3.2.12 Lernaeid Parasitism

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A. Name of Disease and Etiological Agent

Anchor parasite infection is caused by parasites of the genus *Lernaea*. Harding (1950) recognized 28 species worldwide. Lernaeid parasitism is most often associated with *Lernaea cyprinacea*. It is assumed here that *Lernaea cyprinacea* has two synonyms, *Lernaea elegans* (Leigh-Sharp 1925) and *Lernaea carassii* (Tidd 1933). Most work citing epizootics of *Lernaea* continue to be associated with the taxon *Lernaea cyprinacea*.

B. Known Geographical Range and Host Species of the Disease

1. **Geographical Range**
   Most lernaeid epizootics are associated with *Lernaea cyprinacea*. The parasite range is warmer temperate fresh waters of all continents and most islands where cyprinids have been introduced.

2. **Host Species**
   In North America, one would expect to find its distribution associated with that of the goldfish *Carassius auratus* and the common carp *Cyprinus carpio* and as a result of baitfish marketing, wherever golden shiners *Notemigonus crysoleucas* and fathead minnows (*Pimemphales promelas*) are used. It also infects a number of noncyprinid species but does not usually result in death of the fish. Among other North American species, *Lernaea cruciata* is occasionally seen as a problem with centrarchids.

C. Epizootiology

The infection cycle consists of the following: eggs that undergo final development within and hatch from dual egg sacs affixed posteriorly and exteriorly on bodies of parasitic adult females; larvae which develop by passing through a series of stages until terminal-stage larvae of females become parasitic and penetrate their host's skin; and adult females that after undergoing a metamorphosis into mature, anchor-shaped adults will complete the cycle by producing the egg-containing sacs close to their posterior ends that protrude from the host into the water medium. Optimum temperature for the infection cycle is 23 to 40^{o}C and dormancy occurs below 15^{o}C. Typical cycling occurs every 20 to 25 days at 20 to 30^{o}C.

Transmission between systems can occur as larval stages are passed with water but most dispersal is by infected fishes. Tadpoles are also parasitized and they and their semi-terrestrial forms are known to act in dispersal. *Lernaea cyprinacea* has a strong affinity for cyprinids and will accumulate in culture systems on these hosts to a degree that infections of companion groups such as ictalurids or centrarchids also obtain epizootic numbers. *Lernaea* spp. are not found in waters with salinity greater then 1.8 parts per thousand (Hoffman 1976).

D. Disease Signs

1. **Behavioral Signs**
   Behavioral changes are similar to infections of other external parasites (flashing, listlessness, and eventual morbidity).

2. **External Gross Signs**
   If there is opportunity to observe fishes closely or in hand, the parasites are readily apparent. They appear as bristle-like projections usually up to 6.5 mm long attached to the body surface. Usual attachment sites are fin bases and the oral cavity, but any exterior surface may be parasitized. Irritation by the parasites and local microbial infection at attachment sites will usually show some degree of inflammation and ulceration. The presence of several parasites does not equate to morbidity unless they provide opportunity for a secondary infection by microbes or unless fishes are particularly small.

3. **Internal Gross Signs**
   Internal signs are not evident unless the anchors penetrate the visceral cavity on small fish. Any organ penetrated will receive obvious physical damage.

4. **Histopathology**
   A fibrinous nodule eventually forms around the head of the parasite.

E. Disease Diagnostic Procedures

1. **Presumptive Diagnosis**
   Occurrence of a high parasite intensity or an apparent correlation between a population portion hosting large parasite numbers per fish and a diseased state is evidence for a presumptive diagnosis.

2. **Confirmatory Diagnosis**
   The entire animal should be examined, including the oral cavity. Verification of parasite identity may be conducted by examination of carefully dissected parasites (Figure 1). The characteristic anchor-shape is helpful in distinguishing lernaeids from other copepods, among them the copepod genus *Achtheres* whose members commonly occur in oral cavities. *Lernaea* spp. adults are usually less than 1.5 cm in length. The arm-like extensions of the anterior end (embedded) and the pencil-shaped posterior portion are relatively stiff but may be inadvertently torn apart during dissection. Twin egg sacs are usually seen at their connection near the posterior end. Infective stages, which are similar in appearence to free-living copepods, are sometimes observed by preparing wet-mounts of skin scrapings or gill filament clippings.

Morphology of dorsal and ventral arms of the cephalic region are primary characters used in distinguishing species (see Harding 1950 for key) but have the disadvantage of being somewhat variable. It is common to see specimens of *Lernaea cyprinacea* with dorsal arms that are less branched. *Lernaea cruciata*, a species sometimes associated with centrarchids, has dorsal and ventral arms of about equal size.

Specimens can be preserved in 5 to 10% formalin and then, if desired, mounted by placing directly into Hoyer medium.

F. Procedures for Detecting Subclinical Infections

A search for parasites in the manner described above.

G. Procedures for Determining Prior Exposure to the Etiological Agent

None available.

H. Procedures for Transportation and Storage of Samples to Ensure Maximum Viability and Survival of the Etiological Agent

When there is a need to keep the parasites alive for experimental work, infected fish carriers should be kept alive after capture. Shields (1968) describes methodology for maintaining a continuous culture of these parasites.

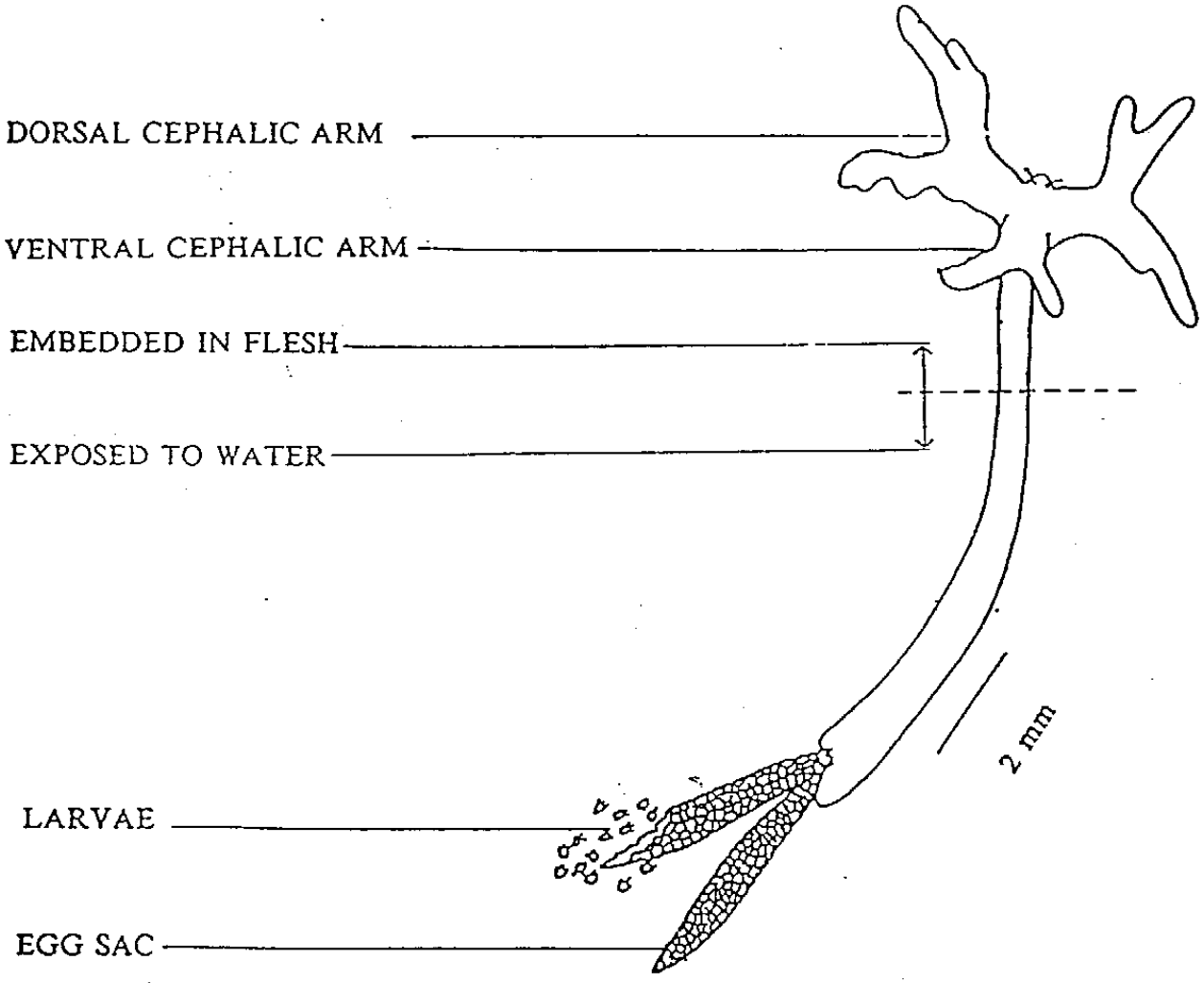

Figure 1. Diagnostic features of *Lernaea cyprinacea*, a species commonly associated with a wide variety of hosts.

References

Amin, O. M. 1981. On the crustacean ectoparasites of fishes from Southeast Wisconsin. Transactions of the American Microscopical Society 100:142-150.

Bauer, O. N., V. A. Musselius, and Y. A. Strelkov. 1973. Diseases of Pond Fishes. Jerusalem: Israel Program for Scientific Translations, Ltd. 220 pp.

Demaree, R. S. 1967. Ecology and external morphology of *Lernaea cyprinacea*. American Midland Naturalist 85:416-427.

Eisen, S. 1983. An alternative model based on random distributions for density-dependent regulation in host-parasite systems. American Midland Naturalist 94:230-239.

Harding, J. P. 1950. On some species of *Lernaea*. Bulletin of the British Museum (Natural History) Zoology 1:1-27.

Hoffman, G. L. 1976. Parasites of Freshwater Fishes. IV. Miscellaneous. The Anchor Parasite (*Lernaea elegans*) and Related Species. Fish Disease Leaflet 46. U. S. Fish and Wildlife Service. Washington, D.C. 8 pp.

Noga, E. J. 1986. The importance of *Lernaea cruciata* (Le Sueur) in the initiation of skin lesions in largemouth bass, *Micropterus salmoides* (Lacepede), in the Chowan River, North Carolina, USA. Journal of Fish Disease 9:295-302.

Shields, R. J., 1968. Experimental infestation of *Fundulus heteroclitus* (L.) (Pisces) by *Lernaea cyprinacea* L. (Copepoda). Crustaceana 15:111-112.

Wilson, C. B. 1918. Economic relations, anatomy, and life history of the Genus *Lernaea*. Bulletin of the U. S. Bureau of Fisheries Washington 35:163-198.