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ACANTHOBOTHRIMUM NICOYAENSE N. SP.
(EUCESTODA: TETRAPHYLLIDEA: ONCHOBOTHRIIDAE) IN
AETOBATUS NARINARI (EUPHRASEN)
(CHONDRICHTHYES: MYLIOBATIFORMES: MYLIOBATIDAE) FROM
THE GULF OF NICOYA, COSTA RICA

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ABSTRACT: A new species of *Acanthobothrium* in *Aetobatus narinari* from the Gulf of Nicoya, Costa Rica, most closely resembles *Acanthobothrium colombianum* in the same host and *A. urotrygoni* in *Urotrygon venezuelae* from Cartagena, Colombia, by having relatively few proglottides per strobila, spinose cephalic peduncles, bothridial margins free at their posterior ends, and irregularly shaped rather than spherical or elongate cirrus sacs. *Acanthobothrium colombianum* differs from the new species by being as much as 35 mm rather than no more than 4.7 mm long and by having 31–48 rather than 13–19 proglottides, an average of 46 rather than 15 testes per proglottis, and bothridial hooks averaging 185 μ m rather than 137 μ m in total length. *Acanthobothrium urotrygoni* differs from the new species by being as much as 15 mm rather than no more than 4.7 mm long and by having V-shaped rather than H-shaped ovaries, bothridial hooks averaging 95 μ m rather than 137 μ m in total length, by having an average of 28 rather than 15 testes per proglottis, and by having poral ovarian arms extending anteriorly to the posterior margin of the cirrus sac and aporal arms extending to the lateral margin of the cirrus sac.

The Spotted Eagle Ray *Aetobatus narinari* (Euphrasen) occurs commonly in mangrove swamps throughout the tropical regions of the world. Included in the list of parasites reported previously in *A. narinari* are 3 species of *Acanthobothrium* van Beneden, 1849. During a preliminary study of the parasite biodiversity of Cosa Rican elasmobranchs, we discovered a previously undescribed species of *Acanthobothrium* inhabiting *A. narinari* in the mangrove swamps of the northern Gulf of Nicoya.

MATERIALS AND METHODS

Stingrays were collected in mid-afternoon at low tide using a beach seine stretched across a channel leading from a mangrove stand into the main channel of the Gulf of Nicoya. Cestodes were relaxed in sea water, killed in a relaxed condition with hot water, fixed immediately with AFA and stored in 70% ethanol. Whole mounts were stained with Mayer's hematoxylin. Serial cross sections of proglottides and scoleces were cut 7 μ m thick, stained with Mayer's hematoxylin and counterstained with eosin. Whole mounts and cross sections were mounted in Canada balsam. All measurements are in μ m unless otherwise noted. USNM Helm. Coll. refers to the U.S. National Museum Helminthological Collection, Beltsville, Maryland; MNHG refers to the Museum of Natural History, Geneva, Switzerland.

***Acanthobothrium nicoyaense* n. sp.**

(Figs. 1–4)

Description (based on 13 complete and 3 incomplete specimens; mean values in parentheses): Strobila acraspedote, apolytic, consisting of 13–19 (16) proglottides, 2.55–4.73 (3.56) mm long. Scolex 294–369 (316) wide, composed of 4 trilobular bothridia each armed with pair of bifid hooks and surmounted by apical sucker and pad. Bothridia 340–431 (397) long by 106–181 (144) wide; anterior loculus 200–269 (235) long, middle loculus 56–81 (67) long, posterior loculus 81–116 (92) long. Average ratio of locular lengths 1:0.3:0.4. Apical suckers 57–71 (64) in diameter. Hook formula (modified from Euzet [1959] to include mean values) for 118 hooks:

29–51 (42) 86–116 (68) 69–108 (90)
119–157 (137)

Cephalic peduncle 244–525 (330) long, spinose. Terminal proglottides 710–1,261 (932) long by 238–463 (321) wide. Genital pores alternating irregularly in anterior 27–44% (34%) of proglottis, protruding in largest proglottides. Cirrus sac irregularly shaped, 105–163 (142) long by 71–114 (92) wide at genital pore, containing highly muscular spined eversible cirrus and convoluted internal seminal vesicle. Vas deferens coiled anteriorly to terminal genitalia. Testes 14–32 (22) in diameter, 12–22 (15) in number; 3–6 (5) preporally, 1–4 (2) postporally, and 7–15 (8) antiporally. Ovary H-shaped in frontal view, 194–416 (300) long, x-shaped in cross section. Ovarian arms rarely extending anteriorly to posterior margin of cirrus sac, generally posterior to posteriormost testes. Vagina opening anterior to cirrus sac; prominent sphincter present. Vitelline follicles 5–17 (10) in diameter, extending in 2 single lateral rows from immediately postovarian to immediately posterior to anteriormost testes.

Host: *Aetobatus narinari* (Euphrasen) (Chondrichthyes: Myliobatiformes: Myliobatidae).

Site of infection: Spiral valve.

Locality: Punta Morales, Golfo de Nicoya, Costa Rica.

Holotype: USNM Helm. Coll. no. 84477.

Paratypes: USNM Helm. Coll. no. 84388; MNHG no. 18255.

Etymology: The species is named for the Golfo de Nicoya, Costa Rica, where it was first discovered.

DISCUSSION

Three species of *Acanthobothrium* have been reported previously from *Aetobatus narinari*. Two of those species, *A. aetiobatis* (Shiple, 1900) Yamaguti, 1959 and *A. tortum* Linton, 1916, are readily distinguished from *A. nicoyaense* by virtue of being larger worms (*A. aetiobatis* is 15–30 mm long, *A. tortum* is 35–205 mm long), having more than 100 proglottides, square rather than elongate proglottides, foliose and relatively flat rather than compact and elongate ovaries, bothridial margins fused to the scolex rather than free at their posterior ends, and bothridial hooks averaging 250 μ m or more; in addition, *A. tortum* has an average of 163 testes per proglottis, and *A. aetiobatis* has an average of 25 testes per proglottis. *Acanthobothrium colombianum* Brooks and Mayes, 1980, from Cartagena, Colombia, resembles *A. nicoyaense* by having spinose cephalic peduncles, bothridial margins free at their posterior ends, H-shaped ovaries with arms not extending anteriorly to the posterior margin of the cirrus sac, and irregularly shaped rather than spherical

FIGURES 1–4. *Acanthobothrium nicoyaense*, holotype. 1. Scolex. Scale bar = 150 μm . 2. Enlargement of bothridial hooks. Scale bar = 75 μm . 3. Enlargement of terminal genitalia. Scale bar = 75 μm . 4. Terminal attached proglottis. Scale bar = 150 μm .

or elongate cirrus sacs. *Acanthobothrium colombianum* differs from the new species by being up to 35 mm long rather than no more than 4.7 mm long, by having 31–48 rather than 13–19 proglottides, an average of 46 rather than 15 testes per proglottis, and bothridial hooks averaging 185 μm in total length rather than 137 μm in total length (Brooks and Mayes, 1980).

Acanthobothrium lineatum Campbell, 1969 in *Dasyatis americana* from the Chesapeake Bay, Virginia resembles *A. nicoyaense* by being relatively small, with a maximum reported length of 6.1 mm compared with 4.7 mm for *A. nicoyaense*, and by having spinose cephalic peduncles, bothridial margins free at their posterior ends, relatively few proglottides (6–19), H-shaped ovaries, ovarian arms about equal in length extending anteriorly to, or nearly to, the posterior margin of the cirrus sac, and an irregularly shaped cirrus sac. It differs from *A. nicoyaense* by having bothridial hooks up to 216 μm long (with a mean of 148 μm) rather than 157 μm long (with a mean of 137 μm), and an average of 36 rather than 15 testes per proglottis (Campbell, 1969). *Acanthobothrium paulum* Linton, 1890 in *Dasyatis centroura*, *D. americana*, and *Raja eglanteria* from Woods Hole, Massachusetts and the Chesapeake Bay, Virginia is very similar to *A. lineatum*, and differs from *A. nicoyaense* by having an elongate rather than irregularly shaped cirrus sac, an average of 42 rather than 15 testes per proglottis, and bothridial hooks up to 229 μm long (with an average of 157 μm) rather than up to 157 μm long (with an average of 137 μm) (Campbell, 1969). *Acanthobothrium urotrygoni* Brooks and Mayes, 1980 in *Urotrygon venezuelae* from Cartagena, Colombia, resembles *A. nicoyaense* by having spinose cephalic peduncles, bothridial margins free at their posterior ends, relatively few proglottides (4–6), and irregularly shaped cirrus sacs. It differs from the new species by being as much as 15 mm rather than no more than 4.7 mm long and by having V-shaped ovaries, bothridial hooks averaging 95 μm rather than 137 μm in total length, an average of 28 rather than 15 testes per proglottis, and poral ovarian arms extending anteriorly to the posterior margin of the cirrus sac and aporal arms extending reaching the lateral margin of the cirrus sac (Brooks and Mayes, 1980).

Two features of *A. nicoyaense* are unusual for species of *Acanthobothrium*. The first is the relatively small number of testes

per proglottis. Only *A. quadripartitum* Williams, 1968, with 18 testes per proglottis and *A. tripartitum* Williams, 1969, with 13–16 testes per proglottis, both in skates (*Raja* spp.) from the North Atlantic Ocean, and *A. parviuncinatum* Young, 1954, with 12–14 testes per proglottis, in stingrays (*Urolophus* and *Gymnura*) from the coast of California, possess numbers of testes per proglottis similar to *A. nicoyaense*, but they all possess bothridial hooks less than 100 μm in total length and differ in a variety of other characters. The second feature is the predominantly pre-ovarian distribution of testes, a trait exhibited also by *A. coronatum* (Rudolphi, 1819) van Beneden, 1849, *A. indicum* Subhapradha, 1955, and *A. mathiasi* Euzet, 1956, species that do not resemble each other or *A. nicoyaense* in any other significant traits.

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