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Some Digeneans (Trematoda) of the Atlantic Hawksbill Turtle, *Eretmochelys imbricata imbricata* (Testudines: Cheloniidae) from Puerto Rico

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ABSTRACT: Seven species of digeneans were collected from an Atlantic hawksbill turtle in Puerto Rico. These included 3 pronoccephalids, *Pleurogonius laterouterus*, *Rameshwarotrema uterocrescens* (new host and geographic locality record), and *Diaschistorchis pandus*; 1 rhytidodid, *Rhytidodes gelatinosus*; 1 calycodid, *Calycodes caborojoensis*; 1 spirorchiid, *Amphiorchis caborojoensis*; and 1 plagiorchiid, *Enodiotrema reductum*. A list of digeneans reported from hawksbill turtles is included.

KEY WORDS: Digenea, *Pleurogonius laterouterus*, *Rameshwarotrema uterocrescens*, *Rhytidodes gelatinosus*, *Calycodes caborojoensis*, *Amphiorchis caborojoensis*, *Diaschistorchis pandus*, *Enodiotrema reductum*, Atlantic hawksbill turtle, *Eretmochelys imbricata imbricata*, Puerto Rico.

The hawksbill sea turtle, *Eretmochelys imbricata* (L., 1776), is found in the Atlantic, Pacific, and Indian oceans. Two subspecies are recognized: *E. i. imbricata* (L.), the Atlantic hawksbill turtle, which ranges through the warmer parts of the western Atlantic Ocean; and *E. i. bissa* (Ruppell, 1835), the Pacific hawksbill turtle, which ranges through the tropical portions of the Indian and Pacific oceans (Ernst and Barbour, 1989). The hawksbills are listed as endangered throughout the range (Anonymous, 1979) and are considered highly endangered due to the lack of protected habitats and centuries of heavy exploitation for tortoise shell (Meylan, 1989). Like other endangered species, the hawksbill reached low population levels before its ecology had been adequately investigated (Carr and Stancyk, 1975).

The Caribbean Stranding Network was established for the treatment and release of rehabilitated turtles as well as the collection of biological data vital to an understanding of wild populations.

Materials and Methods

On 11 May 1993, the Caribbean Stranding Network received 2 Atlantic hawksbills that had been speared in the neck near La Parguera, Puerto Rico. One died during the night on 23 May 1993 and was held for necropsy (Moore and Dyer, in press). The digestive tract, lungs, circulatory system, gall bladder, and urinary bladder were examined. All helminths were recovered alive in situ, fixed in hot AFA, stained in Har-

ris's hematoxylin, dehydrated, cleared in beechwood creosote, and mounted in Canada balsam.

This work was conducted under federal permits (DRN-93-01) for handling endangered species and operating a rehabilitation facility for endangered animals that were obtained and maintained by the Caribbean Stranding Network.

All measurements are in micrometers unless indicated otherwise. For comparative purposes, specimens were borrowed from the U.S. National Museum: *Amphiorchis caborojoensis* (USNM 73312, paratypes), *Pleurogonius laterouterus* (USNM 73317, paratypes), *Calycodes caborojoensis* (USNM 73321, holotype), *Enodiotrema reductum* (USNM 73334, voucher), and *Rhytidodes gelatinosus* (USNM 73336, voucher). A list of digeneans reported from hawksbill turtles is included (Table 1).

Results and Discussion

Seven species of digeneans including 3 pronoccephalids, 1 rhytidodid, 1 calycodid, and 1 plagiorchiid were found in the digestive tract and 1 spirorchiid in a blood vessel of the lung. All other tissues examined were negative for digeneans.

Pronoccephalidae Looss, 1902

Pleurogonius laterouterus Fischthal and Acholonu, 1976

Sixteen gravid specimens were found in the large intestine. They are similar to those reported by Fischthal and Acholonu (1976) from Puerto Rico except that they are larger and the lateral body margins are smooth rather than sinuous in the midbody region. This sinuous condition in Fischthal and Acholonu's specimens (USNM

Table 1. Digeneans reported from hawksbill turtles.**Angiodictyidae**

- Angiodictyum posterovitelatum* Chattopadhyaya, 1972
Microscaphidium reticulare (van Beneden, 1859) Looss, 1901
Octangium microchis Chattopadhyaya, 1972
Octangium sagitta (Looss, 1899) Looss, 1902
Octangium travassosi (Ruiz, 1943) Yamaguti, 1958

Calycodidae

- Calycodes caborjoensis* Fischthal and Acholonu, 1976

Gorgoderidae

- Pleiochorus cymbiformis* (Rudolphi, 1819) Looss, 1901

Pachypsolidae

- Pachypsolus puertoricensis* Fischthal and Acholonu, 1976
Pachypsolus ovalis Linton, 1910

Paramphistomidae

- Schizamphistomum scleroporium* (Creplin, 1844) Looss, 1912

Plagiorchiidae

- Enodiotrema megachondrus* Looss, 1901
Enodiotrema microvitellatus Chattopadhyaya, 1970
Enodiotrema reductum Looss, 1901
Styphlotrema solitarium (Looss, 1899) Odhner, 1910

Pronocephalidae

- Adenogaster serialis* Looss, 1901
Cricocephalus albus (Kühl and van Hasselt, 1822) Looss, 1899
Cricocephalus americanus Pérez Viguera, 1955
Cricocephalus megastomus Looss, 1902
Desmogonius desmogonius Stephens, 1912
Diaschistorchis lateralis Ogura, 1936
Diaschistorchis pandus (Braun, 1901) Johnston, 1913
Epibathra stenobursata Fischthal and Acholonu, 1976
Glyphicephalus latus Fischthal and Acholonu, 1976
Glyphicephalus lobatus Looss, 1901
Glyphicephalus solidus Looss, 1901
Metacetabulum invaginatum Freitas and Lent, 1938
Pleurogonius laterouterus Fischthal and Acholonu, 1976
Pleurogonius linearis Looss, 1901
Pleurogonius longibursatus Pérez Viguera, 1955
Pleurogonius macrophallus (Oguro, 1936) Ruiz, 1946
Pleurogonius mandapamensis Chattopadhyaya, 1972
Pleurogonius ozakii Oguro, 1936
Pleurogonius puertoricensis Fischthal and Acholonu, 1976
Pleurogonius solidus (Looss, 1901) Ruiz, 1916
Pleurogonius trigonocephalus (Rudolphi, 1809) Looss, 1901
Pleurogonius truncatus Prudhoe, 1944
Pyelosomum parvum Prudhoe, 1944
Pyelosomum posterorichis Oguro, 1936
Pyelosomum solum Chattopadhyaya, 1972
Rameshwarotrema uterocrescens Rao, 1975

Rhytidodidae

- Rhytidodes gelatinosus* (Rudolphi, 1819) Looss, 1901
Rhytidodes indicus Simha and Chattopadhyaya, 1969

Table 1. Continued.

Spirorchiidae

- Amphiorchis amphiorchis* Price, 1934
Amphiorchis caborojoensis Fischthal and Acholonu, 1976
Amphiorchis indicus Mehrotra, 1973
Amphiorchis lateralis Oguro, 1938
Hapalotrema orientale Takeuti, 1942
Hapalotrema synorchis Luhman, 1935
Learedius orientale Mehra, 1939

Telorchhiidae

- Orchidasma amphiorchis* (Braun, 1899) Braun, 1901

Helm. Coll. No. 73317) may be the result either of postmortem changes or of the technique used in preparing the specimens for study. As pointed out by Ulmer (1952), morphological changes in digeneans of known age can be induced by varying the method of preparation.

DIMENSIONS ($N = 16$): Body 3.00–4.28 (3.64) by 0.62–0.82 mm (0.75), oral sucker 88–129 (110) by 90–121 (106), esophagus 200–470 (303), postcecal space 120–180 (130), right testis 270–430 (382) by 210–330 (255), left testis 270–370 (328) by 190–300 (242), posttesticular space 110–270 (202), cirrus sac 400–720 (537) by 40–90 (51), prostatic vesicle 200–380 (274) by 50–70 (65), male genital pore 350–750 (562) from cecal bifurcation, ovary 140–220 (174) by 140–200 (160), distance from right testis 70–180 (120), anteriormost extent of vitelline follicles from anterior extremity 2,000–2,970 (2,448), Mehlis's gland 80–170 (129) by 60–130 (102), eggs 32–37 (33) excluding filaments by 15–19 (16). Six voucher specimens deposited: USNM Helm. Coll. No. 83353.

This is the second report of *P. laterouterus* in *E. i. imbricata* from Puerto Rico.

In addition to the records of *Pleurogonius* found in Yamaguti (1971), *Pleurogonius mandapamensis* Chattopadhyaya, 1972, was described from *Eretmochelys squamosa* in Mandapam, Gulf of Mannar, India; and Fischthal and Acholonu (1976) described *P. puertoricensis* and *P. laterouterus* from *E. i. imbricata* at Cabo Rojo, Puerto Rico.

***Rameshwarotrema uterocrescens* Rao, 1975**

Nine specimens of a monostome detected in the mucosa of the intestine concurred with the description of *Rameshwarotrema uterocrescens* as given by Rao (1975) on the basis of 15 mature

specimens recovered from the deeper layers of the intestine of 6 *Chelonia mydas* taken at the Gulf of Mannar, India. Measurements reported by Rao for the length (0.23–0.41 mm) and width (0.10–0.17) are in error. According to the scale given for the illustration, this specimen measures 2.03 by 0.50 mm. This is larger than our specimens.

DIMENSIONS ($N = 5$): Body 0.67–0.94 (0.76) by 0.30–0.41 mm (0.37), oral sucker 88–92 (87) by 71–110 (86), right testis 110–220 (150) by 110–176 (129), left testis 110–189 (138) by 101–147 (124), ovary 40–70 (58) by 60–90 (72), eggs 26–30 (28) by 13–15 (14). Five voucher specimens deposited: USNM Helm. Coll. No. 83356.

This is the second report of *R. uterocrescens* in a sea turtle and represents a new host and locality record.

***Diaschistorchis pandus* (Braun, 1901)
Johnston, 1913**

Fifty specimens were found in the stomach and 20 in the small intestine.

DIMENSIONS ($N = 10$): Body 6.73–9.25 (8.25) by 2.25–2.62 mm (2.56), oral sucker 470–690 (597) by 520–700 (625), esophagus 280–360 (320), testis divided into several follicles arranged in 2 lateral rows, in a U-shaped manner 200–450 (286) by 240–350 (286), cirrus sac 700–950 (809) by 190–250 (216), ovary 340–400 (362) by 320–350 (345), eggs 29–39 (31) by 15–22 (18). Six voucher specimens deposited: USNM Helm. Coll. No. 83357.

In addition to the records of *Diaschistorchis* found in Yamaguti (1971), *Diaschistorchis pandus* has been reported in *Eretmochelys i. imbricata* from India by Simha et al. (1971) and Mehrotra and Gupta (1976), from Cuba by Pérez Viguera (1955), and from Cabo Rojo, Puerto

Rico, by Fischthal and Acholonu (1976). This is the second report of this monostome in *E. i. imbricata* from Puerto Rico.

Plagiorchiidae Ward, 1917

Enodiotrema reductum Looss, 1901

Eleven specimens were found in the small intestine. Our specimens agree with the description as given by Looss (1901) except that our specimens are slightly smaller.

DIMENSIONS ($N = 6$): Body 1.21–1.42 (1.31) by 0.33–0.38 mm (0.34), oral sucker 128–171 (144) by 143–169 (149), acetabulum 157–160 (159) by 158–162 (160), left testis 147–187 (161) by 94–160 (151), right testis (121–191 (157) by 138–170 (153), cirrus sac 147–190 (159) by 59–84 (72), ovary 88–114 (99) by 59–88 (72), egg 31–35 (34) by 15–18 (17). Eight voucher specimens deposited: USNM Helm. Coll. No. 83354.

In addition to the records of *Enodiotrema* found in Yamaguti (1971), Groschaft et al. (1977) reported 27 specimens of *E. megachondrus* from *Eretmochelys imbricata* in Cuba. Fischthal and Acholonu (1976) found *E. reductum* in the small intestine of 3 *Eretmochelys i. imbricata* from Cabo Rojo, Puerto Rico. The present finding represents the second report of *E. reductum* in *E. i. imbricata* from Puerto Rico.

Rhytidodidae Odhner, 1926

Rhytidodes gelatinosus (Rudolphi, 1819) Looss, 1901

Fifty gravid specimens were recovered from the stomach and 60 from the small intestine. Our specimens are comparable to those described by Looss (1901) and Pérez Viguera (1955) from *Thalassochelys corticata* and *Eretmochelys imbricata*, respectively. While our specimens are larger than those described from *Caretta caretta* by Pratt (1914), they are smaller than those described from *Caretta caretta* and *Chelonia mydas* by Euzet and Combes (1962) and Rodriguez (1960), respectively.

DIMENSIONS ($N = 20$): Body 9.60–16.30 (11.78) by 1.18–2.81 mm (1.99), oral sucker 250–420 (342) by 300–470 (374), acetabulum 300–400 (332) by 270–370 (331), pharynx 150–250 (201) by 160–250 (200), esophagus 180–1,690 (1,014) by 20–50 (34), cirrus sac 400–500 (498) by 270–400 (328), anterior testis 500–600 (542) by 250–450 (321), posterior testis 490–730 (621) by 280–440 (348), ovary 130–370 (298) by 120–400 (394), eggs 55–70 (59) by 27–44 (34). Sev-

enteen voucher specimens deposited: USNM Helm. Coll. No. 83355.

In addition to the records of *Rhytidodes* found in Yamaguti (1971), it has also been reported in *Chelonia mydas* from the Karachi coast, Pakistan (Bilqees, 1974), and in *E. i. imbricata* from Cabo Rojo, Puerto Rico (Fischthal and Acholonu, 1976).

This represents the second report of this species in *E. i. imbricata* from Puerto Rico.

Calycodidae Dollfus, 1929

Calycodes caborojoensis Fischthal and Acholonu, 1976

One gravid specimen was found in the small intestine. This species was described by Fischthal and Acholonu (1976) on the basis of a single specimen found in the small intestine of *Eretmochelys i. imbricata* from Cabo Rojo, Puerto Rico. Our specimen agrees with their description except that our specimen is smaller.

DIMENSIONS ($N = 1$): Body 8.71 by 0.81 mm, oral sucker 320 by 400, acetabulum 400 by 290, anterior testis 200 by 180, posterior testis 300 by 210, cirrus sac 610 by 201, ovary 200 by 150, eggs 54–68 (64) by 42–47 (44). Our specimen was inadvertently destroyed but not before it was identified and measured.

This species has not been reported since its original description. The present report therefore constitutes the second report of this species in *E. i. imbricata* from Puerto Rico.

Spirorchiidae Stunkard, 1921

Amphiorchis caborojoensis Fischthal and Acholonu, 1976

This species was described by Fischthal and Acholonu (1976) based on 11 specimens found in the blood vessels of the lungs of 1 *Eretmochelys i. imbricata*. The single specimen found in the present study concurs with the original description.

DIMENSIONS ($N = 1$): Body 3.42 by 0.74 mm, oral sucker 220 by 170, acetabulum 230 by 160, anterior testis 550 by 400, posterior testis 510 by 350, cirrus sac 250 by 70, ovary 165 by 290, eggs 200–235 including filaments by 38–45. Our single specimen was inadvertently discarded but not before it was identified and measured.

This species has not been reported subsequent to the original description. This constitutes the second report of *A. caborojoensis* in *E. i. imbricata* from Puerto Rico.

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