

THE OPISTHOSIPHONS OF NORTH ANDROS ISLAND, BAHAMAS (ANNULARIIDAE)

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Abstract Five taxa of *Opisthosiphon* are reviewed from the North Island of Andros Island, Bahamas: *O. alleni*, *O. nicholasi*, *O. millsii* (all Bartsch, 1946), *O. androsensis* Pilsbry, 1930, and *O. thesaurus* new species. *Opisthosiphon alleni*, previously recorded from New Providence and Eleuthera, has only been found at the San Andros airport on Andros Island and probably was anthropogenically introduced. *Opisthosiphon thesaurus* new species is a troglodytic taxon endemic to Henry Morgan Cave at Morgan's Bluff. The distribution of these snails on the island may be dictated by the degree of inundation by hurricane storm surges.

Key words Annulariidae, Bahamas, systematics, *Opisthosiphon*

INTRODUCTION

Between 1973 and 1982 staff of the Ohio State University Museum of Zoology (USA) made extensive collections on the Bahamian island of Andros. These collections included large numbers of terrestrial snails made at numerous locations on the northern-most part of Andros, the North Island. Some of this material was incorporated into the then-existing malacological collection, now the Ohio State University Museum of Biological Diversity, Division of Molluscs. In 2018 the remaining material, forming the bulk of the original collections, was donated to the Division. The total annulariid component consisted of 2,768 specimens comprising 88 lots; all were species of *Opisthosiphon*.

Andros Island, composed of three main parts (North Island, Mangrove Cay, South Island), is the largest of the Bahamian islands. *Opisthosiphon* species seem to be limited to the eastern half of the island, particularly along the east coast. Elevations decrease from east to west across the island with eastern limestone hills that may rise to 13m above sea level. It is here that these species are most abundant, limited almost exclusively to elevations of 5m or greater. The western half of the island, generally less than 5m in elevation, may be inundated by storm surge during hurricanes. *Opisthosiphon* species are not arboreal and storm surge may be the most important factor in the distribution of the snails on this island.

MATERIALS AND METHODS

Descriptions and measurements were based on adult shells oriented with the spire up and the aperture facing the viewer. Length was measured from the tip of the decollated spire to the opposite anterior-most extension of the outer lip. All specimens were dry shells; none were available for phylogenetic analysis.

Institutional abbreviations used

ANSP – Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
 BMSM – Bailey-Matthews National Shell Museum, Sanibel, Florida, USA
 OSUM – Ohio State University Museum of Biological Diversity, Columbus, Ohio, USA
 UF – Florida Museum of Natural History, Gainesville, Florida, USA
 USNM – U.S. National Museum of Natural History, Washington D.C., USA

SYSTEMATIC DESCRIPTIONS

Superfamily Littorinoidea
 Family Annulariidae
 Subfamily Rhytidopomatinae

Genus *Opisthosiphon* Dall, 1905a
Opisthosolen [sic] Dall, 1905b [see Bartsch, 1946: 216]

Type species *Ctenopoma bahamense* Shuttleworth, 1865, by original designation.

Subgenus *Opisthosiphon* Dall, 1905

Description Adult shell small (ca. 6–13mm in length), spire height \geq aperture height, usually decollate. Nuclear whorls 1.25–1.5, scarcely demarcated from teleoconch, smooth. Axial sculpture of low threads that extend from suture to umbilicus, thickened at suture into individual cusps. Spiral sculpture at least in umbilicus but may occur on remainder of shell as well. Umbilicus open or closed off by extension of outer lip. Outer lip usually expanded all around. Breathing device just behind posterior of outer lip in form of short tube or siphon opening towards previous whorl, which communicates with inner aperture through pore. Operculum rhytidopomine with radiating, pin-wheel-like raised calcareous ribs across proteinaceous base. Taenioglossate radula with rachidian, single pair of laterals, and two pairs of marginals. Rachidian and lateral teeth usually unicuspid. Inner marginal with broad, triangular cusp laterally flanked by much smaller cusp. Outer marginal pectinate.

Key to Opisthosiphon taxa of North Island

1. Lip deflected back over umbilicus..... 2
1. Lip not deflected back over umbilicus..... 3
2. 80–110 axial lamellae on final whorl..... *alleni*
2. 40–60 axial lamellae on final whorl ... *nicholasi*
3. Suture with few, widely separated denticles..... *thesaurus*
3. Suture with numerous, narrowly separated denticles..... 4
4. Lip narrowly expanded and widely detached from previous whorl..... *millsi*
4. Lip widely expanded and attached or narrowly detached from previous whorl *androsensis*

Opisthosiphon (Opisthosiphon) androsensis

Pilsbry, 1930
(Figs 1–9, 24)

Opisthosiphon androsensis Pilsbry, 1930: 298, pl. 30, fig. 9.

Opisthosiphon (Opisthosiphon) androsensis: Bartsch, 1946: 226, pl. 35, fig. 8.

Opisthosiphon (Opisthosiphon) vaughani vaughani Bartsch, 1946: 231–232, pl. 37, fig. 1.

Opisthosiphon (Opisthosiphon) vaughani occidentalis Bartsch, 1946: 233, pl. 37, fig. 3.

Opisthosiphon (Opisthosiphon) goldingi masticensis Bartsch, 1946: 238, pl. 37, fig. 12.

Opisthosiphon (Opisthosiphon) goldingi goldingi Bartsch, 1946: 239, pl. 37, fig. 14.

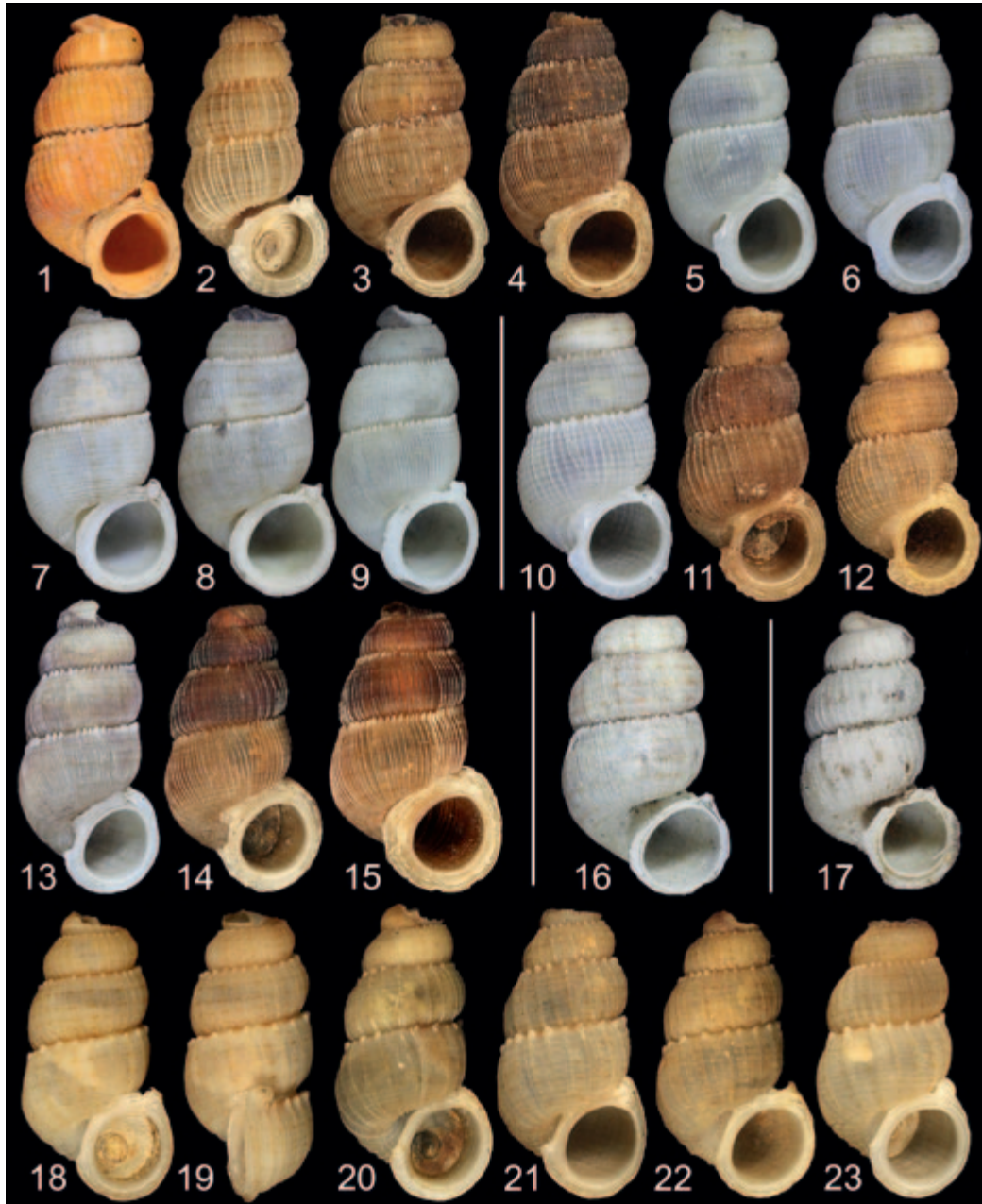
Opisthosiphon (Opisthosiphon) drewi Bartsch, 1946: 239–240, pl. 37, fig. 15.

Opisthosiphon (Opisthosiphon) simpsoni williamsae Watters & Duffy, 2010: 3–4, figs. 10–12.

Types *Opisthosiphon androsensis* Pilsbry, 1930: Lectotype: ANSP 151789. *Opisthosiphon (Opisthosiphon) vaughani vaughani* Bartsch, 1946: Holotype: USNM 355432. *Opisthosiphon (Opisthosiphon) vaughani occidentalis* Bartsch, 1946: Holotype: USNM 355430. *Opisthosiphon (Opisthosiphon) goldingi masticensis* Bartsch, 1946: Holotype: USNM 355524. *Opisthosiphon (Opisthosiphon) goldingi goldingi* Bartsch, 1946: Holotype: USNM 269405. *Opisthosiphon (Opisthosiphon) drewi* Bartsch, 1946: Holotype: USNM 270066. *Opisthosiphon (Opisthosiphona) simpsoni williamsae* Watters & Duffy, 2010: Holotype: UF 420736; Paratypes: OSUM 32480, 32481, 32479 (one shell each).

Type localities *Opisthosiphon androsensis* Pilsbry, 1930: “Stafford Lake, in gravel on shore.” *Opisthosiphon (Opisthosiphon) vaughani vaughani* Bartsch, 1946: “various parts of Mangrove Cay.” *Opisthosiphon (Opisthosiphon) vaughani occidentalis* Bartsch, 1946: “Gun Cay, one of three small islands on the northwestern rim of the Bahama Banks.” *Opisthosiphon (Opisthosiphon) goldingi masticensis* Bartsch, 1946: “Mastic Point, northeastern Andros.” *Opisthosiphon (Opisthosiphon) goldingi goldingi* Bartsch, 1946: “Golding Cay off the east entrance to South Bight on Andros Island.” *Opisthosiphon (Opisthosiphon) drewi*: “Smith’s place on the south side of South Bight at its eastern termination, Andros Island.” *Opisthosiphon (Opisthosiphona) simpsoni williamsae* Watters & Duffy, 2010: “Bahamas, Andros Island, Twin Lakes Farm along Fresh Creek.”

Redescription Adult shell small (8–12mm in adult length, decollate), pupoid, usually decollate as adult, umbilicus narrow but open. Nuclear whorls 1.25, scarcely demarcated from teleoconch, smooth, tan with brown periphery, rarely retained when adult. Teleoconch of 4 whorls, adnate except for immediately behind peristome. Suture channeled. Peristome double, not (rarely) or only narrowly attached to previous whorl. Outer lip thin, perpendicular to



Figures 1–23 Andros Island *Opisthosiphon* 1–9 *Opisthosiphon androsensis*. 1 *Opisthosiphon androsensis* Pilsbry, 1930: Lectotype: ANSP 151789, 8.6mm. 2 OSUM 246–20, 11.6mm. 3 *Opisthosiphon (Opisthosiphona) simpsoni williamsae* Watters & Duffy, 2010: Paratype: OSUM 32481, 9.7mm. 4 *Opisthosiphon (Opisthosiphona) simpsoni williamsae* Watters & Duffy, 2010: Paratype: OSUM 32480, 11.6mm. 5 *Opisthosiphon (Opisthosiphon) vaughani occidentalis* Bartsch, 1946: Holotype: USNM 355430, 8.7mm. 6 *Opisthosiphon (Opisthosiphon) vaughani vaughani* Bartsch, 1946: Holotype: USNM 355432, 11.2mm. 7 *Opisthosiphon (Opisthosiphon) goldingi masticensis* Bartsch, 1946: Holotype: USNM 355524, 10.4mm. 8 *Opisthosiphon (Opisthosiphon) goldingi goldingi* Bartsch, 1946: Holotype: USNM 269405, 8.7mm. 9 *Opisthosiphon (Opisthosiphon) drewi* Bartsch, 1946: Holotype: USNM 270066, 11.2mm. 10–12 *Opisthosiphon nicholasi* 10 *Opisthosiphon (Opisthosiphon) nicholasi* Bartsch, 1946: Holotype: USNM 536844, 7.8mm. 11 OSUM 303–4, 9.6mm. 12 OSUM 303–4, 10.7mm. 13–15 *Opisthosiphon alleni* 13 *Opisthosiphon (Opisthosiphon) alleni providentialis* Bartsch, 1946: Holotype: USNM 536846, 12.0mm. 14 *Opisthosiphon (Opisthosiphon) alleni* Bartsch, 1946: OSUM 158–10, 11.5mm. 15 *Opisthosiphon (Opisthosiphon) alleni* Bartsch, 1946: OSUM 158–10, 10.5mm. 16 *Opisthosiphon (Opisthosiphon) millsii* Bartsch, 1946: Holotype: USNM 355525, 8.8mm. 17 *Opisthosiphon (Opisthosiphon) mayori* Bartsch, 1946: Holotype: USNM 355429, 9.0mm. 18–23 *Opisthosiphon thesaurus* 18, 19 Holotype OSUM 46073, 8.8mm. 20 Paratype 1: OSUM 46074, 9.4mm. 21 Paratype 2: OSUM 46074, 9.1mm. 22 Paratype 3: UF 525640, 9.0mm. 23 Paratype 4: BMSM 128506, 7.6mm.

whorl, narrow to moderately expanded (often wider over umbilicus), composed of numerous layers. Inner lip exerted, very short. Siphon short, recurved dorsally and towards previous whorl, its opening facing inward. Spiral sculpture present at least as weak cords within umbilicus, but may continue as numerous fine threads across entire whorl. Axial sculpture of numerous (50–150 on last whorl), closely spaced, low lamellae. At suture every or every other lamella is expanded into prominent denticle that partially obscures suture. Background colour white, orange-red, purplish, gray, or pale brown with 7–10 narrow spiral rows of smudged brown spots or interrupted bands, pattern visible through shell in aperture (lectotype of *O. androsensis* is stained with rust-coloured coating). Operculum rhytidopomine as in genus.

Etymology From Andros Island.

Distribution This is by far the most widely distributed *Opisthosiphon* on the island. It occurs at all higher elevations along the eastern and northern coasts and inland at the “island” of higher ground west of Andros Town, the site of the old Owens Lumber Company. It appears to be absent from the western low-lying half of the island. As *O. simpsoni williamsae* Watters & Duffy (2010), it is recorded from Chub Cay, Berry Islands, and as *O. vaughani occidentalis* Bartsch (1946), from Gun Cay, Bahama Bank.

Comparison with other species *Opisthosiphon nicholasi* and *O. alleni* have similar sculpture but the umbilicus is covered by a cut portion of the outer lip; the outer lip is continuous in *O. androsensis* and the umbilicus is open.

Remarks Based on examination of 2,462 specimens, it is apparent that this is a very variable species, both within a single population and between populations. Bartsch (1946) and Watters & Duffy (2010) created several nominal taxa based on variations in sculpture. These variations include: specimens with coarse, widely spaced axial sculpture and a few spiral cords below the suture (the type of *O. androsensis*); specimens with coarse, widely spaced axial sculpture and lacking spiral cords below the suture (*O. simpsoni williamsae*) (these two forms are primarily found in the northern part of the island); specimens with coarse axial sculpture and numerous fine

spiral threads (*O. vaughani*); and specimens with fine axial sculpture and numerous fine spiral threads (*O. goldingi*, *O. drewi*, primarily found on the South Island). All of these taxa fall within the variation of *O. androsensis* and are here regarded as synonyms.

This species is part of a confusing complex of very similar Bahamian taxa including the non-Andros species *O. eleutheraensis* Bartsch, 1946, *O. simpsoni* Bartsch, 1946, and *O. bahamaensis* (Shuttleworth, 1865), all of which may prove to be genetically indistinguishable in future studies. Bartsch’s (1946) species of Bahamian *Opisthosiphona* belong to this group as well. Bartsch based *Opisthosiphona* on species lacking spiral sculpture outside of the umbilicus but as seen here that is a variable feature in these specimens. However, as pointed out by Watters (2006), the type of *Opisthosiphona* is the peculiar Cuban *O. moreletianum* (Petit, 1850), which does not seem closely related to these Bahamian taxa. For this reason *Opisthosiphona* is not synonymised with *Opisthosiphon* here.

The density and number of the axial lamellae, the extent of the spiral sculpture, and the width of the outer lip varies substantially among specimens, as does the strength of the cusps. The colour pattern is often well-developed and varies from broken spiral bands and spots to (rarely) solid bands. In some specimens the earlier whorls are dark brown or purplish. Bartsch’s specimens, including most of the types of the species reviewed here, are white and bleached.

Opisthosiphon (Opisthosiphon) nicholasi

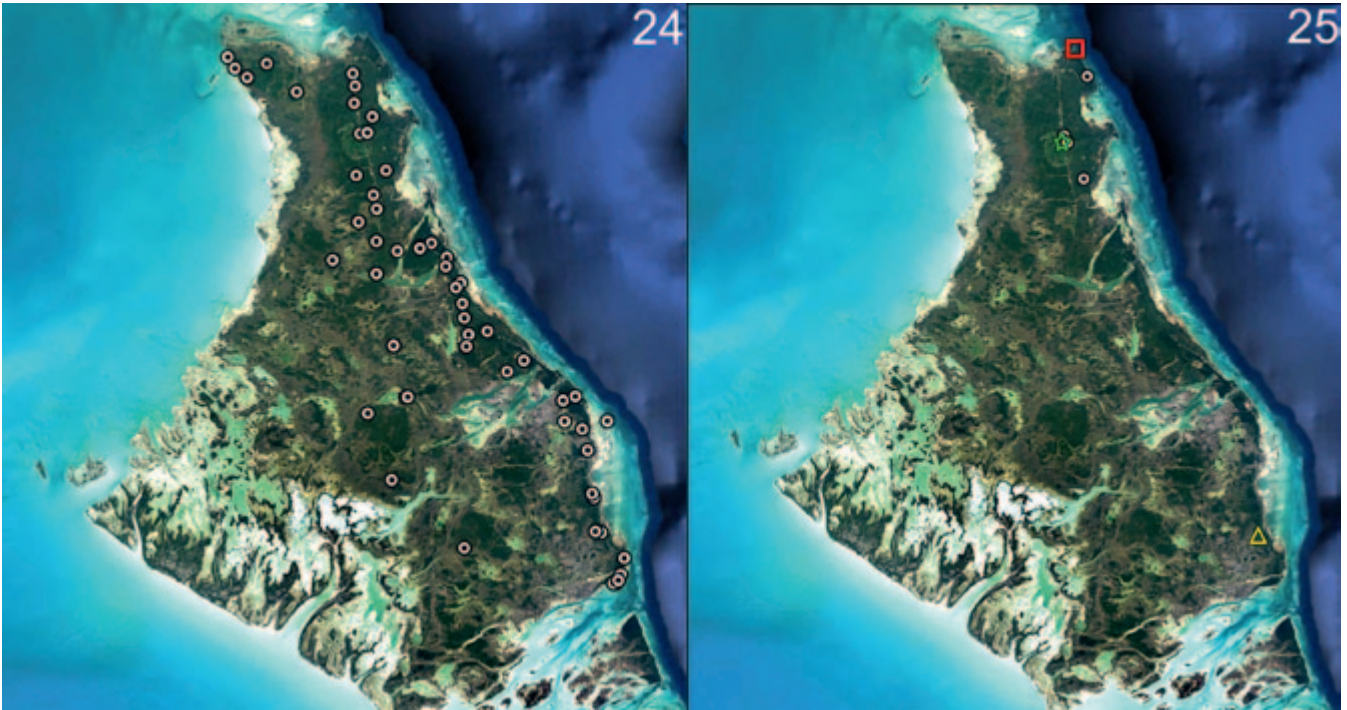
Bartsch, 1946
(Figs 10–12, 25)

Opisthosiphon (Opisthosiphon) nicholasi Bartsch, 1946: 222–223, pl. 36, fig. 6.

Type Holotype: USNM 536844.

Type locality “Nicholas Town, Andros Island, Bahamas.”

Redescription Adult shell small (9–12mm in length, decollate), pupoid, usually decollate as adult, umbilicus closed by outer lip. Nuclear whorls unknown. Teleoconch of 4–4.5 adnate whorls. Suture channeled. Peristome double, broadly attached to previous whorl. Outer lip



Figures 24, 25 24 Distribution of *Opisthosiphon androsensis* (bullseye). 25 Distributions of *Opisthosiphon nicholasi* (bullseye), *Opisthosiphon alleni* (star), *Opisthosiphon millsii* (triangle), and *Opisthosiphon thesaurus* (square). Maps Google™ Earth Pro. Image Landsat. © 2018 Google. Data: SIO, NOAA, US Navy, NGA, GEBCO.

thin, perpendicular to whorl, narrowly expanded, composed of numerous layers. Columellar side of outer lip cut and folded back over umbilicus; umbilicus completely sealed by lip; anterior border of cut forming small auricle. Inner lip exerted, very short. Siphon short, recurved dorsally and towards previous whorl, its opening facing inward. Spiral sculpture of low, flat cords (ca. 25 on final whorl) across entire whorl. Axial sculpture of numerous (40–60 on last whorl), widely spaced lamellae, weakly scalloped where spiral sculpture crosses them; overall sculpture reticulate. At suture every or every other lamella is expanded into denticle that partially obscures suture. Background colour tan to dark copper, often with metallic sheen, denticles and lip white, with ca. 7 spiral rows of smudged brown spots or interrupted bands. Operculum rhytidopomine as in genus.

Etymology From “Nicholas” [Nicoll’s] Town. Bartsch often gave place names a personal rather than place-name Latin suffix.

Distribution Endemic to the higher ground of the northern peninsula in the vicinity of Nicoll’s Town.

Comparison with other species The very similar *O. alleni* has finer sculpture (80–110 axial lamellae on the final whorl vs. 40–60 lamellae in *O. nicholasi*). These two may yet be shown to be variants of the same species that occur across adjacent islands. The outer lip does not cover the umbilicus in *O. androsensis*.

Opisthosiphon (Opisthosiphon) alleni Bartsch, 1946
(Figs 13–15, 25)

Opisthosiphon (Opisthosiphon) alleni providentialis Bartsch, 1946: 224, pl. 36: fig. 12.

Opisthosiphon (Opisthosiphon) alleni alleni Bartsch, 1946: 224, pl. 36: fig. 10.

Types *Opisthosiphon (Opisthosiphon) alleni providentialis* Bartsch, 1946: Holotype: USNM 536846. *Opisthosiphon (Opisthosiphon) alleni alleni* Bartsch, 1946: Holotype: USNM 536845.

Type locality *Opisthosiphon (Opisthosiphon) alleni providentialis* Bartsch, 1946: “Island of New Providence.” *Opisthosiphon (Opisthosiphon) alleni alleni* Bartsch, 1946: “Egg Island, one of the small cays close to Eleuthera ... and [also] in the region of Current Sound, Eleuthera.”

Redescription Adult shell small (10–13mm in length, decollate), pupoid, usually decollate as adult, umbilicus closed or nearly so by outer lip. 1.5 smooth, erect nuclear whorls. Teleoconch of 3.5–4 adnate whorls. Suture deeply channeled. Peristome double, broadly attached to previous whorl. Outer lip thin, perpendicular to whorl, broadly expanded, composed of numerous layers. Columellar side of outer lip cut and folded back towards umbilicus; umbilicus completely or nearly covered by lip; anterior border of cut forming auricle. Inner lip exerted, very short. Siphon short, recurved dorsally and towards previous whorl, its opening facing inward. Spiral sculpture of weak threads (ca. 20) across entire whorl, strongest in umbilicus. Axial sculpture of numerous (80–130 on last whorl), evenly and narrowly spaced lamellae. Each lamella forms denticle at suture. Background tan to dark brown, denticles and lip white, with ca. 12 spiral rows of faint, interrupted tan bands. Operculum rhytidopomine as in genus.

Etymology C.C. Allen, who collected the types.

Distribution Out of 88 sites on Andros Island *O. alleni* has only been found in the vicinity of San Andros International Airport. This airport receives chartered and scheduled air service from Nassau, New Providence Island, among other Bahamian origins. It seems likely this species has been accidentally introduced to Andros Island from Nassau by anthropogenic means.

Comparison with other species See under *O. nicholasi*.

Remarks Bartsch (1946) described two subspecies, *O. alleni alleni* and *O. alleni providentialis*, distinguished only by the spacing of the axial threads. These are not recognised as distinct here.

The outer lip may be folded over to completely occlude the umbilicus or it may be only half folded. In the latter case it is obvious that the outer lip has a pronounced sinuosity at the columella that is not found in other species.

Opisthosiphon (Opisthosiphon) millsii Bartsch,
1946
(Figs 16, 25)

Opisthosiphon (Opisthosiphon) millsii Bartsch, 1946:
225–226, pl. 36, fig. 14.

Type Holotype: USNM 355525.

Type locality “The edge of a pine coppice about one-half mile north and east of the western end of South Bight on Mangrove Key, Andros Island, Bahamas.”

Redescription Adult shell small (9–12mm in length, decollate), pupoid, usually decollate as adult, umbilicus narrow but open. Nuclear whorls unknown. Teleoconch of 3–3.5 whorls, solute for one half whorl behind peristome. Suture channeled. Peristome double, detached from previous whorl. Outer lip thin, perpendicular to whorl, narrowly, evenly expanded, composed of numerous layers. Inner lip exerted, very short. Siphon short, recurved dorsally and towards previous whorl, its opening facing inward. Spiral sculpture of weak cords within umbilicus, which continue as numerous fine threads across entire whorl. Axial sculpture of numerous (90–110 on last whorl), closely spaced, low lamellae. At suture every or every other lamella is expanded into minute denticle that partially obscures suture. Background colour white, with or without spiral rows of smudged brown spots or interrupted bands. Operculum rhytidopomine as in genus.

Etymology John Mills, Carnegie Institution, who assisted Bartsch while on Andros.

Distribution Originally described from Mangrove Key, it is reported here from the adjacent southeastern corner of North Island. A single weathered specimen from Red Bays seems referable to this species but that location is at the other end of the island. Additional material from Red Bays is needed to confirm this record.

Comparison with other species Only *O. mayori* shares the openly coiled shell and detached lip. That species has much coarser sculpture than *O. millsii*.

Opisthosiphon (Opisthosiphon) thesaurus sp.
nov.
(Figs 18–24, 25)

Types Holotype: OSUM 46073 (8.8mm in length); Paratype 1: OSUM 46074 (9.4mm in length); Paratype 2: OSUM 46074 (9.1mm in

length); Paratype 3: UF 525640 (9.0mm in length); Paratype 4: BMSM 128506 (7.6mm in length).

Additional material OSUM 6231 (12 specimens); OSUM 242–23 (7 specimens); OSUM 130–17 (4 specimens); OSUM 160–3 (17 specimens) (all from type locality).

Type locality Bahamas, Andros Island, North Island, Henry Morgan Cave, 25.1761° N, -78.0236° W.

Description Adult shell small (6–9.5mm in length, decollate), pupoid, usually decollate as adult, umbilicus narrow. 1.5 smooth, erect nuclear whorls. Teleoconch of 3.25–4 adnate whorls. Suture deeply channeled. Peristome double, attached to previous whorl. Outer lip thin, perpendicular to whorl, narrowly expanded, composed of numerous layers. Columellar side of outer lip weakly cut and folded back over umbilicus; umbilicus completely sealed by lip; anterior border of cut forming small auricle. Inner lip exerted, very short. Siphon short but wide, recurved dorsally, its opening facing backwards. Spiral sculpture of low, flat cords (ca. 25 on final whorl) across entire whorl. Axial sculpture of several (25–30 on last whorl), very widely spaced lamellae, some nearly obsolete, weakly scalloped where spiral sculpture crosses them. At suture most lamellae are expanded into minute but distinct denticle that partially obscures suture. Background colour white or yellowish, with ca. 10 spiral rows of faint, narrow, interrupted tan bands. Operculum rhytidopomine as in genus.

Etymology Latin, *thesaurus*, treasure, storehouse. Henry Morgan's Cave is believed by some to be the site of the treasure of the 17th century Welsh privateer Sir Henry Morgan. A masculine noun in apposition.

Distribution Known only from Henry Morgan Cave at Morgan's Bluff on the extreme northern coast. This seems to be one of the few true troglodytic annulariid species.

Comparison with other species The widely crenulated suture is unique among Andros opisthosiphons.

Opisthosiphon (Opisthosiphon) mayori Bartsch, 1946
(Fig. 17)

Opisthosiphon mayori Bartsch, 1946, described from the Middle Bight, was not encountered on the North Island. It is figured here for completeness.

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