Serendip deborahae n. gen. and n. sp. (Eucestoda: Tetraphyllidea: Serendipidae n. fam.) in Rhinoptera steindachneri Evermann and Jenkins, 1891 (Chondrichthyes: Myliobatiformes: Myliobatidae) from Southeastern Ecuador

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Nothing is known about the parasite fauna of elasmobranchs inhabiting the coast of Ecuador. During the initial stages of an inventory of the parasite biodiversity of Ecuadorian elasmobranchs, stingrays were collected from Puerto Bolivar, Puerto Jeli, and Puerto Hualtaco, Provincia de el Oro. Among the parasites collected were specimens of an undescribed and unusual tetraphyllidean eucestode, which we describe and discuss herein.

MATERIALS AND METHODS

Stingrays were collected by professional fishermen in bottom trawls using bag seines. 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, and counterstained with eosin. Whole mounts and cross sections were mounted in Canada balsam. All measurements are in μm unless otherwise noted; n = number of specimens examined or measured. MEPN refers to Museo de la Escuela Politecnica Nacional, Quito, Ecuador; MNHG refers to Museum of Natural History, Geneva, Switzerland.

SERENDIPIDAE N. FAM.

Diagnosis: Eucestoda; Tetraphyllidea. Scolex comprising 4 rounded or triangular bothridia, each subdivided by septa in various patterns; distinct loculi present or lacking. Bothridia exhibiting some degree of fusion to each other, to scolex, or both. Bothridial apical suckers lacking. Pedicels present or absent. Vestigial apical sucker embedded in tissues of scolex apex or apical pit may be present. Proglottides apolytic or anapolytic; markedly protandric. Testes in 2 or more layers in each proglottis. Postovarian testes present. Cirrus sac spherical to subcircular; cirrus armed. Genital pore pre-equatorial. Vagina passing anteriorly to cirrus sac. Ovary X-shaped and bifurcating, radially diverging, muscular septa not dividing bothridial face but not into distinct loculi, ringed with marginal loculi with thin velum. Bothridial apical suckers lacking. Bothridia fused to form a single plate-like structure giving bothridial faces a dorsal rather than lateral aspect; pedicels lacking. Vestigial apical sucker embedded in tissues of scolex apex. Proglottides apolytic, protandric. Testes in 2 layers in each of 2 fields in each proglottis. Some testes postovarian in maturing proglottides, disappearing as ovary develops. Cirrus sac spherical; cirrus armed. Genital pore pre-equatorial. Vagina passing anteriorly to cirrus sac. Ovary X-shaped in cross section; lobes bifurcating. Ventralia folicular, medullary, in 2 lateral fields extending length of proglottis, except for ovarian and terminal genitalia areas. Ventralia fields converging dorsally in each proglottis, except for ovarian and terminal genitalia areas.

Type genus: Serendip n. gen.


SERENDIP DEBORAHAE N. SP.

(Figs. 1–11)

Description (based on 9 specimens, 8 whole mounts and 1 scolex prepared for scanning electron microscopy and strobila cut in serial cross sections): Strobilia craspedote, apolytic, up to 60 mm long, composed of approximately 150 proglottides. Scolex 1.5–2.6 mm wide. Immature proglottides squared. Terminal attached proglottides (n = 9) 272–856 long by 546–781 wide. Testes in 2 longitudinal fields and 2 layers extending length of proglottis, 64–116 in total; 3–8 preporal, 25–45 postporal, 36–63 aporal; 47–125 in diameter. Cirrus sac in anterior 1/3 of proglottis, 125–312 long by 156–281 wide, containing spined, eversible cirrus. Vas...

**Taxonomic summary**

*Type host:* Rhinoptera steindachneri Evermann and Jenkins, 1891 (Chondrichthyes: Myliobatiformes: Myliobatidae).

*Type locality:* vic. Puerto Bolivar, Provincia de el Oro, Ecuador.

*Site of infection:* Middle ⅓ of spiral valve.


Etymology: Schmidt (1974) noted that when he found Dioecotaenia in Rhinoptera bonasus and realized it belonged in its own family, he was tempted to name it Serendip, type genus of the family Serendipidae (serendipity) because he was looking for something else at the time he discovered Dioecotaenia. We discovered this cestode species living in a species of Rhinoptera while looking for something else, so we have named it Serendip to honor the memory of Gerald D. Schmidt. The species is named for Deborah A. McLennan.

Remarks

The Tetraphyllidea lack much rigorous phylogenetic examination. Traditional classifications, e.g., Wardle and McLeod (1952), Euzet (1959), and Yamaguti (1959), divided the order into 2 families, the Phyllobothriidae and the Onchobothriidae, diagnosed on the basis of the presence (Onchobothriidae) or absence (Phyllobothriidae) of hooks associated with the bothridia. Regardless of its convenience, this scheme is weak because the absence of hooks is plesiomorphic (Brooks et al., 1991; Brooks and McLennan, 1993; Berman and Brooks, 1994) and thus not an appropriate character on which to base taxonomic groupings (Wiley et al., 1991). This may have led Schmidt (1986) to recognize the Dioecotaeniidae, comprising 1 genus with 2 species (which Schmidt placed in its own order) and the Triloculariidae, comprising 4 genera with 5 species (Berman and Brooks, 1994).

The "Phyllobothriidae" can be divided into cestodes that have bothridial apical suckers, but lack bothridial septa dividing the bothridial face into distinct loculi (e.g., Anthobothrium van Beneden, 1850; Caelytrobothrium Monticelli, 1893; Clistobothrium Dailey and Vogelbein, 1990; Clydonobothrium Euzet, 1956; Crossobothrium Linton, 1889; Echeneibothenium van Beneden, 1805; Monorygma Diesing, 1863; Orygmatobothrium Diesing, 1863; Rhodobothrium Linton, 1889; and the Phyllobothrium lacteum species group) and species that have bothridial septa dividing the bothridial face into distinct loculi but lack bothridial apical suckers (e.g., Caulobothrium Baer, 1948; Duplicibothrium Williams and Campbell, 1977; Glyphobothrium Williams and Campbell, 1977; Rhadiobothrium Euzet, 1953; Rhinebothrium Linton, 1889;
Rhinebothroides Mayes, Brooks, and Thorson, 1981; Triatophros Lönnerg, 1889; and the Phyllobothrium centrurum species group). Notably, the Triloculariidae comprises species having bothridial septa and loculi, some possessing bothridial apical suckers (Trilocularia Olsson, 1867 and Escherbothrium Berman and Brooks, 1994) and some lacking them (Zychobothrium Hayden and Campbell, 1981 and Pentaloculum Alexander, 1953), and the members of the Dioecoteniidae have bothridial loculi but lack apical suckers.

The absence of bothridial septa by the first group of phyllobothriids is a plesiomorphic trait that renders the taxa a paraphyletic collection of undetermined phylogenetic relationships. Because it contains the paraphyletic Phyllobothrium, this group retains the appellation Phyllobothriidae pending a full phylogenetic analysis of the assemblage. The second group, including the Trilocularidae and Dioecoteniidae, comprises those taxa that have bothridial septa and loculi. If the septa and loculi in all these taxa are homologous, and are nonhomologous with the bothridial loculi in many onchobothriids, the group would form a clade. The form and structure of the bothridia and the septa and loculi in each of the 3 groups are, however, diverse. Bothridia of the Trilocularidae are round to elongate with 3–5 loculi arranged in nonlinear patterns. In the Dioecoteniidae, the bothridia are rounded with closely packed hexagonal loculi arranged as a central row of loculi surrounded by large marginal loculi. Glyphobothrium is similar to Dioecotenia, but the loculi are round to squared rather than hexagonal. Duplicibothrium exhibits bothridia with transverse septa anteriorly and a cup-shaped posterior end with indistinct radially arranged septa. Finally, members that we will refer to as the "Rhinebothrium group" (e.g., Caulobothrium, Rhodobothrium, Rhinebothrium, Tritaphros, Rhinebothroides, and the Phyllobothrium centrurum group), have elongate bothridia with linearly arranged loculi. Members of the Dioecoteniidae, Duplicibothrium, Glyphobothrium, and the Rhinebothrium group share another apparently derived trait, the absence of bothridial apical suckers. This may indicate that these taxa are more closely related to each other than either is to the Trilocularidae; however, 2 members of the Trilocularidae, Zychobothrium and Pentaloculum, also lack bothridial apical suckers. The presence or absence of bothridial apical suckers, by itself, may not be a strong indicator of phyllogenetic relationship, or the Trilocularidae may be paraphyletic.

Serendip deborahae has bothridia possessing septa, but lacking apical suckers. This would seem to place it with the Dioecoteniidae, Duplicibothrium, Glyphobothrium, and Rhinebothrium group. Dioecotenia, Duplicibothrium, and Glyphobothrium exhibit several traits that appear to be apomorphic among the Tetraphyllidea, suggesting a relationship with Serendip. They exhibit some degree of fusion of the bothridia, either with each other (Dioecotenia, Duplicibothrium, Serendip) or with the scolex (Glyphobothrium). They also possess testes arranged in 2 layers in each proglottis, and possess postovarian testes, suggesting a possible relationship with the Dioecoteniidae + Serendipidae. Like S. deborahae, they possess vestigial suckers embedded in the scolex apex (the "apical pit" of Glyphobothrium may also be a vestigial apical sucker). Species of this group lack bothridial septa or marginal loculi, although the bothridial faces are covered with "numerous convolutions forming an irregular pattern" (Campbell and Carvajal, 1979; Mayes and Brooks, 1981). They lack the vitelline configuration diagnostic for the Serendipidae and show no sign of bothridial fusion. If Rhodobothrium is a member of the Dioecoteniidae + Serendipidae clade, it would be the sister group of the other 2.

Phylogenetic systematic studies begin with Hennig's Auxiliary Principle (Hennig, 1966; Brooks and McLennan, 1991, 1993; Wiley et al., 1991) that similarity equals homology. Such initial assumptions are corroborated by congruence with other characteristics in a phylogenetic analysis and are falsified by incongruence. Testing and supporting the above hypotheses of homology and classification consistent with them will require a larger suite of characters than the few discussed above.

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LITERATURE CITED


