

## Observations on the lack of specificity of *Spinitectus carolini* and *Spinitectus gracilis* (Spirurida: Nematoda) for their intermediate hosts

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Species representing 27 different genera of invertebrate animals were utilized in determining the intermediate host specificity of *Spinitectus carolini* and *Spinitectus gracilis*. A broad co-accommodation was demonstrated, as members of several different orders of insects were experimentally infected and observed to be naturally infected with both *S. carolini* and *S. gracilis*. This study also expands the intermediate host records for both *S. carolini* and *S. gracilis*.

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Des espèces appartenant à 27 genres différents d'invertébrés ont été utilisées pour déterminer la spécificité de l'hôte intermédiaire de *Spinitectus carolini* et de *Spinitectus gracilis*. Il semble y avoir une grande co-accommodation, puisque des insectes appartenant à plusieurs ordres peuvent être infectés expérimentalement ou naturellement par *S. carolini* et *S. gracilis*. De nouveaux hôtes intermédiaires ont été trouvés pour les deux espèces au cours de cette étude.

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In general, helminths that have an indirect life history exhibit a greater specificity for their intermediate hosts than for their definitive hosts (Baer 1952; Noble and Noble 1971). The present study therefore was undertaken to determine the degree of intermediate host specificity exhibited by two of the most common nematode parasites of fish in eastern and central North America (Hoffman 1970), *Spinitectus carolini* Holl, 1928, and *Spinitectus gracilis* Ward and Magath, 1916.

Various (27 species of invertebrate animals) potential invertebrate organisms (Table 1) were utilized in determining the intermediate host specificity of *S. carolini* and *S. gracilis*. With the exceptions of the collembolans ( $n = 5$ ), all other observations were based on a minimum of 50 and a maximum of 2500 individuals. All potential intermediate hosts were placed in fingerbowls containing distilled water and thousands of fully larvated eggs for a 24-h period, after which they were removed and placed in fingerbowls containing only distilled water. Animals exposed to infective larvae were maintained for a period of 3–4 weeks, a time span that allowed for development to the infective 3rd stage larvae.

Natural and experimental infections of both *S. carolini* and *S. gracilis* occurred in mayfly naiads, dragonfly nymphs, and stonefly larvae (Table 1). In addition to these three closely related groups (Ephemeroptera,

Odonata, and Plecoptera), we observed natural infections of *S. carolini* in chironomid larvae (Table 1) and experimentally infected three of five collembolans with *S. gracilis* (Table 1).

From these results it appears that *S. carolini* and *S. gracilis* exhibit a less pronounced specificity for their intermediate hosts than previously thought. Prior studies by Keppner (1975) and Gustafson (1939) indicated mayfly naiads to be the only intermediate hosts of *S. gracilis*. This study, however, has shown that aquatic insect larvae of several different orders are capable of serving as suitable intermediate hosts of *S. carolini* and *S. gracilis*. Ecological barriers may preclude the natural infections of several aquatic invertebrates, which were experimentally infected in our laboratory.

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TABLE 1. Experimental and natural infections of *Spinitectus carolini* and *Spinitectus gracilis* in aquatic invertebrates. (L) indicates larval forms.

| Aquatic invertebrate               | <i>Spinitectus carolini</i><br>(natural) | <i>Spinitectus carolini</i><br>(experimental) | <i>Spinitectus gracilis</i><br>(natural) | <i>Spinitectus gracilis</i><br>(experimental) |
|------------------------------------|------------------------------------------|-----------------------------------------------|------------------------------------------|-----------------------------------------------|
| <b>Ephemeroptera</b>               |                                          |                                               |                                          |                                               |
| <i>Hexagenia limbata</i> (L)       | +                                        | +                                             | +                                        | +                                             |
| <i>Caenis simulans</i> (L)         | —                                        | +                                             | +                                        | +                                             |
| <i>Stenonema frontale</i> (L)      | —                                        | +                                             | —                                        | +                                             |
| <i>Heptagenia marginalis</i> (L)   | +                                        | +                                             | +                                        | +                                             |
| <i>Baetis carolina</i> (L)         | —                                        | +                                             | —                                        | +                                             |
| <i>Ephemerella doris</i> (L)       | +                                        | +                                             | —                                        | +                                             |
| <b>Odonata</b>                     |                                          |                                               |                                          |                                               |
| <i>Gomphus quadricolor</i> (L)     | —                                        | +                                             | —                                        | +                                             |
| <i>Pachydiplax longipennis</i> (L) | —                                        | +                                             | —                                        | +                                             |
| <i>Ischnura verticalis</i> (L)     | —                                        | +                                             | —                                        | +                                             |
| <b>Plecoptera</b>                  |                                          |                                               |                                          |                                               |
| <i>Neoperla clymene</i> (L)        | +                                        | —                                             | +                                        | —                                             |
| <i>Acroneuria brevicauda</i> (L)   | —                                        | +                                             | —                                        | +                                             |
| <b>Hemiptera</b>                   |                                          |                                               |                                          |                                               |
| <i>Belostoma fluminea</i>          | —                                        | —                                             | —                                        | —                                             |
| <i>Notonecta undulata</i>          | —                                        | —                                             | —                                        | —                                             |
| <b>Trichoptera</b>                 |                                          |                                               |                                          |                                               |
| <i>Limnephilus rhombicus</i> (L)   | —                                        | —                                             | —                                        | —                                             |
| <b>Diptera</b>                     |                                          |                                               |                                          |                                               |
| <i>Chironomus tentans</i> (L)      | +                                        | —                                             | —                                        | —                                             |
| <b>Collembola</b>                  |                                          |                                               |                                          |                                               |
| <i>Podura aquatica</i> (L)         | —                                        | —                                             | —                                        | +                                             |
| <b>Hydracarina</b>                 |                                          |                                               |                                          |                                               |
| <i>Arrhenurus marshalli</i>        | —                                        | —                                             | —                                        | —                                             |
| <b>Ostracoda</b>                   |                                          |                                               |                                          |                                               |
|                                    | —                                        | —                                             | —                                        | —                                             |
| <b>Copepoda</b>                    |                                          |                                               |                                          |                                               |
| <i>Diaptomus stagnalis</i>         | —                                        | —                                             | —                                        | —                                             |
| <i>Cyclops bicuspidatus</i>        | —                                        | —                                             | —                                        | —                                             |
| <b>Cladocera</b>                   |                                          |                                               |                                          |                                               |
| <i>Bosmina longirostris</i>        | —                                        | —                                             | —                                        | —                                             |
| <i>Daphnia longispina</i>          | —                                        | —                                             | —                                        | —                                             |
| <b>Isopoda</b>                     |                                          |                                               |                                          |                                               |
| <i>Asellus intermedius</i>         | —                                        | —                                             | —                                        | —                                             |
| <b>Amphipoda</b>                   |                                          |                                               |                                          |                                               |
| <i>Gammarus pseudolimnaeus</i>     | —                                        | —                                             | —                                        | —                                             |
| <b>Oligochaeta</b>                 |                                          |                                               |                                          |                                               |
| <i>Chaetogaster pellucides</i>     | —                                        | —                                             | —                                        | —                                             |
| <i>Branchiura sowerbyi</i>         | —                                        | —                                             | —                                        | —                                             |
| <b>Rotifera</b>                    |                                          |                                               |                                          |                                               |
| <i>Keratella quadrata</i>          | —                                        | —                                             | —                                        | —                                             |