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The Parasites of Necturus

Joseph P. Harris, Jr.

The first note on parasites of *Necturus* was published in 1858 by Kneeland, who saw white ectoparasites upon the gills. Wright & Macallum (1887) described one of these white polystome ectoparasites as *Sphyranura osleri.* Wright (1880) reported the presence of the ciliate *Trichodina* (= *Kerona*). The cestode *Crepidobothrium lonnbergii* was described by Fuhrmann in 1895; LaRue (1909) was the first to report it from *Necturus* (in which it is common). Howard 1915) observed that *Necturus* is the host for the glochidium of *Simpsoniconcha* (quondam *Hemilastena*) *ambigua*; this is apparently the only fresh-water mussel in America which parasitizes a non-fish host. Arey studied the method of glochidial attachment on the gills of the *Necturus,* and made observations upon the method of healing of small wounds.

In all, some fifteen species of animals parasitic upon Necturus have been reported. It is probable that none is exclusively a parasite of Necturus, for nearly all have also been reported from other animals.

LIST OF THE PARASITES OF NECTURUS

- Phylum Protozoa Goldfuss
  - Subphylum Plasmodroma Doflein
    - Class Mastigophora Diesing
      - Order Protomonadina Blochmann
        - Family Bodonidae Bütschli
          - *Proteromonas* Kunstler (= *Prowazekella* Alexeieff)
      - Order Polymastigina Blochmann
        - Family Trichomonadidae
          - *Trichomonas* Donné
  - Subphylum Ciliophora Doflein
    - Class Ciliata Perty
      - Order Peritricha Stein
        - Family Urceolariidae Stein
          - *Trichodina pediculus* (Müller) (= *Kerona pediculus*)
- Phylum Platyhelminthes Gegenbaur
  - Class Trematoda Rudolphi
    - Subclass Monogenea Carus
      - Order Polyopisthocotylea Odhner
        - Family Polystomidae van Beneden
          - *Sphyranura oligorchis* Alvey
          - *Sphyranura osleri* Wright & Macallum
          - *Sphyranura polyorchis* Alvey
        - Family Allocreadiidae Odhner
          - *Crepidostomum cooperi* Hopkins
          - *Crepidostomum farionis* (O. F. Mueller) Hopkins.
        - Family Telorchiidae
          - *Cercorchis necturi* Perkins
        - Family Heterophyidae Odhner
          - *Neochasmus umbellus* Van Cleave & Mueller
        - Family Microphallidae (Ward) Travassos
          - *Monocaecum baryurum* Stafford

Class Cestoidea Rudolphi
Order Pseudophyllidea Carus
Family Proteocephalidae LaRue
Crepidobothrium lonnbergii (Fuhrmann) Meggett
Phylum Nematoidea Rudolphi
Family Trichostrongylidae Leiper
Oswaldocruzia subauricularis (Rudolphi) Travassos
Phylum Mollusca Linnaeus
Class Pelecypoda Goldfuss
Family Unionidae
Simpsoniconcha ambigua (Say) (= *Hemilastena ambigna*)
Megalonaias gigantea (Barnes) (= *Quadrula heros*)

The ciliate *Trichodina pediculus* found on Necturus is identical with that found on *Hydra* (Fulton 1923; Wright 1880), *Triturus,* and some anuran tadpoles (Charipper 1929). It can be easily demonstrated in smears of the mucus present on the gills and in the gular and cloacal folds (Charipper 1929). In a strict sense, *Trichodina* is an epizoic, commensal, or ectocommensal, not a parasite.

The flagellates *Proteromonas* (= *Prowazekella*) and *Trichomonas* are found in the intestine. *Proteromonas* infestation is by ingestion of cysts, while that of *Trichomonas* is by ingestion of the active flagellates (Wenyon 1926).

The trematode worms, *Sphyranura oligorchis, S. osleri* and *S. polyorchis,* are ectoparasitic on the gills. These may be abundant; Pearse (1921) found 25 *Sphyranura* on one animal. Apparently their presence is sometimes annoying to the host; Kneeland (1858) and Wright & Macallum (1887) reported that Necturus under such circumstances passes its forefeet through the gills alternately from above downward and forward, as if to cleanse the gills.

The life cycle of *Sphyranura oligorchis* is simple. At room temperature (24° – 32°C.) the eggs hatch in about 32 days. At the time of hatching, the young trematode has the shape of the adult. Cilia are absent. There is no intermediate host. The larva swims or creeps to a Necturus, attaches itself to the gills and quickly transforms to an adult. The life cycle is completed in two months (Alvey 1933, 1936).

The trematodes *Crepidostomum cooperi, Crepidostomum farionis, Cercorchis necturi, Neochasmus umbellus,* and *Monocaecum baryurum* are found in the intestine. *Crepidostomum farionis* is the only one whose life cycle is known, and it is a parasite of fishes rather than of amphibia. In Britain it is known to have the following life cycle: larvae are found in the sphaerid pelecypods, *Pisidium amnicum* and *Sphaerium corneum.* Two generations of rediae develop, attached to the gills of the molluscs. In the daughter rediae cercariae develop having a long, tapered, unforked tail about half the length of the body (which is nearly 1 mm. long). These cercariae swim actively, seek out and enter the body of larval mayflies, *Ephemera danica*, and there develop into metacercariae. Neither cysts nor metacercariae interfere with the development of the mayfly, as both are found in the adult. Mayflies in turn are ingested by trout and grayling, and the young flukes are found in the pyloric caeca of the fishes (Dawes 1946).

The common cestode *Crepidobothrium lonnbergii* may not require an intermediate host (Rankin 1937). Studies by several investigators suggest, however, that the eggs of proteocephalid cestodes generally have to be eaten by a copepod crustacean (where the onchosphere invades the hemocoele and forms a procercoid). For proteocephalans generally, a second intermediate host is not needed. The final host is infected by swallowing infected crustacea; the procercoids invade many organs, as the liver, gut, and muscles, and develop into typical plerocercoids. The plerocercoids probably wander about in the host, and finally end up in the intestine. It is difficult otherwise to account for the arrival of the plerocercoids in the gut where they become adults (Wardle & McLeod 1952). Of course, cannibalism may be a means of spreading the cestodes (LaRue 1914) ; in this case, the plerocercoid will normally arrive in the gut, and wandering no longer has to be supposed to occur. Adult *Crepidobothrium* in Necturus may reach a length of 83 cm.; sometimes proglottids protrude from the cloaca of the host (Canavan 1928).

Stunkard (1932) attempted to grow *Crepidobothrium lonnbergii* from Necturus *in vitro*. He kept young specimens alive for 32 days, during which time they grew from 3 to 4 times their original length. His culture medium included some tissues from Necturus; fresh serum from Necturus was definitely toxic to the worms.

The parasites of Necturus afford some slight evidence that as the host is modified phylogenetically, so also are the parasites (Fulton 1923; Wright & Macallum 1887).

The glochidium of *Simpsoniconcha ambigua* (Say) is a common parasite on the filaments of the gills of Necturus; 12 of 15 Necturus caught by Howard (1915) were thus parasitized. The period of parasitism is lengthy; glochidia attach to the gills in October (Howard 1915, 1951, Arey

1932a), and are shed in May (Howard 1915, 1951). The actual attachment of the hooked glochidium is accomplished in a second or less (Arey 1932c). Simple tactile stimulation of the glochidium is sufficient to cause closure of the glochidial valves. The "bite" of the glochidium closes on epithelial (and usually some sub-epithelial) tissue of the gill filament: (Arey 1932c). After attachment, the glochidium is rapidly covered by a migration of epithelial cells of the host. Cyst formation may be completed in as little time as four hours, depending on the temperature (Arey 1932c). Mitotic cell proliferation takes place some hours later, to replace those cells of the gill filament which have migrated to form the cyst. The glochidium digests the cells bitten from the host; later its own larval adductor muscle and larval mantle may be used as food. It is also possible that some host-tissue transudate is used to nourish the developing glochidium (Arey 1932a).

Adult *Simpsoniconcha ambigua* are most commonly found under stones. Call (1900) found more than 200 of these clams under a flat rock of about one square-foot area. Similar habitat-preferences in both the mussel and Necturus account for their host-parasite relationships (Howard 1915).

The glochidia of *Megalonaias gigantea* Barnes are sometimes found as "accidental" parasites on Necturus (Howard 1915). Various fishes, including the gizzard shad and white crappie, are the normal hosts (Baker 1928). Usually encystment of the *Megalonaias* glochidium is not completed on Necturus, as the cyst walls grow thin and the glochidium may be either destroyed by cytolysis, or prematurely shed. Disintegrating glochidia may be adjacent to unaffected glochidia of *Simpsoniconcha,* showing that Necturus is specifically immune to *Megalonaias gigantea* (Arey 1932b.)

Lefevre & Curtis (1912) tried unsuccessfully to culture glochidia artifically; among other ingredients in their media they used Necturus blood.

Rankin (1937) studied the parasites of North Carolina salamanders (Necturus *not* included). He found that little damage was done to the hosts by the parasites; that there was a considerable degree of host specificity; that multiple infestation was common; that there was a tendency of certain parasites either to inhibit the presence, or limit the abundance, of other parasites. Rankin found, furthermore, that there was an increase of infestation with increase in age and size of host; and that the total infestation with parasites was greater in aquatic, and less in terrestrial salamanders. The data at hand seem to indicate that Rankin's findings on other salamanders may also be found in Necturus parasitization.

Holl (1932) found some evidence of periodicity of parasites in *Triturus viridescens,* and Pearse (1921) some slight evidence for periodicity of parasites of Necturus. The occurence of glochidial parasites, of course, shows a definite periodicity.

Cleveland (1925) oxygenated 10 young Necturus at 3.5 atmospheres pressure with a view to deparasitizing them. *Trichomonas* and *Proteromonas* in some hosts were killed in 9 to 10 hours, while in others not until 11 to 12 hours. Cleveland suggests it might take longer to defaunate adult Necturus. The hosts were not killed by 50 to 60 hours of exposure.

Hassler (1932) and Kline & Fuller (1932) proved that a number of salamanders (which are occasionally found in springs) are a source of colon bacillus contamination of such spring water. Laboratory tests on such waters would suggest condemnation, even though the supply was otherwise unpolluted. To date, Necturus has not been implicated by such studies.

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Note

ASCLEPIAS ASPERULA (Decaisne) Woodson var. **decumbens** (Nuttall) Shinners, comb. nov.——*Anantherix decumbens* Nuttall, Trans. Amer. Philos. Soc. [n.s.] 5:202-203. 1837. *Asclepias capricornu* Woodson, Ann. Mo. Bot. Garden 32:370. 1945. *A. asperula* ssp. *capricornu* (Woodson) Woodson, l.c. 41:195. 1954. This was long familiar under the name *Asclepiodora decumbens* (Nuttall) Gray; for this reason I do not join in Woodson's effort "to salvage the name *capricornu*," of recent date. That publication of the new varietal combination will not be viewed as 'the best nomenclatural procedure" of which the monographer speaks, is certain. This is not the place, however, to detail my objections to his use of subspecies in the zoological sense.——*Lloyd H. Shinners.*