

ured a specimen collected in Barbados and mentioned a specimen which also existed in the National Museum that had been collected in a kitchen midden in Brazil.

Dr. Jutting has kindly checked specimens in certain of the European museums and her notes are as follows: The Amsterdam Museum has two specimens labeled "China" from Cuming. These are apparently part of the same set that is possessed by the Acad. Nat. Sci., Philadelphia, and by the Mus. Comp. Zoöl. The Leyden Museum has two specimens, one marked "Indian Ocean" and the other "Haiti." Dr. Bayer, however, did not consider the latter locality as at all trustworthy. There are three examples in the British Museum, all from St. Lucia, two from Cuming and one from Ponsonby.

Recently (NAUTILUS 52, p. 109) McGinty has reported this species from Lake Worth, Boynton, Florida.

The known range then for this species extends from southern Florida to Texas and south as far as Brazil. A brief synonymy follows:

#### TEREBRA FLAMMEA Lamarck

*Terebra flammea* Lam. 1822, An. s. Vert. p. 284; Kiener 1839, Icon. Coquilles Viv. 10, p. 12, pl. 5, fig. 10 (specimen probably from Lamarck's collection); Clench 1938, NAUTILUS 51, p. 114, pl. 9, figs. 1-2; McGinty 1939, NAUTILUS 52, p. 109.

*Terebra texana* Dall 1898, NAUTILUS 12, p. 44; Henderson, J. B. 1919, Univ. of Iowa Studies 8, p. 89, pl. 40, fig. 5.

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## A REVISION OF *SPIRAXIS* C. B. ADAMS

### H. BURRINGTON BAKER

This is part 4 of a series on Mexican mollusks collected for Dr. Bryant Walker in 1926. The first part appeared (1928) as Occasional Papers Mus. Zool. Univ. Michigan, no. 193, in which the symbols for localities are explained on pp. 2-25. In plates 3 to 5, the scales for shells, genitalia and pallial complexes indicate lengths of 1 mm.; those for lines of right half of radular rows (T) 0.05 mm.; those for radular teeth 0.01 mm. (10 microns). In each new form, the figured shell is the type.

On account of the traditional importance ascribed to columellar

differences, the union of *Pseudosubulina* and *Spiraxis* into a single genus may seem rather iconoelastic. But, the generic retention of the former would necessitate four other genera (my subgenera) and I doubt if anyone could definitely place many of the species that are anatomically unknown. While I now feel that I could arrange shells with some accuracy, the name *Versutaxis* expresses the bewilderment one feels during their examination; senescent examples of *Rectaxis* and *Miraradula* may closely imitate the sigmoid columella of true *Volutaxis* and *S. (P.) orizabensis* and an undescribed species approach the columella of *Versutaxis*.

The following anatomical definition and subdivision of *Spiraxis* (new subfamily **SPIRAXINÆ**) are founded on drawings of dissections of 24 Mexican (+ 2 radulae) and 5 Jamaican species and on the radulae of one Cuban and one Venezuelan species.

Foot long and slender, pointed posteriad; lower pedal groove distinct; mantle-collar (MC; pl. 3, f. 10, pl. 5, f. 3) quite deep but thin; right (MR) and anterior (MA) and posterior (MP) left mantle-lappets small. Lung wall elongate; minor venation indistinct; principal vein (HV) often bordered by bands of muscle. Kidney (K) with a triangular pericardial (H) limb and a vestigial (in large forms) to conspicuous (in small species; pl. 3, f. 3) extension between ureter (KD) and hindgutff varying around 1.5 times as long as its base or length of pericardium. Anal mantle gland extending posteriad between hindgut and ureter; relatively large in small species.

Ovotestis (G; pl. 3, f. 7) about one whorl in length and imbedded in liver about a half-whorl above stomach; duct (GD) markedly swollen when filled with sperm; talon (GT) very short; carrefour (X) slender. Albumen gland (GG) large, elongate. Oviduct consisting of short slender duct (UX) below carrefour, uterus (UT) and postuterine or free oviduct (UV). Spermatheca (S) of long type; sac imbedded in base of albumen gland above aorta. Vagina (V) various. Prostate (DG) completely separate from uterus (at least in large species). Free vas deferens (D) fairly heavy and muscular but without epiphalloid enlargement (except in *Micromena*; E, pl. 3, f. 6); caught into penioviducal angle by right eye-muscle; opening (EP) into penial apex without definite verge (except in *Micromena*; PV). Penis (P) without appendages; retractor (PR) arising high on diaphragm and inserting on or near penial apex. Atrium (Y) opening below base of right ommatophore.

Columellar system with left free and buccal retractors joined for short distance.

Labial lobes quite prominent (at least in larger forms), triangular (like in *Streptostyla*). Jaw absent (despite statements to contrary), although fleshy fold, which usually supports it, is present and may have weakly cornified edge (as in most Systrophiiidae). Buccal mass quite to very small and radula minute and very flimsy (except in *Miraradula*). Radula with V-shaped rows (T, pl. 5, f. 1); central small, with 1 to 3 conical or triangular cusps; outer teeth all bicuspid; 0-4 laterals with 2 short subequal cusps and 9-31 marginals with inner or both (in *Micromena*; pl. 3, f. 5) cusps developed into a long slender needle (except in *Miraradula*; pl. 4, f. 7); 24-50 rows counted but usually about 35. Salivary glands broad but short (small as compared to carnivorous but large for herbivorous species), forming a lanceolate plate over oesophagus. Stomach fusiform, about 2 whorls in length, imbedded along side of albumen gland but extending anteriorly beyond it. Hindgut with S-loops reduced; running parallel with stomach to posterior end of pericardium, then across posterior end of kidney and forward as usual (I, pl. 3, f. 10).

The following key defines the subgenera and sections:

- A(AA) Radula with over 100 short-cusped laterals or marginals either side of tricuspid central; penis with small apical chamber and a peculiar pilaster (pl. 4, f. 6); shell with subvertical, although spirally twisted columella; type *S. similaris* (S. & P.) from Necaxa (station 54): ..... subg. *Miraradula*, new.
- AA(A) Radula with 0-4 short-cusped laterals and 6-31 marginals with one or both cusps long and needle-like. (B) Radula with tricuspid central, 2 laterals and 10-13 marginals; penis much as in *Miraradula*; shell usually with fairly straight columella; type *S. decussatus* (H.B.B.) from Venezuela (but genitalia from Mexico):  
..... subg. *Rectaxis* H.B.B. (1926).
- B(AA) Radula with unicuspid central; penis not as in *Miraradula*. (G) Apparently oviparous; uterus about as long as prostate and smaller than free oviduct + vagina; radula with 2 laterals (1 in *S. parvus*) or none; mainland and Cuba (+ *S. problematicus* from Jamaica). (F) Radula with laterals and with 9-18 marginals developing one needle-like and one shorter cusp; penis without marked verge or epiphallus. (E) Penis usually elongate, without heavy pilasters and with at least its apical end surrounded by a sheath; shell usually with columella not markedly truncate; Central American: ..... subg. *Volutaxis* S. & P. (1882).

- (D) Vagina practically obsolete. (C) Free oviduct less than twice as long as uterus; shell usually smaller with weakly twisted columella and with last embryonic whorl assuming neanic sculpture; type *S. opeas*, n. sp. from Mexico: ..... sect. *Versutaxis*, new.
- C(B) Free oviduct about 4 times as long as uterus; shell larger, with heavy sigmoid columella; last embryonic whorl with widely spaced ribs but later ones with close threads; type *S. acus enigmaticus*, n. ssp. from Mexico: ..... sect. *Mirapex*, new.
- D(B) Vagina longer; shell with heavy sigmoid columella, with closely spaced threads on last embryonic whorl, mainly larger; type *S. sulciferus* (Mo.) from Mexico: ..... sect. *Volutaxis* s.s.
- E(B) Penis usually shorter, with two internal pilasters; vagina almost obsolete; shell usually with definitely truncate columella; type *S. berendti* (Pfr.) from Mexico: ..... subg. *Pseudosubulina* S. & P. (1882).
- F(B) Radula without laterals and with subequal needle-like cusps on 29-31 marginals; penis with vergic papilla and vas with epiphalloid swelling; shell minute, spirally striate and with straight, very weakly truncate columella; type *S. minutus*, n. sp. from Mexico (1 sp. from Jamaica): ..... subg. *Micromena*, new
- G(B) Viviparous; uterus longer than prostate and much larger and longer than free oviduct + short vagina; radula with 1 or with 4 laterals; Jamaica and (?) Los Roques: ..... subg. *Spiraxis* C.B.A. (1850).  
(H) Radula with 4 laterals and 6 marginals; shell like sect. *Spiraxis* but with only one columellar lamella and with later whorls markedly inflated below suture; type *S. mirabilis* (C.B.A.) from Jamaica: ..... sect. *Dignaxis*, new.
- H(C) Radula with only one lateral; shell not markedly inflated below suture. (K) Shell with palatal tooth or with columellar fold strongly projecting into aperture. (I) Columellar fold weaker; anatomy unknown; type *S. blandi* (Crosse) from Los Roques: ..... sect. *Ravenia* Crosse (1873).
- I(H) Columellar fold strong. (J) Shell with internal parietal lamella; radula with 13 marginals; type *S. inusitatus* (C.B.A.) from Jamaica: ..... sect. *Spiraxis* s.s.
- J(I) Shell without internal parietal lamella; radula with 26 marginals; type *S. costulosus* C.B.A. from Jamaica: ..... sect. *Euspiraxis* Pfr. (1855).
- K(H) Shell without palatal tooth and with columella moderately sigmoid; radula with 28 marginals; type *S. terebella* (C.B.A.) from Jamaica: ..... sect. *Repressaxis*, new.

SPIRAXIS (MIRARADULA) SIMILARIS (Strebel & Pfeffer), new subgenus.

Because no authentic material of this species has been seen by me, the subgenus *Miraradula* is founded on *Neeaxa* (station 54) specimens, one of which is described below. It also occurs around Córdoba.

Shell (pl. 4, f. 6) turrite, silvery-white, translucent, finely ribbed. Whorls 8 (fig.) to 8.5, quite convex, often weakly shouldered, with deep, slightly crenulate suture. Embryonic whorls 2.5, quite rapidly widening; first almost smooth, second gradually assuming low, very closely spaced threads and last with widening interspaces. Later whorls quite short, gradually increasing, with thin riblets crested below suture, weakening basally and much narrower than interspaces, which are granulate-striate but without distinct spirals; first two (neanic) with about 31 riblets; third to fifth with 34-35 and last with 38. Aperture elliptic-trapezoidal; peristome simple, almost vertical and very obscurely and obliquely truncate. Alt. 5.06 mm., diam. 33 (1.65 mm.), alt. last whorl 40 (2.03 mm.); aperture alt. 24 (1.22 mm.), diam. 68 (0.83 mm.); 8 whorls.

Lung about 5 times as long as base or kidney length, which is as long as its base and  $1\frac{1}{4}$  times pericardial length. Ototestis (pl. 4, f. 8) complexly lobed. Penis large; internally (f. 7) with a pyramidal apical chamber with longitudinal, beaded folds on its walls; large basal chamber with a very heavy pilaster, which extends about 0.7 distance down one side and terminates in a large, apparently almost cartilaginous, partially free, subspherical enlargement, and with two minor longitudinal folds. Columellar retractor comparatively broad. Buccal mass big and ovoid (larger than in *S. acus enigmaticus*). Radula very large for a *Spiraxis* with formula (f. 9): 114-1-114, with 61 rows; central elongate, tricuspid; all other teeth bicuspid and similar in form, evenly spaced, with both cusps subequal and conical, until outermost teeth, with shorter and rarely subdivided outer cusp. Salivary glands broadly lanceolate, subequal, with combined volume smaller than buccal mass.

*Miraradula* appears to have the most primitive radula in the genus, which suggests that the form of columella in *Pseudosubulina* is derived from a fairly straight axis with a spiral twist, while the twist is simply accentuated in *Volutaxis*. *S. miradorensis* (S. & P.) is probably related but no living specimens were obtained.

*S. (RECTAXIS) INTERMEDIUS* (S. & P.).

Penis of animals from near Córdoba relatively smaller but otherwise similar to that in *S. similaris*. Radular formula: 13-1-(2+11), with 38 rows; central trienspid.

Radulae of three additional Mexican species have been examined.

*S. (VERSUTAXIS) OPEAS*, new subgenus and species.

Shell (pl. 3, f. 1) cylindric-turrite, whitish corneous, slightly translucent, with lightly incised growth-lines and polished interspaces. Whorls 7.5, moderately flattened with somewhat impressed suture. Apex relatively large; embryonic whorls  $2\frac{3}{4}$ , rapidly widening; first 1.7 almost smooth but last assuming sculpture of incised growth-lines that separate flattened threads. Later whorls gradually increasing, with sharp but shallow growth-lines that become weaker on base of last whorl; first (neanic) with 48; second with 50; third with 57; fourth with 55 and last with 33. Aperture ovate-trapezoidal with greatest dimensions  $30^\circ$  to shell-axis; peristome almost vertical, weakly arcuate; columella narrow but definitely twisted. Alt. 4.89, diam. 33 (1.63), alt. last whorl 45 (2.22); aperture alt. 28 (1.36), diam. 63 (0.86 mm.).

Above Necaxa (BD, I, a, 34), 5000 ft.; infrequent. *S. opeas* appears closest to *S. odiosus* (Pilsbry), but is smaller with more closely spaced growth-lines and more twisted, although nearly vertical columella. Four other Mexican species of *Versutaxis* have been dissected.

*S. (MIRAPEX) ACUS* (?) *ENIGMATICUS*, new subgenus and subspecies.

Shell (pl. 4, f. 1) subulate-turrite, greenish white, somewhat translucent, closely thread-costulate. Whorls 9.5, convex to flattened (last 2) with quite deep, weakly crenulate suture. Apex nipple-shaped; embryonic whorls 2.7 to 3, quite rapidly widening; first almost smooth with very weak spiral striae; last with 18 riblets. Later whorls gradually increasing, with low angular threads and progressively narrower, concave interspaces; spiral striae becoming obsolete; first (neanic) with 36 threads; second with 35; third with 38; fourth with 52; fifth with 61 and last with 58. Aperture truncate reniform, with long axis about  $40^\circ$  to shell-axis; peristome slightly thickened,  $20^\circ$  to shell-axis and very little arcuate; columella sigmoid, strongly thickened. Alt. 9.92, diam. 25 (2.57), alt. last whorl 34 (3.47); aperture alt. 19 (1.88), diam. 79 (1.49 mm.).

Ovotestis (f. 2) with few alveoli, which are often bifurcate. Free oviduct very long and slender, swollen apically. Radular formula: 16-1-(2+14), rows not counted.

Las Tortolas, Córdoba (D, I, a, 4), 2650 ft.; infrequent. Shuttleworth's description of *S. acus* is almost unrecognizable; *S. acus* (?) *enigmaticus* is considerably stouter than the dimensions given by him but he states that he was not sure of the size or the number of whorls. My form must have a much more arcuate columella than *S. tenuis* Pfr. Certainly, "var. *minor*" of Fischer et Crosse has little in common with any of these. The section *Mirapex*, with its change from widely spaced ribs on the last embryonic to close threads on the later whorls, reverses the usual tendency in *Spiraxis*.

S. (VOLUTAXIS) SULCIFERUS (Morelet).

Talon (pl. 4, f. 5) minute. One animal with large, white-shelled egg in free oviduct, which is equalled by vagina. Penis folded (in fig.) inside of a fusiform sheath. Radular formula (H.B.B., 1926): 17-1-(2+15).

My animals, found with typical shells near Córdoba, belong to the paedogenetoid form, which is apparently what Pfr. named *S. berendti* (not the type of *Pseudosubulina*). In addition, *S. tenuicostatus* (S. & P.), *S. nitidus* (S. & P.) and two new species have been dissected; also, *S. melanielloides* (Pfr.) from Cuba has the radular formula: 20-1-(2+18).

S. (PSEUDOSUBULINA) BERENDTI BERENDTI (Pfeiffer).

Lung (pl. 3, f. 10) of animals from Necaxa almost 6 times as long as base or kidney length, which is 1.5 times its base or pericardial length. Talon (f. 7) cylindrical. Penis internally (f. 8) with one very heavy and two smaller convoluted pilasters. Cerebral ganglia (f. 9) large, each longer than their commissure; labels same as in H.B.B., 1938, Zonitid snails from Pacific Islands, part 1, p. 92.

Besides the type of *Pseudosubulina*, 7 Mexican species have been dissected.

S. (MICROMENA) MINUTUS, new subgenus and species.

Shell (pl. 3, f. 2) turritate, silvery white, translucent, finely thread-costulate. Whorls about 6.5, flattened convex with deep, quite simple suture. Apex obtuse; embryonic whorls  $2\frac{1}{4}$ , rapidly

widening, almost smooth (weakly punctate) except on last half-whorl, which becomes closely striate. Later whorls quite short, gradually increasing, with fine thread-riblets, much narrower than interspaces and attenuate at both ends, and with prominent, continuous, spiral striae; first (neanic) with about 41 threads; second with 33; third with 35 and last with 39. Aperture about  $20^\circ$  to shell-axis, broadly ovate-trapezoidal; peristome almost vertical, slightly but distinctly arcuate; columella almost straight, tapering and scarcely truncate. Alt. 2.23 mm., diam. 39 (0.87). alt. last whorl 52 (1.16); aperture alt. 31 (0.69), diam. 64 (0.44 mm.).

Kidney (f. 3) U-shaped (*i.e.*, approaching that of *Punctum*); ureter along inside of curvature. Anal mantle-glands conspicuous. Ototestis (f. 4) weakly lobate. Vas deferens swollen to form a fusiform epiphalloid sac. Penis (f. 6) almost filled by an acuminate verge. Radular formula (f. 5): 31+1+31, with 33 rows; central relatively large; other teeth with two subequal, needle-shaped cusps.

Below *Necaxa* (D, III, a, 53), 3000 ft.; very common. *S. minutus* somewhat resembles *S. decussatus* (H.B.B.) from Venezuela, but has less shouldered whorls, is much smaller and has less prominent growth-threads, which do not crenulate the suture. In the subgenus *Micromena*, *S. problematicus* (Pils.) from Jamaica and a new Mexican species have also been dissected.

\*SPIRAXIS (DIGNAXIS) MIRABILIS (C. B. Adams), new subgenus.

Lung of animals from Somerset, Jamaica, similar to that of *S. anomalus*. Ototestis weakly lobed. Uterus with eggs or embryos. Penis simple; sheath easily separated. Radular formula (pl. 5, f. 5): 10-1-(4+6), with 39 rows; lateral field almost as wide as marginal.

*Dignaxis* is the most aberrant Jamaican section of *Spiraxis*.

\*S. (SPIRAXIS) INUSITATUS (C. B. Adams).

Lung of animals from Somerset similar to that of *S. anomalus*. Ototestis (pl. 5, f. 2) clavate; talon not distinct. Uterus with 4 embryos. Vas deferens swollen near entrance into penis, which internally shows longitudinal folds. Radular formula (f. 1): 14-1-(1+13), with 41 rows; needle cusps of marginals mediocre.

*Spiraxis* s.s. becomes monotypic, but the next group is very closely related.



\*S. (EUSPIRAXIS) ANOMALUS (C. B. Adams).

Lung (pl. 5, f. 3) over 6 times as long as its base or length of U-shaped kidney. Ovotestis consisting of several clavate lobules. Uterus with large, white-shelled eggs in some animals but with embryos surrounded by decalcified membranes in others. Apical half of penis internally with spiral ridges; basal half with transverse folds. Radula formula (f. 4) : 27-1-(1 + 26), with 37 rows; needle-cusps of marginals fairly short.

Typical specimens from near Catadupa have been dissected but the figures represent the race *hollandi* (Henderson) from Ipswich, Jamaica. The animal of the type of *Euspiraxis* is still unknown.

\*S. (REPRESSAXIS) TEREBELLA (C. B. Adams), new subgenus.

Animals from behind Kingston, Jamaica (KF) similar to those of *S. inusitatus*. Ovotestis with 2 lobes. Prostate much more reduced. Uterus containing 4 much larger embryos. Penis smaller and vas not enlarged. Radular formula (pl. 5, f. 6) : 29-1-(1 + 28), with 50 rows.

Although the shell of the section *Repressaxis* resembles that of *Versutaxis*, *S. terebella* is evidently most closely related to *S. anomalus*.

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## NEW MARINE MOLLUSKS FROM THE WEST ATLANTIC

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The identification of specimens sent to the United States National Museum for that purpose by correspondents makes it necessary to give a status to some undescribed forms which is here done.

ADRANA NOTABILIS, new species. Plate 6, figs. 4, 12.

Shell large, whitish (dead shells), compressed lanceolate, the beaks anterior to the middle slightly prominent, weakly arching the dorsal margin. The posterior part of the shell is attenuated and subrostrate, while the anterior portion of the shell is broader. A gradually broadening, weakly bipartite, shallow groove runs from the beaks to the anterior ventral angle, forming there a small

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