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NEW LAND SNAILS FROM EL SALVADOR

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Drs. Andrew Starrett, Priscilla H. Starrett, and Thomas M. Uzzell, Jr., assembled a moderate collection of land snails while collecting reptiles and amphibians in various Central American countries during June through August 1957. Their work was well rewarded with many new species, four of which are herein described. The collection is particularly valuable because many of the species are represented by animals preserved in alcohol.

Only a few localities in El Salvador were visited. Of particular interest was Hacienda Monte Cristo, Cerro de Monte Cristo, Metapán, Santa Ana. Collections were made at an elevation of about 2,200 meters on this mountain, which lies on the borders of El Salvador, Guatemala, and Honduras. At this elevation the mountain is covered with cloud forest, and is one of the few undisturbed natural areas in El Salvador. Collections were made from bromeliads and forest floor debris. Additional material was purchased from a native collector.

The success of the collectors' work in El Salvador was due to a large extent to Dr. Aristides Palacios, Director General of the Instituto Tropical de Investigaciones Científicas, at San Salvador, and to the staff of the institution. Dr. Palacios generously provided the collectors with quarters and transportation during their short stay in El Salvador.

I am grateful to Dr. Henry van der Schalie of the University of Michigan Museum of Zoology (UMMZ), Ann Arbor, Michigan, for providing me with the facilities of his division. I also wish to express my gratitude to Dr. Adolf Zilch of the Senchenbergische Naturforschende Gesellschaft (SMF), Frankfurt, a. M., Germany. Dr. Zilch has offered critical comments concerning this paper, and has allowed me to include material from his extensive collection from El Salvador.

TABLE 1.—Measurements of ten paratypes of *Amphicyclotus parvus*

HEIGHT	WIDTH	H/W RATIO	UMBILICUS	APERTURE	WHORLS
14.5	20.7	0.70	4.9	9.9	4⅝
13.0	18.7	0.69	4.0	8.7	4⅛
13.1	17.8	0.74	3.8	7.7	4⅝
12.0	17.0	0.70	3.6	7.5	4⅜
11.2	16.7	0.67	3.8	8.0	4⅜
11.7	16.5	0.71	3.6	7.7	4⅛
11.6	16.5	0.70	3.4	7.5	4⅛
11.0	16.5	0.67	3.5	7.8	4⅛
12.1	16.4	0.74	3.0	7.8	4⅛
11.0	16.2	0.68	3.3	7.2	4⅜

The color nomenclature is taken from Ridgway (1912). Measurements of all specimens are in millimeters.

Amphicyclotus parvus, new species
(Plate II, figs. 4–7)

Shell helicoid, thin, covered with a sulphine yellow periostracum; spire low, conical; umbilicus large, open; 4⅝–4¾ whorls; 1¼ embryonic whorls, smooth (corroded in adults); following whorls crossed by fine axial ribs, which progressively grow stronger and more irregular, until on the last whorl they become vermiculated; vermiculations extending from suture into umbilicus and usually most distinct on dorsal and peripheral sides of last whorl; vermiculations lost near umbilicus and lip in larger specimens; vermiculated ribs in turn crossed by numerous fine, incised spiral lines which are broken into short segments on each rib, discernible only on last whorl; suture deeply impressed, descending slightly to the aperture; lip simple, sharp; aperture ovate, slightly or not at all indented by last whorl; peristome thin, slightly convex; inside of aperture bluish white.

Operculum corneous, circular, and consisting of about six whorls; suture on outside distinct and coarse; nucleus sunken, surface of attachment smooth and glossy; area directly behind nucleus elevated into a low circular plate with its center raised into a small conical point.

Measurements of type: Height, 12.2; width, 19.3; height of aperture, 8.7; width of aperture, 8.8; width of umbilicus, 4.5; 4⅝ whorls.

Type: UMMZ 195882; Hacienda Monte Cristo, Metapán, Santa Ana, El Salvador, 2,200 meters altitude; collected 6 July 1957, by Andrew Starrett, Priscilla H. Starrett, and Thomas M. Uzzell, Jr.

Paratypes: UMMZ 195881 (35), SMF 101151–6 (120); same locality as the type.

A. parvus is similar in shell characters to *A. texturatus* (Sowerby), *A. t. goldfusi* (Boettger) and *A. boucardi* (Pfeiffer). It differs from these

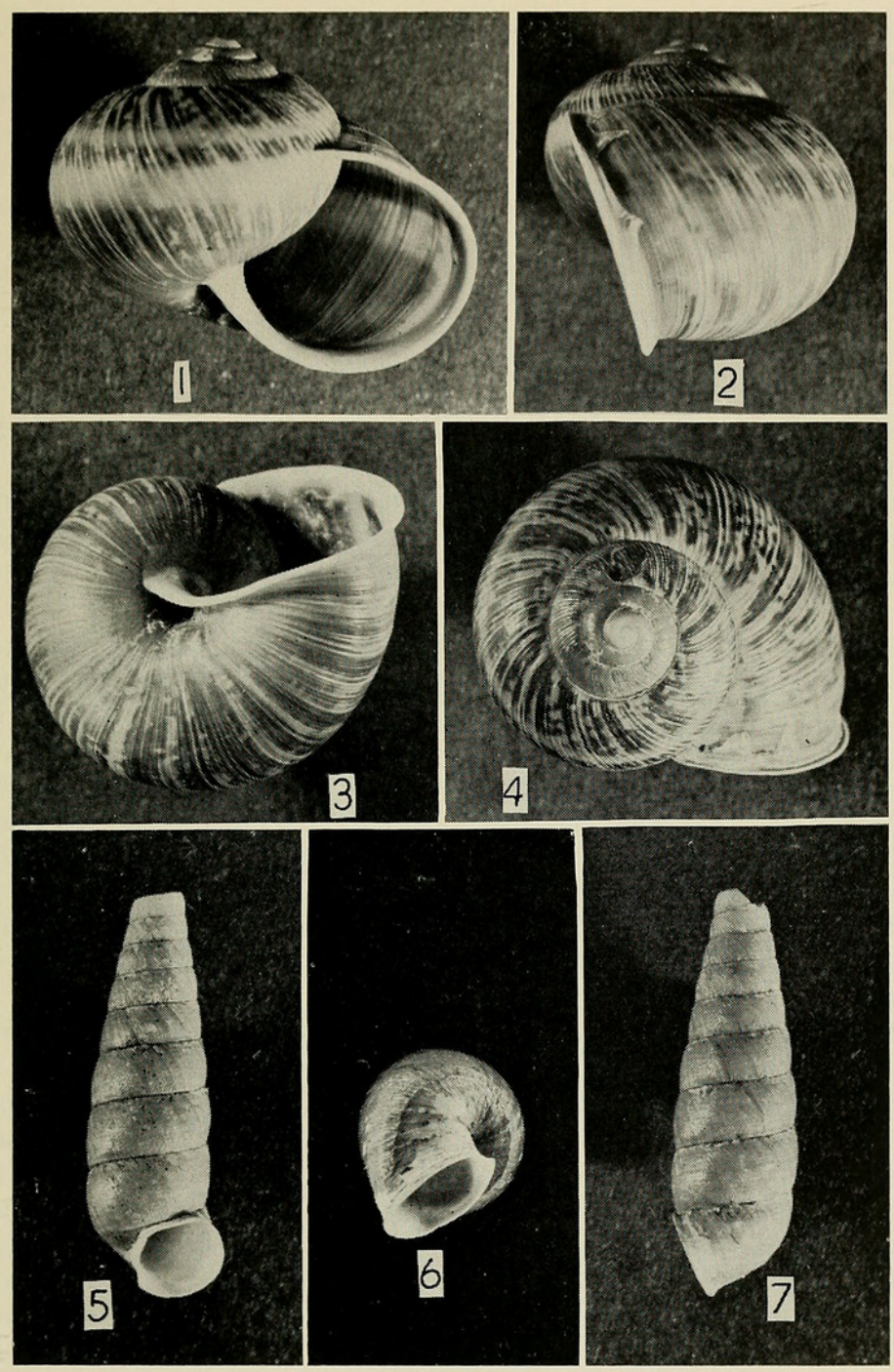

PLATE I

FIGS. 1–4. Type of *Lysinoe starretti*, new species, UMMZ 195327; Figs. 5–7, paratype of *Eucalodium australis*, new species, UMMZ 195762.

species by its much smaller size. It is also distinguished from *A. texturatus* and A. *t. goldfusi* by its more elevated spire and its sculpture. The vermiculated ribs of *A. parvus* are much finer, and are reduced in texture or absent on the underside of the last whorl and near the lip. In *A. texturatus*

and *A. t. goldfusi* the vermiculations are much more distinct over the whole shell, and are continuous into the umbilicus and to the edge of the lip.

Besides its small size, *A. parvus* is distinguished from *A. boucardi* as follows. In *A. parvus* the size of the whorls increases more rapidly, and the umbilicus is proportionately smaller. The spiral sculpture of *A. boucardi* is heavier and more deeply incised, and the vermiculations are continuous over the surface of the shell.

A. parvus is so named because of its small size.

Streptostyla propinqua, new species
(Plate II, figs. 1–3)

Shell cylindric-oblong, solid, subpellucid, amber yellow, glossy, with weak growth lines; spire elevated, conoidal, moderately long, obtuse at the apex; whorls 5½, slightly convex, nearly flattened, margined at the suture; the first whorl slightly wider at its termination then the second whorl at the point directly below it; remaining whorls regularly increasing in size to the last whorl, which, in its last ¾ turn, descends more rapidly; last whorl cylindric; suture slightly impressed; aperture narrowly auriform, dilated at the base; outer lip slightly impressed in the center, strongly arched forward in the middle, retracted below and above; lip slightly recurved at suture; columella moderately twisted, calloused, narrow in front view and only a little wider as seen in profile; parietal callus thin, white.

Measurements of type: Height, 14.9; width, 6.9; height of aperture, 8.4.

Measurements of two paratypes (SMF): Height, 14.8, 17.4; width, 6.5, 7.2; height of aperture, 8.9, 9.4.

Type: UMMZ 195760; Hacienda Monte Cristo, Metapán, Santa Ana, El Salvador, 2,200 meters altitude; collected 6 July 1957, by Andrew Starrett, Priscilla H. Starrett, and Thomas M. Uzzell, Jr.

Paratypes: UMMZ 195761 (1), SMF 101157 (2); same locality as the type.

S. propinqua is most similar to *S. sololensis* Crosse and Fischer. It differs from that species in five ways: (1) it is more obese, (2) the auriform aperture is wider, (3) the lip is not as strongly impressed, (4) the anteriorly arched portion of the lip is wider, and (5) the columella is weaker and less strongly twisted. *S. propinqua* also resembles *S. meridana* (Morelet) and *S. yucatanensis* Pilsbry. It can readily be separated from these species by its larger size, and its more rapidly descending last whorl.

The name *propinqua* alludes to the similarity of this species to *S. sololensis*.

Eucalodium australis, new species
(Fig. 2, A–E; Plate I, figs. 5–7)

Shell cylindric-tapering, arcuate-rimate, imperforate, solid, moderately thick, decollate, 6¼–8⅛ whorls remaining; whorls slightly convex and regularly increasing in size; internal pillar slender and slightly sigmoid; no internal lamella present; last whorl with or without a fine, sharp angle which lies below periphery and continuous with suture; aperture extending

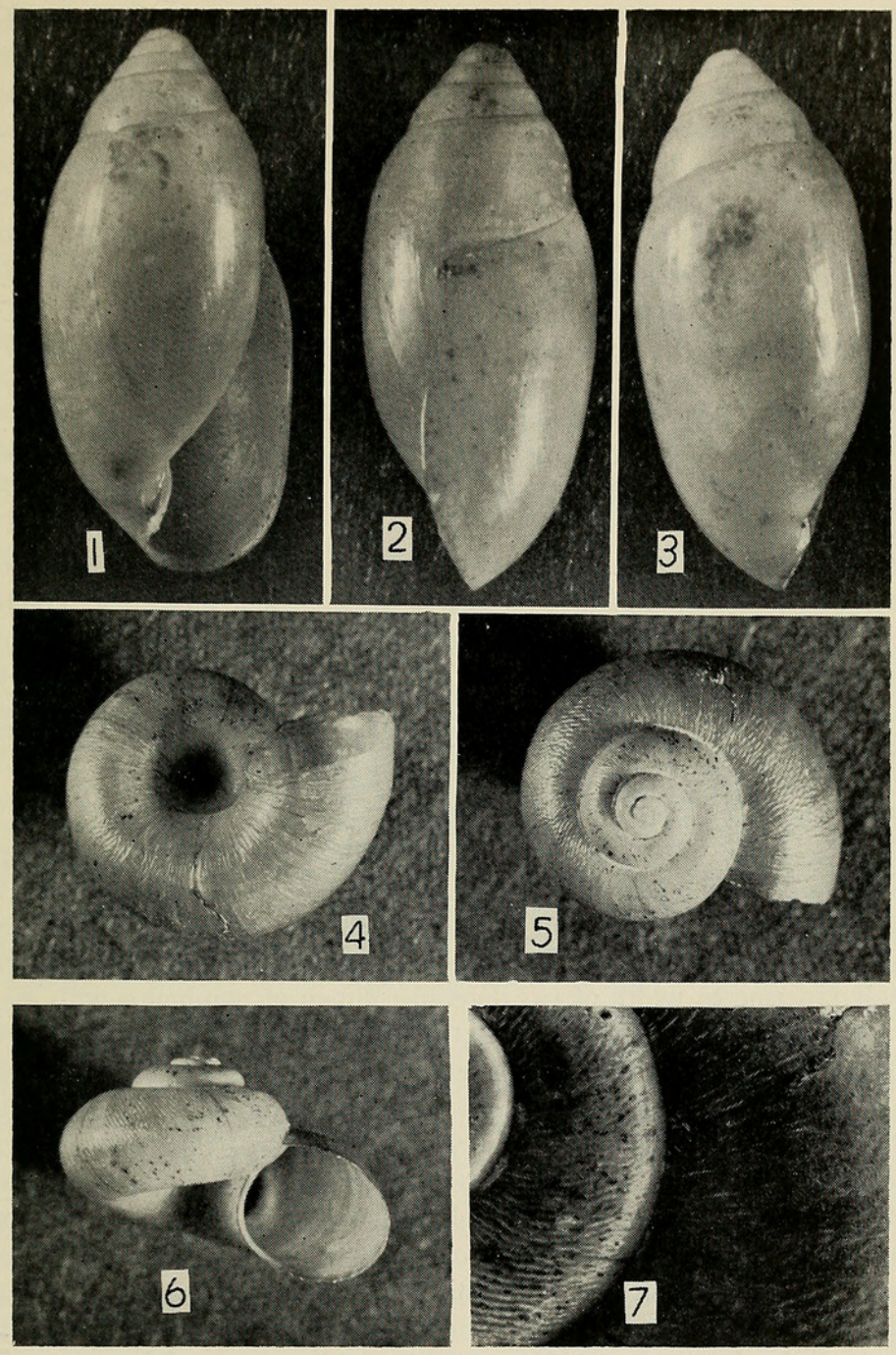

PLATE II

FIGS. 1–3. Type of *Streptostyla propinqua*, new species, UMMZ 195760; Figs. 4–7, type of *Amphicyclotus parvus*, new species, UMMZ 195882.

only slightly or not at all beyond margin of previous whorl; lip thick, rounded, reflected; surface of whorls somewhat glossy, with numerous close, distinct, slightly arched riblets; last whorl with 146 riblets; riblets on earlier whorls very distinct, heavy and continuous across whorls; riblets on later whorls lower in center of whorl than at margins, and on last whorl

they occasionally become indistinct in center of whorl; intervals between riblets wider than individual riblets, and without sculpture paralleling riblets; in addition to riblets, the whorls bear several irregularly spaced spiral threads; threads generally higher than riblets, though not as broad; threads on early whorls vaguely discernible, becoming more distinct on later whorls.

Ground color snuff brown; interspaces between riblets slightly lighter than riblets; several fine, light colored spiral lines accompany the spiral threads; inside of aperture and columella livid white.

Measurements of type: Height, 33.1; width, 11.3; height of aperture, 7.9; width of aperture, 7.9, 7 whorls remaining.

Type: SMF 161266; Hacienda Monte Cristo, Metapán, Santa Ana, El Salvador, 2,350 meters altitude, collected by Adolf Zilch, 27 August 1951.

Paratypes: SMF 101158–60 (31); UMMZ 195762–3 (6); same locality as the type.

Radula: See Fig. 2, D. Radular formula ($C \frac{1}{1} L \frac{1\,3}{2} M \frac{1\,4}{1-3}$) 116; central tooth relatively long and slender with a large, slender mesocone, which is flanked on both sides by a buttress; lateral teeth with a short, broad entocone, and a much larger mesocone, which increases in size toward the marginals; first two marginal teeth both with two small entocones as well as an enlarged mesocone; remaining marginals very irregular in size, shape and structure, their cusps too irregular to be determined.

Reproductive system: See Fig. 2, B–C. Genital atrium slender, about 3.0 mm long; penis short and stout, about twice as long as wide, its upper limits marked by a slight constriction; a small, simple bulbous verge extends into penial cavity; wall of penis with four large, fleshy pilasters, which continue through the penis; epiphallus rapidly expanding, and then slowly tapering to width of vas deferens; lumen of epiphallus with seven nearly equal longitudinal folds, length of epiphallus about 3.0 mm; penial retractor muscle long and slender, attaching to inner wall of lung, 8 mm long; vas deferens very long and slender, extending considerably beyond epiphallus and doubling back to atrium where it attaches to vagina with fine bands of muscle, and continues to prostate; length of vas deferens, about 40 mm; vagina about 9 mm long, bulbous at first, becoming very slender above spermathecal duct; uterus and prostate tightly appressed throughout their length to albumen gland, which is a relatively small, finger-shaped structure; highly convoluted hermaphroditic duct leaving albumen gland near its middle; ovotestes tri-lobed; two lobes are small, round, and of nearly equal size; remaining lobe much larger and elongate; spermatheca small and sausage-shaped, with a long, stout duct; a long, narrow, tubular, convoluted appendix arises from spermathecal duct shortly above vagina, and lies connected to side of duct by a thin membrane; spermathecal duct, 24 mm long; spermatheca, 3 mm long; appendix, 13 mm long.

Retractor muscles: Free retractor muscles similar to those of *E. blandianum* as described by Strebel (1880: 66); columellar muscle has the usual

TABLE 2.—Measurements of twelve paratypes of *Eucalodium australis*

HEIGHT	WIDTH	APERTURE HEIGHT	APERTURE WIDTH	WHORLS
40.0	12.2	8.8	8.6	8⅜
38.6	12.2	8.2	8.1	7⅜
37.6	11.8	7.8	7.9	6⅛
37.4	12.2	8.8	8.6	7⅜
37.1	12.1	8.6	8.6	6⅜
37.1	11.1	8.4	8.1	8⅜
36.5	12.2	8.2	8.3	7⅜
35.4	11.1	8.0	7.5	6⅝
34.5	11.6	8.0	8.0	6⅞
33.9	11.0	7.8	7.4	7⅜
33.6	11.3	7.8	7.7	6⅛
33.4	11.6	7.9	7.8	6⅛

distal insertion on posterior integument of mantle and gives off three bands in the following order: (1) pharyngeal retractor, (2) left pedal retractor, and (3) right pedal retractor; right and left ocular retractors attach to corresponding pedal retractors; ocular retractors each give off a branch which connect to form a muscular plate over pharynx.

Pallial organs: See Fig. 2, A. Lung long and slender, about 50 mm long and 6 mm wide; kidney long (46 mm), narrow and curved, about twice as wide at its base as at its distal end, sigmourethrous; primary ureter originates at distal end of kidney, and borders it at its base, tightly adhered to kidney; secondary ureter becoming much broader, narrowing again before reaching mantle collar, lying on and slightly below middle of rectum; rectum and ureter open between two folds of mantle collar; each inner surface of these two folds is impressed with three narrow winding grooves; pneumostome with two small lunar valves, forming two channels, one which passes between the two valves, and one which passes between the outer valve and the underside of the mantle folds; pericardium bordering inner margin of kidney, slightly more than half length of kidney (26 mm); auricle about one-half size of ventricle; a single long artery leads from heart to mantle collar, about half distance from collar becoming convoluted and loosely attached.

The anatomy of only two other species of *Eucalodium* has been described. Strebel (1880: 66) described the soft parts of *E. blandianum,* and Fischer and Crosse (1878: 355–360) described those of *E. ghiesbreghti.* Pilsbry (1903: 1–2) summarized these two accounts. The most characteristic anatomical feature of this genus is the union of the branches of the ocular retractor muscles to form a plate over the pharynx.

Essentially, the anatomy of *E. australis* is like that of the other two species, except that no investigator mentioned the presence of an appendix on the spermathecal duct, nor do their figures illustrate one. This structure

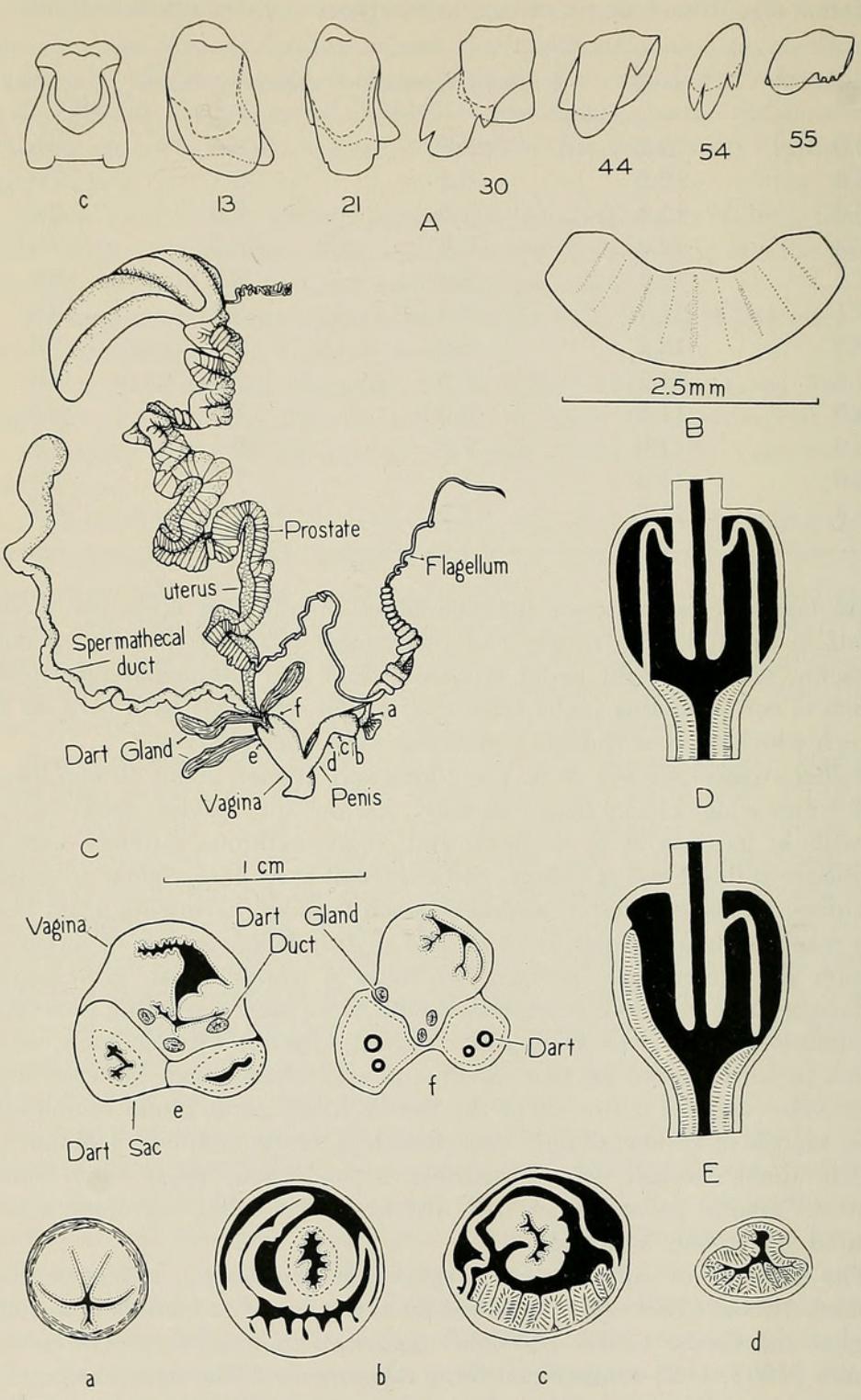

FIG. 1. Soft parts of *Lysinoe starretti*, new species. A, Radula (c, central tooth; 13, lateral tooth; 21, 30, 44, 54, 55, marginal teeth); B, jaw; C, reproductive system; D, E, diagrammatic reconstruction of penis; a, b, cross sections through penis; e, f, cross sections through vagina.

was found in *Holospira nelsoni* by Pilsbry (1903: 71), and I have found it in four species of *Bostrichocentrum* (in press).

E. australis is readily distinguished by its sculpture. Its relationships are obscure, although it apparently belongs to the *splendidum* group as defined by Pilsbry (1903: 8, 13–19). The shell does not suggest closer relationship to one species than to another. Martens (1897: 269) described two urocoptid snails from southwestern Guatemala as *Coelocentrum championi* and *C. clathratum*. Although both species apparently possess the hollow axis that characterizes *Coelocentrum*, other features of the shell more strongly resemble *Eucalodium*. The axis of *C. championi* as illustrated by Pilsbry (1903: pl. 9, fig. 14) is very similar in shape and structure to that of *E. australis*. Until the anatomy of *championi* and *clathratum* is examined, it seems best to provisionally retain them in the genus *Coelocentrum*.

The name *australis* is proposed for this species because it is the southernmost known member of the genus *Eucalodium*.

Lysinoe starretti, new species
(Fig. 1, A–E, a–f; Plate I, figs. 1–4)

Shell globose, relatively thin; spire raised, obtuse, forming an angle of about 120°; whorls 4¾, globular, shouldered, rapidly increasing in size, heavily, irregularly and closely wrinkled, wrinkles equal to or narrower than their intervals, posteriorly arched and continuous into umbilicus; wrinkles and interspaces with numerous small granules, which become elongate and indistinct on last half of last whorl; granules continuous into umbilicus where they become finer and sparser; embryonic whorls 2¼, moderately large, raised, crossed by fine, slightly incised lines which slant backward; suture moderately impressed, descending slightly to aperture, which is large and ovate, lying at an angle of about 30° to axis of shell, lip reflected and rounded, originating at lower edge of second color band of preceding whorl; directly behind lip there is a slightly impressed groove which continues into umbilicus; columellar margin reflected, half concealing umbilicus; parietal callus thin, finely granular.

Ground color mars yellow with four black bands; first band lies above periphery of whorl; second band very close to first (in mature specimens the zone that separates these two bands may become obscured so that first two bands may appear as a single dark zone); third band generally the narrowest, separated from second band by a light zone nearly twice as wide as that which separates preceding two bands; fourth band widest of all, separated from third band by a wide peripheral light zone; between fourth band and umbilicus is a wide dark zone, which in immature shells appears to be a very wide fifth band; ground color and banding obscured by color of growth wrinkles which are generally streaked with aniline yellow. This color also occurs in patches and flecks between the wrinkles; embryonic whorls cinnamon rufous; lip and interior of aperture livid brown; parietal callus tinted with same color, but is so thin that color pattern of preceding whorl shows through.

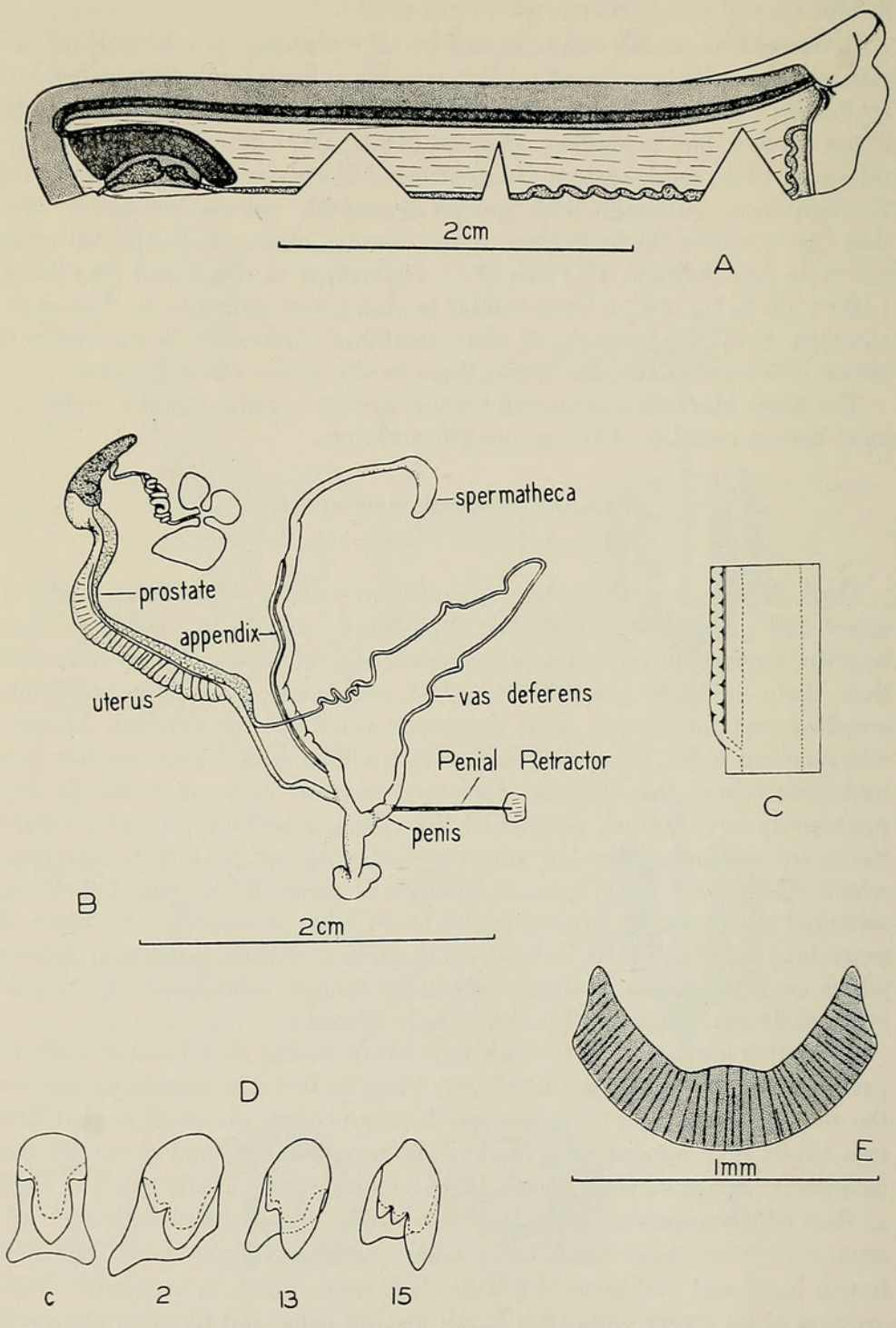

FIG. 2. Soft parts of *Eucalodium australis*, new species. A, Pallial organs; B, reproductive system; C, enlarged section of spermathecal duct and associated appendix, diagrammatical reconstruction; D, radula (c, central tooth; 2, 13, lateral teeth; 15, marginal tooth); E, jaw.

Measurements of type: Height, 31.7; width, 41.8; height of aperture, 25.0.

Measurements of two paratypes: Height, 31.8, 35.0; width, 38.9, 45.3; height of aperture, 23.5, 24.7.

Type: UMMZ 195327; Hacienda Monte Cristo, Metapán, Santa Ana, El Salvador, 2,200 meters altitude; collected 6 July 1957, by Andrew Starrett.

Paratypes: UMMZ 195326 (2), UMMZ 195328 (1), SMF 89593–4 (8); same locality as type.

Jaw: See Fig. 1, B. Large, solid, with five moderate grooves and several smaller grooves alternating with these; numerous fine striations crossing grooves and extending length of jaw. In cross section the face surface is straight, and the surface of attachment is moderately arched.

Radula: See Fig. 1, A. Radular formula ($C \frac{1}{1} L \frac{1\,9}{1} M \frac{2\,3}{3} + \frac{1\,3}{2-4}$) 86; central higher than wide, with a single broad mescone; lateral teeth with a single broad mesocone; length of this cone successively increasing to 13th tooth; first marginal marked by appearance of an ectocone and an entocone; remaining marginals acquire and lose cusps quite freely, except for last marginal which appears to have no cusps.

Reproductive system: See Fig. 1, C–E, a–f. Penis and vagina unite near body wall, penis small and club-shaped about 12 mm long; internal structure complex, verge extending into lumen of penis; end of verge unipartite, impressed with two shallow winding grooves which begin at end of verge and continue for a third of its length; several smaller grooves present between these; a partition of muscular tissue extends from opposite sides of penis to top of verge, partition folded in a sigmoid curve one-fourth of distance down from top of penial chamber, and continues as a wall through penial chamber to end of verge; an opening is present at bottom of partition so that chamber formed by partition is continuous with lower portion of lumen of penis (Fig. 1, D, E, b–d); side of penial lumen opposite partition with six longitudinal glandular columns, which begin near top of lumen and continue to vagina (Fig. 1, b–d, E); at bottom of partition additional glandular columns appear and also continue to vagina (Fig. 1, d, E). Penis terminated by a long epiphallus; lumen of epiphallus with five large folds and five smaller folds alternating with these, folds surrounded by a thick layer of muscular tissue (Fig. 1, a); epiphallus and flagellum continuous, tightly coiled a short distance from penis to form a long springlike structure around vas deferens; first six coils formed by epiphallus; remaining 4–6 coils formed by flagellum; after forming coils flagellum becomes a long, loosely convoluted appendage about 25 mm in length; from base of flagellum vas deferens passes down through center of coils formed by epiphallus, and continues along penis to atrium, and up along and encircling female system to prostate. Penial retractor muscle short and wide, about 5 mm long;

originating on epiphallus and attaches to lung wall; and additional long slender muscle passes through center of coils formed by epiphallus and flagellum; it originates on genital atrium and extends slightly beyond last coil of flagellum, where it attaches to that structure. Vagina short and stout, about 10 mm long, with two dart sacs; each dart sac contains two unequal darts which have a common opening into vagina (Fig. 1, f); there are three long club-shaped dart glands slightly above point of origin of dart sacs; two dart glands enter between dart sacs; third gland originates behind left dart sac; within wall of vagina ducts of dart glands which enter between dart sacs diverge so that openings of all three glands become equally spaced (Fig. 1, e), and open into deep grooves extending from lumen of vagina; uterus and prostate closely appressed, long; albumen gland large and lunar shaped, with two deeply impressed grooves formed by sigmoid loop of intestine; hermaphroditic duct entering albumen gland near its base; ovotestis lost during dissection. Spermathecal duct originating on vagina opposite dart sacs, about 75 mm long, terminated by a large bulbous spermatheca about 10 mm long.

Retractor muscles: Columellar muscle extending a distance of one whorl into shell, tripartite; pharyngeal retractor narrowest; left ocular retractor attaching to underside of left pedal retractor; right ocular retractor passes through atrium of vagina and penis, and attaches to right margin of pharyngeal retractor.

Pallial organs: Length of lung about 2⅓ times width of its base, and about twice length of kidney; aereated surface supplied by a heavy network of arteries and veins; pericardium about one-half length of kidney and overlaps kidney internally; auricle about one-fourth size of ventricle; kidney irregularly trapezoidal, about five times as long as wide, sigmourethrous; primary ureter slightly larger than secondary ureter, which drains through a groove in right corner of pneumostome; mantle collar wide and thick, heavily pigmented with black; mantle marked with numerous spots which are particularly concentrated along secondary ureter and collar.

Fischer and Crosse (1878: 206–211) superficially described the anatomy of *Lysinoe ghiesbreghti* and *L. eximia*. On the basis of anatomical and conchological characters, *L. starretti* is most closely related to *L. eximia*. Both species have a short spermathecal duct as compared to the much longer duct of *L. ghiesbreghti*. Conchological similarities between *L. eximia* and *L. starretti* are (1) size of shell, (2) size of embryonic whorls, and (3) width of umbilicus.

L. starretti differs from *L. eximia* in several characters. The color pattern of *L. eximia* consists of five unequal dark bands on a lighter background. *L. starretti* has homologous bands, but they are obscured by the aniline yellow streaks and specks on the growth wrinkles. The interior of the aperture of *L. eximia* is white, while that of *L. starretti* is livid brown. The shell of *L. eximia* is thick and solid; *L. starretti* is thinner and considerably more fragile. In *L. eximia* the growth wrinkles are finer and

more sparse, and the granules are more numerous, much larger and more distinct than they are in *L. starretti.*

I take pleasure in naming this species after Dr. Andrew Starrett, who collected the type.

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