A New Species of *Echinocephalus* (Nematoda: Gnathostomidae) from Neotropical Stingrays with Comments on *E. diazi*

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A NEW SPECIES OF ECHINOCEFALUS (NEMATODA: GNATHOSTOMIDAE) FROM NEOTROPICAL STINGRAYS WITH COMMENTS ON E. DIAZI

Thomas L. Deardorff,* Daniel R. Brooks,† and Thomas B. Thorson‡

ABSTRACT: Echinocephalus daileyi sp. n. is described from the freshwater stingrays Potamotrygon circularis and P. hystrix in South America. It is most similar to E. diazi by virtue of possessing a gubernaculum and six postanal papillae, but may be distinguished from E. diazi and other members of the genus by possessing 30 to 34 rows of spines on the cephalic bulb, three preanal papillae, and a body 53 to 85 mm long. Specimens of E. diazi were collected from Himantura schmardae, the type host, from Cienaga Grande, Colombia, a new locality record. Based on numerical phylogenetic analysis, E. daileyi is a member of a monophyletic group including E. sinensis, E. diazi, and E. pseudouncinatus.

Examination of marine and freshwater stingrays in northern South America during 1975 to 1978 revealed the presence of two species of Echinocephalus Molín, 1858. One of those species is described herein as new, and a new locality record is reported for the other.

Specimens were removed from hosts, fixed in 10% formalin or in glacial acetic acid, stored in a solution of five parts glycerin and 95 parts 70% ethanol, then examined in glycerin after evaporation of the alcohol. All measurements are in micrometers unless otherwise stated, and figures were drawn with the aid of a drawing tube.

**Echinocephalus daileyi** sp. n.
(Figs. 1–12)

**Description**

Based on specimens from Potamotrygon circularis. Body unarmed, reaching greatest width posterior to midbody. Pseudolabia oriented dorsoventrally, equal in size, wider than long, two in number, each with two lateral double papillae and one medial amphid on surface and with two cuticularized toothlike structures; internal pulp pedunculate, trilobed. Dentigerous ridges and interlabia lacking. Cuticle with inconspicuous annulations. Dereidis 0.9 to 1.1 mm from anterior extremity. Cephalic bulb armed with spines in transverse rows; rows slightly more compact near anterior and posterior ends of bulb, with maximal separation near midbulb; some rows not continuous; spines uncinate, larger near midbulb, not overlapping adjacent rows; bulb containing four ballonets. Cuticular collar present. Cervical sacks extending from ballonets just anterior of muscular-glandular junction of esophagus, reaching greatest width near posterior extremity, four in number. Esophagus 6 to 11% total body length, divided near midpoint into anterior muscular and posterior glandular regions. Nerve ring located at anterior 12 to 23% of esophagus. Tail conical, with blunt tip; tip without ornamentation.

**Male** (based on five whole specimens and five tail fragments): Body 55 to 66 mm long by 0.6 to 0.9 mm wide at greatest width; ratio of greatest width to length 1:67 to 83. Pseudolabia 154 to 184 long by 278 to 309 wide. Cephalic bulb 438 to 525 long by 605 to 646 wide, with 30 to 32 rows of cephalic spines; spines 4 to 9 long. Nerve ring 0.8 to 1.0 mm from anterior extremity, 24 to 43 in breadth. Cervical sacs 1.5 to 2.2 mm long by 78 to 173 wide at greatest width. Esophagus 6 to 11% total body length, 3.6 to 6.2 mm long; muscular esophagus 1.6 to 3.4 mm long by 283 to 362 wide; glandular esophagus 2.0 to 3.2 mm long by 378 to 535 wide; ratio of glandular esophageal to muscular esophageal lengths 1:0.7 to 1.4. Spicules similar, equal in length, 2.7 to 3.6% total body length, 1.4 to 2.4 mm long by 31 to 37 wide. Gubernaculum V-shaped, 96 to 185 long. Caudal alae united ventrally, surrounding cloaca, 0.5 to 1.2 mm long, supporting nine pairs of caudal papillae; preanal pairs three, of unequal length, with midpair largest and most lateral; postanal pairs six, of unequal length, with first pair from extremity extremely small, with third pair most lateral and largest, with sixth pair immediately posterior to anus. Medioventral preanal organ distinct, papillated. Modified annules on ventral surface near caudal alae, extending anteriorly 2.2 to 3.7 mm or 4 to 6% total body length. Phasminds paired near end of tail. Tail 339 to 568 long.

**Female** (based on eight mature specimens): Body 55 to 85 mm long by 0.9 to 1.4 mm wide at greatest width; ratio of greatest width to length 1:46 to 71.

Pseudolabia 154 to 236 long by 296 to 378 wide. Cephalic bulb 475 to 677 long by 587 to 803 wide, with 30 to 34 rows of spines; spines 4 to 12 long. Nerve ring 0.7 to 1.2 mm from anterior extremity, 37 to 78 in breadth. Cervical sacs 1.9 to 2.8 mm long by 60 to 267 at greatest width. Esophagus 7 to 11% total body length, 5.4 to 6.6 mm long; muscular esophagus 2.8 to 3.6 mm long by 166 to 394 wide; glandular esophagus 2.3 to 3.4 mm long by 315 to 551 wide; ratio of glandular esophageal to muscular esophageal lengths 1.0.8 to 1.5. Vulva opening 1.5 to 2.4 mm or 2 to 4% total body length from poste-
rior extremity. Uterus didelphic, prodelphic. Eggs with smooth thin shell, oval, 14 to 43 long by 18 to 50 wide. Tail 724 to 961 long.

**Type specimens**

*Holotype:* Male, USNM Helm. Coll. No. 76094.

*Allotype:* Female, USNM Helm. Coll. No. 76095.

*Paratypes:* USNM No. 76096, University of Nebraska State Museum, H. W. Manter Laboratory No. 21172 (pair).

**Hosts:** Type host—*Potamotrygon circularis* (Garman); Other host—*Potamotrygon hystrich* (Muller and Troschel).

**Localities:** COLOMBIA: nr. Leticia (type locality). BRAZIL: Rio Itacuai. VENEZUELA: Delta of Rio Orinoco, nr. Curiape.

**Site of infection:** Intestine, immediately anterior to spiral valve.

**Etymology:** This species is named for Dr. Murray D. Dailey, California State University, Long Beach, in recognition of his contributions to our knowledge of elasmobranch helminths.

**Remarks**

By possessing a gubernaculum, *Echinocephalus daileyi* most closely resembles *E. sinensis* Ko, 1975, *E. diazi* Troncy, 1969, and *E. pseudouncinatus* Millemann, 1951. Both Millemann (1963) and Ko (1975) reported that *E. pseudouncinatus* lacked a gubernaculum, but our examination of a male deposited in the National Museum by Millemann from *Myliobatis californicus* in the Gulf of California, Mexico (USNM Helm. Coll. No. 57450), clearly showed a gubernaculum to be present. The new species differs from *E. sinensis* by exhibiting six rather than five postanal papillae and three rather than two preanal papillae, and by possessing 30 to 34 rather than 26 to 29 rows of cephalic bulb spines. *Echinocephalus daileyi* differs from *E. diazi* and *E. pseudouncinatus* by having more rows of cephalic bulb spines; *E. diazi* has 25 to 27 rows and *E. pseudouncinatus* has 16 to 21. By exhibiting three rather than six postanal papillae, *E. pseudouncinatus* is unique among members of the genus. Lastly, *E. daileyi* differs from *E. diazi* by having three rather than two preanal papillae. *Echinocephalus daileyi* represents the first member of the genus known from freshwater stingrays (*Potamotrygonidae*).

**Echinocephalus diazi** Troncy, 1969

Troncy (1969) described *E. diazi* from Lake Maracaibo, Venezuela, and listed *Potamotry-

![Figure 13. Cladogram depicting genealogical relationships of eight species of *Echinocephalus*. Slash marks indicate derived states for characters indicated by accompanying number. Single slash refers to character state with a positive notation, x-slash marks refer to character states with a negative notation. For identities of characters, see text.](image)

**DISCUSSION**

Specificity in site of infection was pronounced in each of the two species collected.
### TABLE I. Nominal species of Echinocephalus.

<table>
<thead>
<tr>
<th>Species</th>
<th>Type host</th>
<th>Type locality</th>
<th>No. of cephalic spines</th>
<th>Body length in mm</th>
<th>Spicules</th>
<th>Gubernaculum</th>
<th>Vulva in mm*</th>
<th>Important reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. daileyi</em> sp. n.</td>
<td>Potamotrygon circularis</td>
<td>Rio Itacuac, Colombia</td>
<td>30-34</td>
<td>55-85</td>
<td>1.4-2.4</td>
<td>Present</td>
<td>1.5-2.4</td>
<td>This paper</td>
</tr>
<tr>
<td><em>E. daisy</em> Troncy, 1969</td>
<td>Himantura schmardae</td>
<td>Lake Maracaibo, Venezuela</td>
<td>25-27</td>
<td>30-45</td>
<td>2.0</td>
<td>Present</td>
<td>0.34</td>
<td>Troncy (1969); Diaz-Ungria (1973); this paper</td>
</tr>
<tr>
<td><em>E. mobulae</em> Kalyankar, 1971</td>
<td>Mobula diabolus</td>
<td>India</td>
<td>35-45</td>
<td>17.4</td>
<td>0.47</td>
<td>Absent</td>
<td>No female</td>
<td>Kalyankar (1971)</td>
</tr>
<tr>
<td><em>E. multidentatus</em> Baylis and Lane, 1980</td>
<td>Urogyrrnus asperrimus</td>
<td>Ceylon</td>
<td>11-13</td>
<td>14.7-16.5</td>
<td>1.4-1.49</td>
<td>Absent</td>
<td>0.60-0.65</td>
<td>Baylis and Lane (1920)</td>
</tr>
<tr>
<td><em>E. pseudouncinatus</em> Millemann, 1980</td>
<td>† ††</td>
<td>Gulf of California, Mexico</td>
<td>16-21</td>
<td>28-64</td>
<td>1.3-2.1</td>
<td>Present</td>
<td>2.5-3.5</td>
<td>Millemann (1963, 1951); Ko (1975); this paper</td>
</tr>
<tr>
<td><em>E. sinensis</em> Ko, 1975</td>
<td>Aetobatus flagellum</td>
<td>Deep Bay, Hong Kong</td>
<td>26-29</td>
<td>16-35</td>
<td>0.6-1.3</td>
<td>Present</td>
<td>0.8-1.5</td>
<td>Ko (1975)</td>
</tr>
<tr>
<td><em>E. southwelli</em> Baylis and Lane, 1980</td>
<td>Urogyrrnus asperrimus</td>
<td>Ceylon</td>
<td>15-18</td>
<td>21.0-21.5</td>
<td>2.0</td>
<td>Absent</td>
<td>0.5</td>
<td>Baylis and Lane (1920)</td>
</tr>
<tr>
<td><em>E. uncinnatus</em> Molin, 1858</td>
<td>Trygon brucei†</td>
<td>Adriatic†</td>
<td>30-40</td>
<td>23.0-35.4</td>
<td>1.5-1.9</td>
<td>Absent</td>
<td>1.2-1.3</td>
<td>Molin (1858); Ko (1975); Millemann (1963)</td>
</tr>
</tbody>
</table>

* Measured from posterior extremity.
† No type host designated.
†† Hosts: Heterodontus francisci, Myliobatis californicus.
††† Additional host listed in subsequent reports.
† Additional localities listed in subsequent reports.
Specimens of *E. diazi* occurred highly localized in the intestine just posterior to the spiral valve, whereas *E. daileyi* occurred highly localized immediately anterior to the spiral valve. In all cases, a visible, associated nodule occurred on the exterior of the intestine at the site of the worm’s localization.

To better understand the phylogenetic relationships of *E. daileyi*, infecting freshwater stingrays, to those species of *Echinocephalus* infecting marine rays, we classified the new species and its seven closest relatives according to the method proposed by Hennig (1966). Hennigian, or phylogenetic, systematics produces branching diagrams (cladograms) in which taxa are clustered according to the presence of one or more shared special traits (synapomorphies). Generalized or primitive traits are uninformative in a phylogenetic sense because they conform to any hypothesis of relationships whatever, and therefore, are included on the cladogram a posteriori to the clustering. Clustering taxa according to shared special traits produces internested sets of monophyletic groups. Clustering by shared primitive traits (synaplesiomorphies), either wholly or in part, produces classifications comprising paraphyletic or polyphyletic groups.

Pending a complete revision of the genus, we accept the provisional synonymies presented by Yamaguti (1962) and Millemann (1963). They recognized *E. uncinitus* Molin, 1858 (=E. gracilis) Stossich, 1906, *E. spinosisimus* [von Linstow, 1905], and *E. etabati* MacCallum, 1921), *E. multidentatus* Baylis and Lane, 1920, *E. southwelli* Baylis and Lane, 1920, and *E. pseudouncinatus* Millemann, 1951. Subsequently, *E. diazi*, *E. sinensis*, *E. daileyi*, and *E. mobulue* Kalyankar, 1971 have been described. Our classification of the above eight species is based on the following characters as presented in their original descriptions and their coded states (see Table I for a more complete data display):

1. Number of rows of cephalic bulb spines.  
2. Presence or absence of a gubernaculum.  
   0 = lacking; 1 = present.
3. Number of preanal papillae.  
   0 = 2; 1 = 3.
4. Number of postanal papillae.  
   0 = 5; 1 = 6; 2 = 3; −1 = 4.
5. Number of pseudolobial teeth.  
   0 = 6; 1 = 4; −1 = 8–11.

*Echinocephalus crassostreai* Cheng, 1975 and *E. muraenesocis* Bilqees, Khanum, and Jehan, 1971 were not included in our cladogram or table, because the former is obviously the third-stage larval form of *E. sinensis* and the latter was described inadequately.

The characters listed above depict the group *sinensis-daileyi-diazi-pseudouncinatus* as a monophyletic group, but incompletely resolve the relationships of the remaining four taxa (Fig. 13). Future studies should provide additional useful characters.

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**LITERATURE CITED**


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