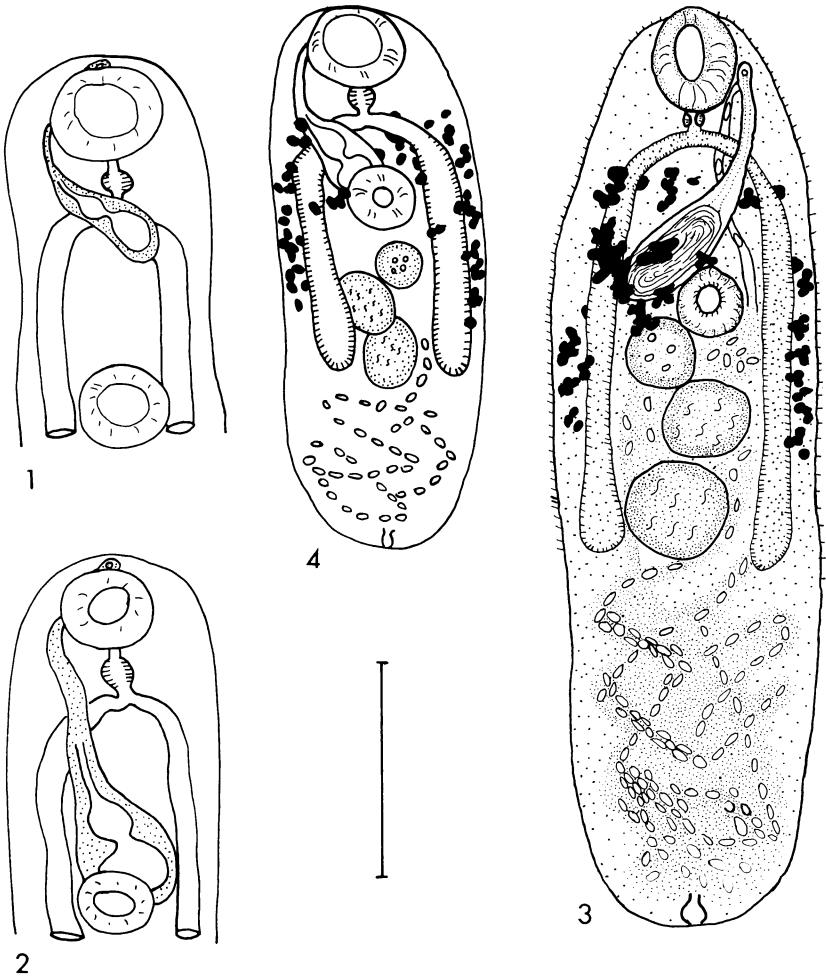
Cephalogonimus americanus

Figs. 1, 2, 3, 4.

Diagnosis: (Based on 30 specimens).

With the characters of the genus. Body small, elongate 1.09 to 2.37 mm long by 0.43 to 0.76 mm wide. Cuticle spinose. Oral sucker subterminal, 119 to 196 long by 91 to 250 wide; ventral sucker 119 to 174 long by 119 to 164 wide, sucker ratio 1.4 to 1 to 1.5 to 1, average 1.45 to 1. Prepharynx absent, pharynx 53 to 66 long by 65 to 98 wide, esophagus equal to length of pharynx, ceca terminating just posterior to posterior testis. Testes oblique to tandem, usually contiguous, irregularly ovoidal, posterior to acetabulum; anterior testis

196 to 240 long by 228 to 501 wide; posterior testis 218 to 501 long by 228 to 272 wide. Cirrus sac preacetabular, ovoid, 436 to 655 long by 82 to 109 wide, containing convoluted seminal vesicle and elongate ejaculatory duct opening into genital atrium lateral to oral sucker.



FIGS. 1-2. Anterior regions of *Cephalogonimus americanus* from *Ambystoma* showing extremes in the location of the cirrus sac.

FIG. 3. Camera lucida drawing of *Cephalogonimus americanus* from *Bufo boreas*.

FIG. 4. Camera lucida drawing of *C. americanus* from *Ambystoma tigrinum*. Scale=0.50 mm.

Ovary ovoid, amphitypic, bordering posterolateral margin of acetabulum, 152 to 218 long by 130 to 218 wide. Seminal receptacle small. Vitelline follicles, 54 to 73 long by 43 to 55 wide, extend along lateral margins from ends of ceca to anterior margin of seminal vesicle and extend as a band across body at level of acetabulum. Uterus with much folded ascending and descending limbs, folds limited to post-ovarian region. Eggs small, numerous 50 to 57 long by 30 to 35 wide. *New Hosts: Ambystoma tigrinum* (Green) and *Bufo b. boreas* Baird and Girard, 1852.

Site of Infection:—Small intestine.

Locality:—Sheep Lake, Horseshoe Park, Rocky Mountain National Park, Colorado.

Relationship of cirrus sac to acetabulum:

The cirrus sac ranged from a small structure some distance anterior to the acetabulum to a large structure extending slightly posterior to the level of the acetabulum (Figure 1, 2). No pattern was found in the relationship of the cirrus sac to the acetabulum in different hosts.

DISCUSSION

Poirier (1885) established the genus *Cephalogonimus* with *C. lenoiri* as type from the turtle, *Tethrathyra vaillantei*. Subsequently many additional species have been described from various amphibia and reptiles. In their reviews of the genus *Cephalogonimus*, Rai (1961) and Lamonthe (1964) recognized 20 and 21 species respectively. Premvatii (1969) described an additional species. Seven species of *Cephalogonimus* are known to occur in amphibians and all occur in North America.

Stafford (1902) described *C. americanus* from the intestine of *Rana clamitans* Latreille. It has been reported to occur in *R. virescens*, *R. pipiens*, *R. clamata*, *R. montezumae* and the salamander, *Rhyacossiredon altamirani*. Lamonthe (1964) redescribed the species and presented a key to all species in the genus.

Lang (1968, 1969) presented information on the life cycle of *C. americanus*. The snail *Helisoma trivolvis* (Say) served as first intermediate host while various tadpoles served as second intermediate hosts. Lang (1968) was successful in infecting tadpoles of *Bufo fowleri* whereas larvae of *Ambystoma maculatum* (Shaw) apparently were refractive to infection.

The occurrence of adult *Cephalogonimus* in *Bufo boreas* and

Ambystoma tigrinum in Colorado represent new host records. Furthermore, the specimens from each host differ considerably in size. The large range of measurements presented in the diagnosis may be due in part to host induced differences.

Experimental studies on *Echinostoma revolutum* Froelich, 1802 in various mammalian and avian hosts by Beaver (1937), on *Brachycoelium* from naturally infected salamanders by Rankin (1937), *Prosthogonimus ovatus* Rudolphi, 1803 in avian hosts by Boddeke (1960) and *Telorchis bonnerensis* Waitz, 1960 in amphibian and reptilian hosts by Watertor (1967) indicate morphological changes may occur when adult trematodes mature in different hosts.

TABLE 1

Specimens Measured (Cephalogonimus)	<i>Ambystoma tigrinum</i> (15 Specimens)	<i>Bufo boreas</i> (10 specimens)
Total length	1.09 to 1.37	1.92 to 2.37
Total width	0.43 to 0.68	0.62 to 0.76
Oral sucker length	0.12 to 0.16	0.17 to 0.19
Oral sucker width	0.09 to 0.12	0.14 to 0.25
Acetabulum length	0.12 to 0.15	0.15 to 0.17
Acetabulum width	0.12 to 0.15	0.15 to 0.16
Ovary length	0.15 to 0.18	0.19 to 0.22
Ovary width	0.13 to 0.17	0.18 to 0.22
Anterior testis length	0.20 to 0.24	0.20 to 0.24
Anterior testis width	0.22 to 0.30	0.37 to 0.50
Pharynx length	0.05 to 0.06	0.05 to 0.06
Pharynx width	0.06 to 0.08	0.08 to 0.10
Cirrus length	0.44 to 0.49	0.58 to 0.66
Cirrus width	0.08 to 0.10	0.10 to 0.11
Posterior margin of acetabulum to anterior end of body	0.45 to 0.54	0.78 to 0.86
Posterior margin of acetabulum to posterior end of body	0.64 to 0.83	1.26 to 1.35
Eggs, length	0.50 to 0.06	0.05 to 0.06
Eggs, width	0.03 to 0.04	0.03 to 0.04

Comparison of selected measurements of *C. americanus* from *Bufo* and *Ambystoma* hosts. All measurements in mm.

Since measurements of most characteristics of *C. americanus* from *Ambystoma* and from *Bufo* (Table 1) showed little overlap, and since *C. americanus* occurred in small populations (4-9) in both hosts, we suggest differences are related to host.

It is important to note the variation in the placement and size of the cirrus sac. *C. brevicinus* was erected by Ingles (1932) for speci-

mens collected from *Rana aurora draytoni* in California. Although quite similar to *C. americanus* it was reported to differ in having a caudal vesicle, in the distribution of the vitellaria, and testes distinctly larger than the ovary. Variation in the cirrus sac observed in our specimens and in the figure of Lamonthe (Figures 2, p. 117) indicated that the cirrus in *C. brevicinus* is within the range of variation exhibited by *C. americanus*. Furthermore, the other characteristics also appear to be of less value in separating these two species. The caudal vesicle in *C. americanus* is frequently not as evident as in *C. brevicinus* but certainly present. On the basis of variation we suggest that *C. brevicinus* Ingles (1932) is probably synonymous with *C. americanus* and that the observed variations are host induced.

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