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OF THE GENERA *COELOSTEMMA*
AND *METASTOMA* (UROCOPTIDAE)

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SOME MEXICAN LAND SNAILS
OF THE GENERA *COELOSTEMMA*
AND *METASTOMA* (UROCOPTIDAE)

FRED G. THOMPSON¹

SYNOPSIS: The following new taxa are described: *C. leucostoma* n. sp., *C. bembix* n. sp., *C. eclipses* n. sp., *C. anacasta* n. sp., *C. richardi* n. sp., *C. notogastor* n. sp., *C. astraxis* n. sp., *C. fornax* n. sp. and *C. fornax* ix n. ssp. Two new subgenera are also proposed: *Crycoryne* n. subg. (type species: *C. astraxis*) and *Styloptyx* n. subg. (type species: *C. fornax*). *C. antricola* Bartsch is reduced to subspecific status as *C. bourgeoisana antricola*. *C. amplexis* Pilsbry, type species of the subgenus *Apertaxis*, is synonymized with *C. coahuilensis* (Bartsch). *Metastoma* is elevated from a subgenus of *Holospira* to generic status and is closely related to *Coelostemma*. Aspects of the embryonic sculpture are determined for *C. elizabethae* (Pilsbry), *C. b. bourgeoisana* Bartsch, *C. b. antricola* Bartsch, *C. igualaensis* (Bartsch), *C. hazelae* Pilsbry, *C. fusca* (Martens), *C. coahuilensis* (Bartsch) and *Metastoma roemeri* (Pfeiffer). These are features omitted in earlier descriptions of these species.

INTRODUCTION

This is a preliminary report on some Mexican land snails of the genus *Coelostemma*. Discussions of their anatomies will be presented in a forthcoming paper on the phylogeny of the Mexican Urocoptidae. The descriptions of some new species of *Coelostemma* from southern Mexico require a review of the status of *Metastoma*.

Coelostemma belongs to the Holospirinae, a subfamily confined to Mexico, the southwestern United States, and a small area in Guatemala. About 17 genera and subgenera are recognized throughout this region, and undoubtedly additions will be made when the more poorly known

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parts of Mexico are further explored. The genera and subgenera are difficult to define, because their distinctions are based upon shell characters, some of which may be polyphyletic in derivation. *Coelostemma* is recognized by its enlarged hollow axis. This character occurs in two other genera, *Metastoma* and *Allocoryphe*, and close relationships may exist between these groups.

ACKNOWLEDGEMENTS

During the course of this study I have been aided by several people who have given me critical assistance. Angela Crane, British Museum (Natural History), provided me with measurements and photographs of the type series of *Holospira fusca* Martens, which were necessary to restrict the name among two species in the type series. Joseph Rosewater, U.S. National Museum (USNM), loaned me the type series of *Epirobia coahuilensis* Bartsch so that aspects of its embryonic sculpture could be determined. Gonzalo Halffter, Instituto Politecnico Nacional, Mexico, sent me specimens of great interest and facilitated my field work through the assistance and courtesies of his office. Field work in Mexico was conducted with a collecting permit issued through the office of Rodolfo Hernandez Corzo, Direccion General de La Fauna Silvestre, Mexico. To all of these people I am grateful. Most of the material studied is deposited in the Florida State Museum collections, University of Florida (UF).

Genus *Coelostemma* Dall

Coelostemma Dall, 1895; Nautilus, 9: 50.- Pilsbry, 1900; Man. Conch., II, 15: 98-99.- Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58.- Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 156. (Type species by original designation: *Holospira elizabethae* Pilsbry, 1889).
Megaxis Pilsbry, 1946; Land Moll. N. Amer., 11(1): 123. (Type species by original designation: *Holospira fusca* Martens, 1897).

The shell is dextral, cylindroid in shape, bears a large hollow axis and lacks any lamella within the aperture. Lamellae or other sculpture may be present on the axis.

Coelostemma consists of four subgenera. The typical and most widely distributed subgenus has minute granular sculpture on the first two embryonic whorls followed by fine vertical ribs on the last half embryonic whorl. The second subgenus, *Apertaxis*, has only fine granular sculpture on the embryonic whorls. The two remaining subgenera have smooth embryonic whorls. They are localized in the same general region in north central Mexico and probably have a common origin from a single *Coelostemma* ancestry.

Coelostemma is most closely related to *Metastoma*. The large hollow axis occurring in both genera contrasts strongly with the narrower,

barely perforate axis of most other Holospirinae. This expanded axial condition is approached in some species of the *Holospira* subgenus *Allocoryphe*, but whether a close relationship exists between *Coelostemma* and *Allocoryphe* is uncertain. The phylogenetic relationships within *Holospira* s. l. and *Coelostemma* are poorly established, and only extensive field work in Mexico will clarify the relationships.

Subgenus *Coelostemma* Dall

The typical subgenus has about two embryonic whorls that are sculptured with minute granules, which on the last $\frac{1}{4}$ embryonic whorl are replaced by fine vertical threads or riblets. The axis is either smooth or has fine vertical threads and may bear a spiral swelling just above the floor of the whorls.

The center of evolution of *Coelostemma* (s. s.) is in southern Mexico, primarily in Guerrero, Oaxaca, and Morelos. It probably will be found extensively in Puebla and Michoacan with some species occurring in adjacent regions of Veracruz and Colima. My field experiences indicate the subgenus probably does not extend south of central Oaxaca.

Some species from northern Mexico are also referred to *Coelostemma* (s. s.). Two species, *C. marrsi* Drake, 1951 and *C. reiteri* Drake, 1951, are known only from broken shells denuded of embryonic whorls, and their subgeneric allocation cannot be determined by embryonic sculpture. The axis of *C. greggi* Drake, 1951 is very narrow, and the species herein is placed in *Haplocion* Pilsbry, 1902. These three species are from Chihuahua. *C. freytagi* Bartsch, 1950, also from Chihuahua, *C. dalli* Pilsbry, 1902 and *C. saltillensis* Pilsbry, 1953 from Coahuila and *C. lissocentrum* Pilsbry, 1953 from Nuevo León are described as being typical for *Coelostemma* (s. s.). Details of the embryonic sculpture for the last three species need to be confirmed.

Coelostemma (s. s.) consists of five or more groups of species, four of which are readily defined while others are less clearly delimited because of limited material from southern Mexico. The typical group, consisting of *C. elizabethae* and some other species from Guerrero and Oaxaca, has fine, oblique riblets on the axis and an opaque, livid-white shell of moderate or large size. A second group, consisting of *C. hazelae* and two new species, has a smooth axis but is similar in other respects to the typical section. A third group, consisting of *C. bourgeoisana* and its allies, has the fine, oblique ribs on the axis broken into serrations and granules. Another group of small brownish species from Oaxaca (*C. richardi* and *C. notogastor*) has oblique riblets on the axis such as occurs in *C. elizabethae*, but the snails' small size and their color pre-

sent an appearance that is quite different from other species groups. Two other species, both of which have smooth axes, are similar in appearance to this group and probably are derived from it.

Coelostemma elizabethae (Pilsbry)

Holospira elizabethae Pilsbry, 1889; Proc. Acad. Nat. Sci. Phila.: 81; pl. 3, figs. 1-5.- Crosse, 1892; Jour. de Conchyliologie: 272; pl. 5, figs. 6-6a.- Martens, 1897; Biol. Cent. Amer.: 635.- Pilsbry, 1903; Man. Conch., II, 15: 99-100; pl. 15, figs. 6-15; pl. 27, fig. 27. (Type locality: Amula, Guerrero).

Holospira (Coelostemma) elizabethae Pilsbry, Dall, 1895; Naut., 9: 50.- Dall, 1895; Proc. U. S. Nat. Mus., 19: 347.- Bartsch, 1906; Proc. U. S. Nat. Mus., 31: 149.

Coelostemma elizabethae (Pilsbry), Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58.

Holospira claviformis von Martens, 1897; Biol. Cent. Amer.: 277; pl. 16, figs. 10-16. (Type locality: Amula, Guerrero).

This species was collected from three places near the type locality. The samples show no variation not encompassed in earlier descriptions by Pilsbry (1889, 1902). The embryonic whorls are low and are separated by a relatively weakly-impressed suture. The first two or so embryonic whorls are sculptured with fine granules. The following quarter whorl bears fine axial ribs that begin along the upper suture, become increasingly intense, and grade into the coarser sculpture of the following post-embryonic whorl (Fig. 1, A).

SPECIMENS EXAMINED.—GUERRERO:—11.2 mi. E of Tixtla, 6500 ft. elev. (UF 20819); 7.7 mi. WSW of Chilapa, 6400 ft. elev. (UF 20820); 2.3 mi. WSW of Chilapa, 5300 ft. elev. (UF 20818).

Coelostemma iqualaensis (Bartsch)

Holospira (Coelostemma) iqualaensis Bartsch, 1926; Proc. U. S. Nat. Mus., 70: 3-4; pl. 1, fig. 12. (Type locality: Iquala [Iguala], Guerrero).

Coelostemma iqualaensis (Bartsch), Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58.

The material listed herein was collected from two localities that lie about 25 miles apart. Both samples demonstrate considerable intra population variation in shell dimensions (Table 1).

The specimen illustrated (Fig. 1, F) has stronger vertical riblets on the embryonic whorls than is usual. The sculpturing is normal in all other aspects.

SPECIMENS EXAMINED.—GUERRERO:—7.7 mi. N of Tonalapa, 3400 ft. elev. (UF 20998); 5.5 mi. SW of Buenavista de Cuéllar, 4100 ft. elev. (UF 20999).

TABLE 1. MEASUREMENTS (in mm) OF TWO POPULATION SAMPLES OF *C. igualaensis*.

Number	Length	Width	Aper. H.	Aper. W.	Whorls
20998 (24)	19.1-29.0	6.8-7.9	4.3-4.8	4.2-4.5	16.8-21.9
20999 (40)	18.9-25.2	5.8-7.7	4.0-4.5	4.0-4.8	15.7-19.1

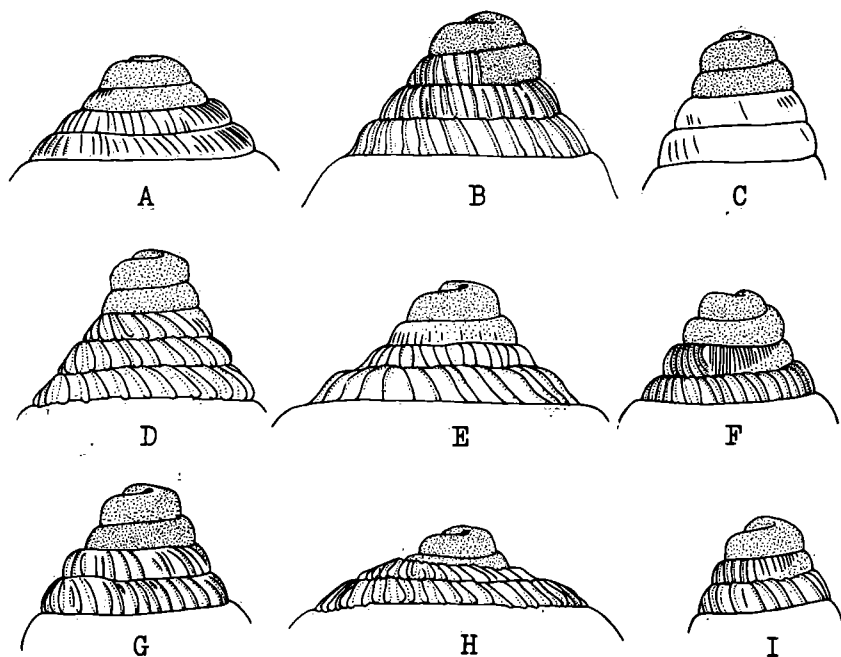


FIGURE 1. Apical sculpture of *Coelostemma*. A. *C. elizabethae* (Pilsbry) (UF 20891). B. *C. eclipses* new species (holotype). C. *C. fusca* (Martens) (UF 20916). D. *C. anaclasta* new species (holotype). E. *C. bembix* new species (paratype). F. *C. igualaensis* (Bartsch) (UF 20999). G. *C. notogastor* new species (paratype). H. *C. richardi* new species (paratype). I. *C. leucostoma* new species (holotype).

Coelostemma bourgeoisana bourgeoisana Bartsch

Coelostemma bourgeoisana Bartsch, 1942; Jour. Wash. Acad. Sci., 32: 187; fig. 1.-1943; *ibid*, 33: 58. (Type locality: Ixtapan de la Sal, Mexico).

This snail is common on limestone terrain about the type locality and is a local variation of the more widely distributed *atricola*, with which all parameters of the shell intergrade (Table 2). Aspects of the embryonic sculpture of both subspecies are similar to those of *C. igualaensis* and other species from southern Mexico.

TABLE 2. MEASUREMENTS (in mm) OF FOUR POPULATION SAMPLES OF
C. bourgeoisana.

Subspecies	No.	Length	Width	Aper. H.	Aper. W.	Whorls
<i>bourgeoisana</i>	21147 (136)	12.6-20.0	4.3-5.6	2.8-3.6	3.1-3.7	13.4-17.5
<i>atricola</i>	21150 (50)	14.1-25.1	4.8-5.6	3.0-4.2	3.2-3.9	16.0-21.8
<i>atricola</i>	21149 (45)	17.0-24.9	4.8-5.5	2.9-3.8	3.0-3.7	17.2-21.4
<i>atricola</i>	21151 (40)	18.8-25.9	4.9-5.9	3.1-3.8	3.0-4.0	17.5-22.7

SPECIMENS EXAMINED.—MEXICO:—0.5 mi. N of Ixtapan de la Sal, 6200 ft. elev. (UF 21148, 146); 0.5 mi. SW of Ixtapan de la Sal, 6500 ft. elev. (UF 21147, 136).

Coelostemma bourgeoisana atricola Bartsch

Coelostemma atricola Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58; fig. 5.
(Type locality: ravine near Las Grutas, Cacahuamilpa, Guerrero).

This subspecies previously was known only from two specimens collected at the type locality.

SPECIMENS EXAMINED.—MEXICO:—14.3 mi. SE of Tonatico, 4900 ft. elev. (UF 21149, 45). GUERRERO:—7.8 mi. NE of Taxco, 5800 ft. elev. (UF 21150, 50); 16.8 mi. NE of Taxco, 4200 ft. elev. (UF 21151, 40).

Coelostemma leucostoma new species

DIAGNOSIS.—A medium-sized cylindrical, ribbed species related to *C. bourgeoisana* because of the similar sculpturing on the axis in the two species. *C. leucostoma* differs from *C. b. bourgeoisana* and *C. b. atricola* by its slender shape, more attenuate apex, and less strongly-arched whorls.

SHELL (Fig. 2, A-E).—The shell is medium-sized (about 14-20 mm long), cylindrical, slender, and narrowly rimate or imperforate. The shell is dull, light tan and the inside of the aperture is white. The apex is attenuate, consisting of about 9-10 nearly flat-sided whorls. The following whorls are nearly uniform in diameter, decreasing slightly near the base. The aperture extends forward and laterally on a moderately-long neck. The neck is rounded on the base and slightly flattened over the parietal wall. Whorls 15.8-20.1 (19.8 in holotype). The suture on the apex and the cylinder is distinctly impressed though the whorls are

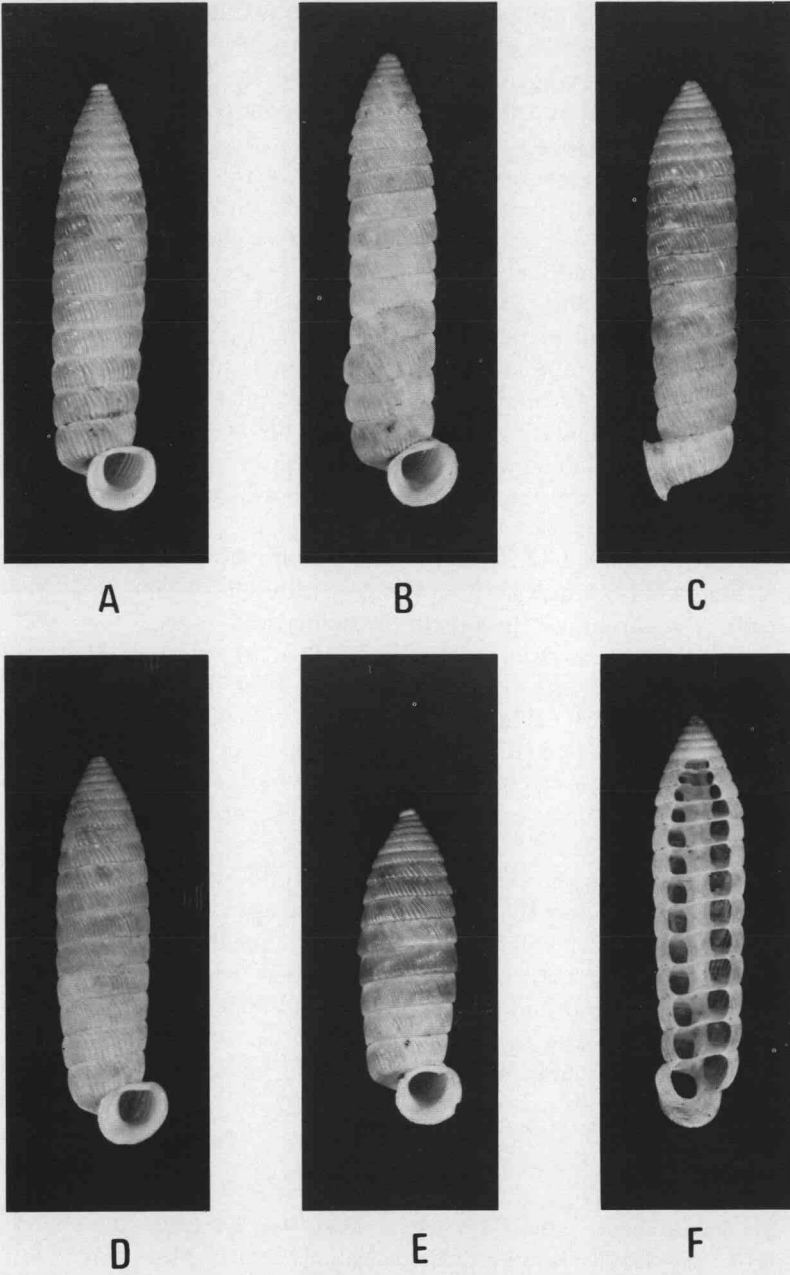


FIGURE 2. *Coelostemma leucostoma* new species. A. Holotype. B-E. Paratypes.

weakly arched. The embryonic shell consists of 2.2-2.5 whorls that are rounded and button-like, the second decidedly larger than the first. The first two embryonic whorls are sculptured with numerous fine granules, which are replaced on the last $\frac{1}{4}$ embryonic whorl by fine regular ribs that become increasingly strong and grade into the coarser sculpture on the following apical whorls (Fig. 1, I). The apical ribs are almost uniformly spaced and widest at the base, where they form white knobs. The ribs on the subsequent whorls are weakly arched, about as wide as their interspaces and lack basal knobs. There are about 35-47 ribs on the penultimate whorl (38 in holotype). The ribs become stronger and more widely spaced on the neck of the last whorl and extend around the base and into the umbilicus where they are finer and sharper. The aperture is nearly ovate in shape, being slightly flattened dorsally. The peristome is moderately expanded around the aperture, being widest along the base and narrowest dorsally. The axis is about $\frac{1}{4}$ the diameter of the shell, is spindle-shaped within each whorl, and bears fine, oblique axial ribs that are weakly serrate.

Length of shell 14.2-20.5 mm (19.6); width 4.0-4.6 mm (4.4); aperture height 2.7-3.0 mm (3.0); aperture width 2.9-3.4 mm (3.2). Measurements in parenthesis pertain to the holotype.

TYPE LOCALITY.—Ruinas de Xochicalco, Morelos; 4900 ft. elev. HOLOTYPE: UF 21145, collected 11 June, 1966 by Fred G. Thompson. PARATYPES: UF 21146 (113); Dept. Zoologia, Instituto Politecnico Nacional, Mexico (25); same data as the holotype. Snails were collected near the ruins from under limestone blocks over a caliche. The area contained submesic scrub and trees that were closely browsed by sheep.

REMARKS.—This species is closely related to *C. bourgeoisana*. It differs from the latter by its more attenuate apex, nodular ribs on the apex, and its flatter whorls. Aspects of the apical sculpture also suggest a relationship with *C. richardi*, described below. The two species are readily distinguished by their shapes and their axial sculpture.

ETYMOLOGY.—The specific epithet is derived from the Greek *leukos*, meaning white, and *stoma* meaning mouth and refers to the white aperture in this species.

Coclostemma hazelae Pilsbry

Coclostemma hazelae Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105-159; pl. 5, fig. 4. (Type locality: between Chilpancingo and Mazatlán, Guerrero).

This species, previously known only from the holotype, is repre-

sented by two series from near the type locality. Specimens from 2.2 mi. NNE of Mazatlán, Guerrero, 4800 ft. alt. (UF 20996) are similar to the holotype in most respects, though most individuals are slightly more slender (Fig. 3, A-C). Specimens from 3.4 mi. NNE of Mazatlán, Guerrero, 4700 ft. alt. (UF 20997) differ by being considerably shorter stockier, though of similar width to the holotype (Fig. 3, D-F).

As in other species of *Coelostemma* from southern Mexico the em-

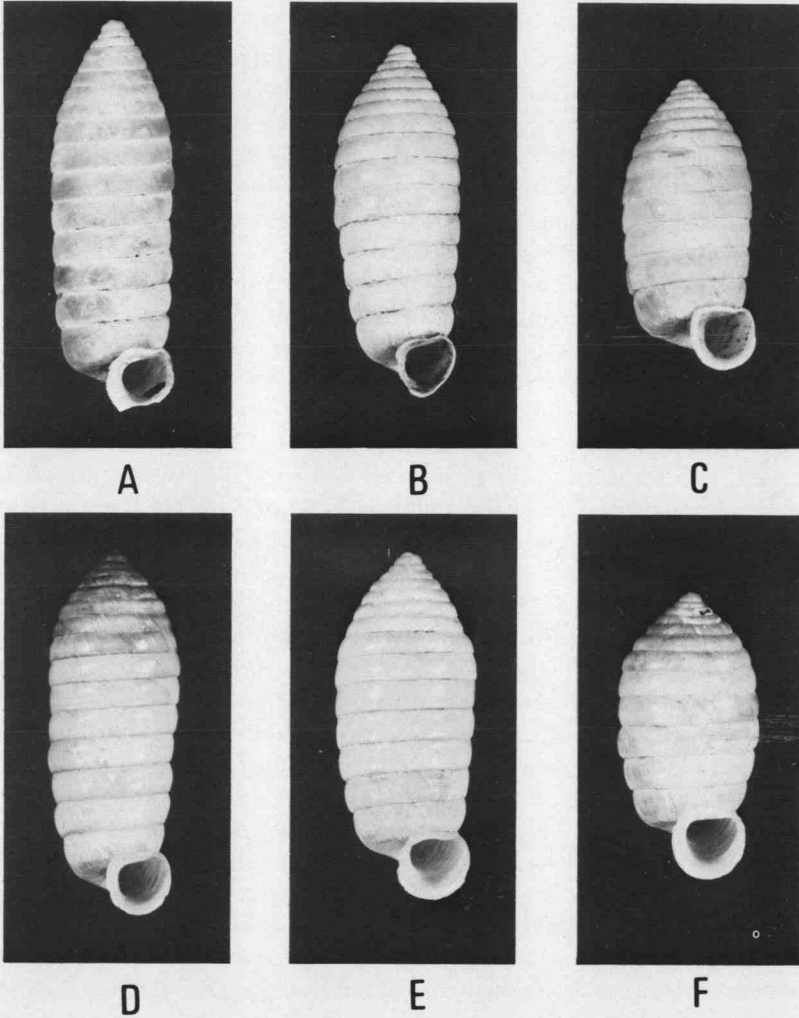


FIGURE 3. *Coelostemma hazelae* Pilsbry. A-C. 2.2 mi. NE Mazatlán, Guerrero. D-F. 3.4 mi. NNE Mazatlán, Guerrero.

bryonic whorls are sculptured with minute granules on about the first two whorls. The following half whorl or so bears weak axial thread-riblets that grade into coarser riblets on the following postembryonic whorl.

Coelostemma eclipses new species

DIAGNOSIS.—A species distinguished by its moderately-large size (usually about 18-20 mm long), opaque, whitish color, subelliptical shape, costulate lower whorls, imperforate axis, moderate neck, and smooth axis. Because of its smooth axis it is related to *C. hazelae* and *C. bembix*, both of which occur in adjacent areas of Guerrero. *C. eclipses* differs from *C. hazelae* by its larger size, larger caliber whorls, costulate lower whorls, imperforate axis and longer neck behind the aperture. The neck also bears a basal impression that is absent in *C. hazelae*. *C. eclipses* is distinguished from *C. bembix* by the numerous peculiarities of the latter species described below.

SHELL (Fig. 4, A-E).—The shell is moderately large and stocky and is subcylindrical or elongate-elliptical in shape. The widest portion lies just below the apical cone. The apex consists of about 7-8 whorls, is elevated, and is slightly convex in outline with protruding embryonic whorls. The shell is dull-white over most of the spire, with a dark gray apex. The umbilicus is imperforate. Whorls, 12.7-16.4 (16.4 in holotype). The whorls are moderately-arched on the apex but are nearly flat on the spire. The 2.5-3.1 embryonic whorls (3.0 in holotype) are offset by a deeply-impressed suture (Fig. 1, B). The first two embryonic whorls are sculptured with dense, minute granulations. The subsequent embryonic whorl bears strong, oblique riblets that are of the same intensity as those on the following postembryonic whorl. The first three postembryonic whorls bear oblique riblets that are about half the width of their intervals. The remainder of the apex and most of the spire are nearly smooth, with only irregular incremental striations. The last 2-3 whorls bear heavy, rounded ribs that are strongest on the last whorl. The aperture is extended forward from the body whorl for about 2 mm. The neck is flattened dorsally and bears on its base a moderate, linear impression that forms a low callused ridge internally. The aperture is usually wider than high and is ovate-auriculate in shape. The parietal wall bears a weak fold similar to that in *C. bembix*. The peristome is moderately expanded, being narrowest at the posterior corner and widest along the baso-columellar margin. The axis is smooth and about $\frac{1}{4}$ - $\frac{1}{3}$ the diameter of the shell. It is spindle-shaped within each whorl and bears a low, spiral swelling just above the floor of the whorls.

Length of shell 14.4-20.2 mm (20.0); width 5.9-6.9 mm (6.4); aperture height 3.3-4.1 mm (4.0); aperture width 3.5-4.2 mm (4.2). Measurements in parenthesis pertain to holotype.

TYPE LOCALITY.—A limestone ledge 16.4 mi. N of Zumpango del

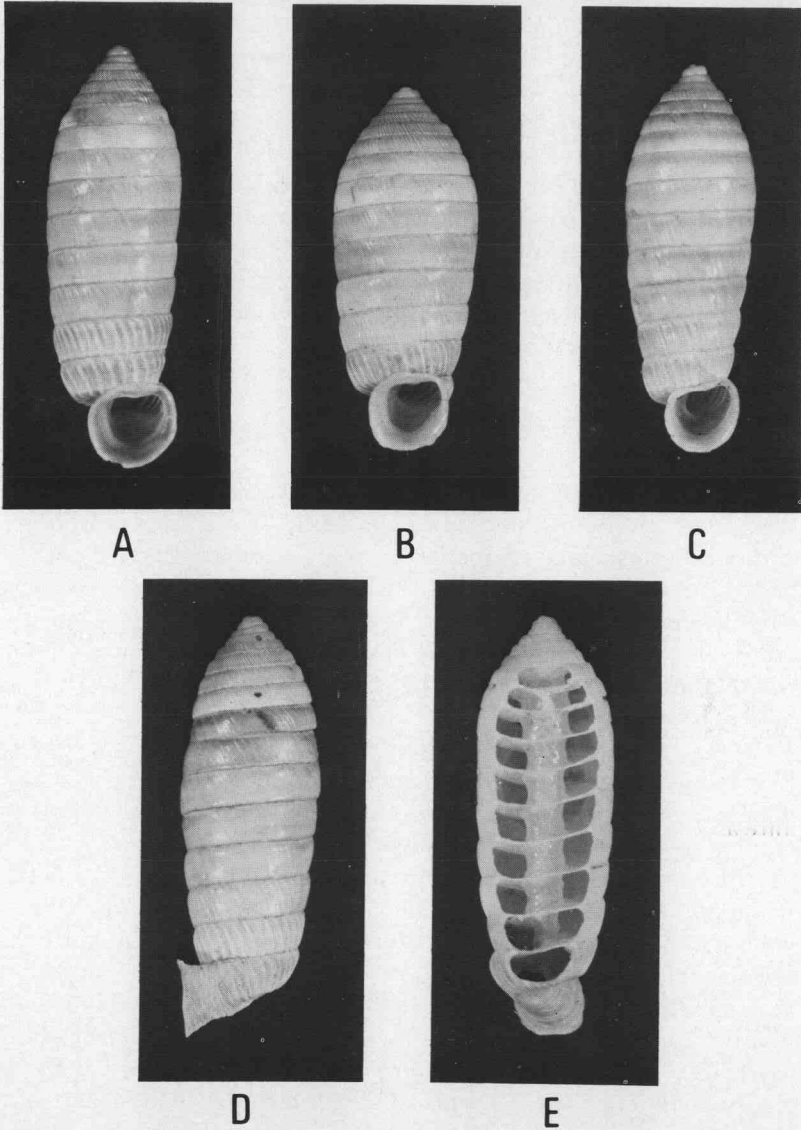


FIGURE 4. *Coelostemma eclipses* new species. A. Holotype. B-E. Paratypes.

Rio, Guerrero; 2300 ft. elev. Snails were found on the ledge along clay seams aestivating beneath the fronds of a small fern. HOLOTYPE: UF 21210, collected 12 June, 1966 by Fred G. Thompson. PARATYPES: UF 21211 (55); Instituto Politecnico Nacional, Mexico (5); same data as the holotype.

REMARKS.—*C. eclipses* is a member of a small group that also includes *C. bembix* and *C. hazelae*. These species have in common a moderately-large, opaque-white shell and a smooth axis. *C. lissocentrum* Pilsbry from Nuevo León is similar in these characteristics, but no close relationship to the other three species is apparent. Similarly *C. fusca* (Martens) and *C. anacasta* have smooth axes, but both species are more similar in other shell aspects to the other species within the genus than to the *hazelae* group.

ETYMOLOGY.—The species name *eclipses* is taken from the Greek *eklipēs*, meaning devoid of or wanting, and refers to the snails smooth axis, lacking ribs or other sculpture.

Coelostemma bembix new species

DIAGNOSIS.—A species characterized by its globose, pupiform shape with an abbreviated spire consisting of scalariform whorls. In addition the auriculate-shaped aperture is extended forward on a long and recurved neck. The parietal wall of the aperture bears a large, laterally-compressed tubercular fold. Other characteristics include a wide, smooth axis, an imperforate umbilicus and the presence of oblique ribs on the apical cone and the last one or two whorls, while the intermittent whorls are feebly striate.

SHELL (Fig. 5, A-F).—Medium-sized and stocky. The shape is highly variable, ranging from depressed pupiform to globular. The apical whorls are conspicuously suppressed, with the embryonic whorls protruding as a short spike. The lower whorls decrease in size and the aperture is born on a long recurved neck. Whorls 13.0-15.0 (14.2 in holotype). Embryonic whorls 2.0-3.0 (2.8 in holotype). The first two embryonic whorls are minutely granular (Fig. 1, E). The last half of the second embryonic whorl bears increasingly distinct vertical ribs that are about one-third the width of their intervals. The following 4-6 apical whorls are strongly ribbed with widely-spaced, slightly oblique axial ribs. The first four post-embryonic whorls are strongly arched on the summit. The next 2-3 whorls, which form the widest part of the cone, are progressively flattened and scalariform. Below the periphery of the cone the shell usually is truncate and has 3-5 smooth, weakly-

arched whorls in the middle. The lowest two whorls are crossed by strong widely-spaced axial ribs that become irregular and ill-defined on the neck of the last whorl. The last whorl bears about 21-30 ribs (22 in holotype). The aperture extends forward on a long recurved neck that is rounded except for a weak angle at the parietal-columellar margin. The umbilicus is imperforate. The aperture is irregularly ovate or pyri-

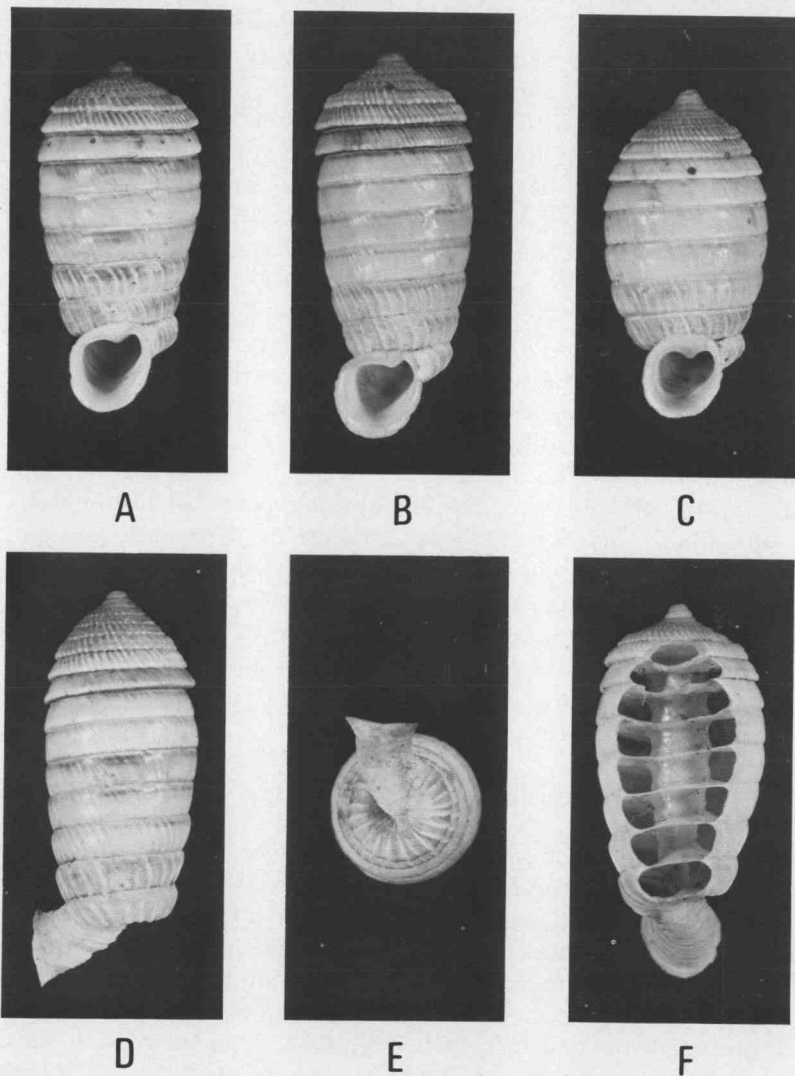


FIGURE 5. *Coelostemma bembix* new species. A. Holotype. B-F. Paratypes.

form and is usually higher than wide. Internally the parietal wall bears a large, medium, laterally-compressed tubercular fold. The peristome is narrowly reflected around the aperture with the base extended and trumpet-shaped. The axis is about one-third the diameter of the shell near the middle and tapers to a very narrow tube in the last three whorls. The axis is smooth, is slightly spindle-shaped within each whorl, and bears a weak spiral swelling just below the middle.

Length of shell 15.3-18.9 mm (16.7), width 7.0-8.6 mm (8.0); aperture height 3.4-4.4 mm (4.3), aperture width 3.6-4.6 mm (4.1). Measurements in parenthesis pertain to holotype.

TYPE LOCALITY.—Guerrero, 12.6 mi. N of Zumpango del Rio, 2300 ft. elev. At this point the Federal Highway 95 crosses a tributary of the Rio Balsas. Snails were collected on a limestone ledge above an old road cut paralleling the east bank of the river. They were found beneath the fronds of a small fern growing along crevices in the ledge. HOLOTYPE: UF 20901, collected 13 June, 1966 by Fred G. Thompson. PARATYPES: UF 20900 (110); Dept. Zoologia, Instituto Politécnico Nacional, Mexico (10); same data as the type.

REMARKS.—*C. bembix* is similar in shape to *C. adria* Bartsch among the known species, although its relationship to *C. adria* is not close. The most noticeable peculiarities of *C. bembix* include the scalariform apical whorls, the reflexed neck of the last whorl and the tubercular fold in the aperture. Additional differences that distinguish *C. bembix* from *C. adria* include the sculpture on the middle portion of the shell, the lack of sculpture on the axis, and the imperforate umbilicus. *C. adria* has weak riblets on the middle whorls, a modification of the stronger sculpture below and above, its axis has feeble vertical threads, and the umbilicus is narrowly perforate.

ETYMOLOGY.—The specific name is taken from the Greek *bembix*, a top, in reference to the appearance of this snail.

Coelostemma anaclasta new species

DIAGNOSIS.—A moderately small species characterized by its clavate shape with protruding embryonic whorls, its peristome located on a long, reflexed neck that is weakly concave along its basal side, its narrowly rimate or imperforate umbilicus, and its smooth axis that is spindle-shaped within each whorl. The sculpture on the embryonic whorls is minutely granular. The following apical whorls bear heavy, oblique axial ribs that tend to be crenulate along their lower suture and are very much reduced in intensity or are obsolete on the lower whorls.

SHELL (Fig. 6, A-F).—The shell is moderately small (about 12-15 mm long) and clavate in shape. The aperture extends forward on a long reflexed neck. The umbilicus is narrowly rimate or imperforate. The color is dull tan, and the shell is subtranslucent. The embryonic whorls protrude strongly to form a nipple-like apex. The next 6-7 whorls rapidly increase in size to form a conical apex that is convex in outline. The remaining 6-7 whorls gradually decrease in size. The last whorl ends in a long, reflexed neck about 1.4-2.2 mm long. The

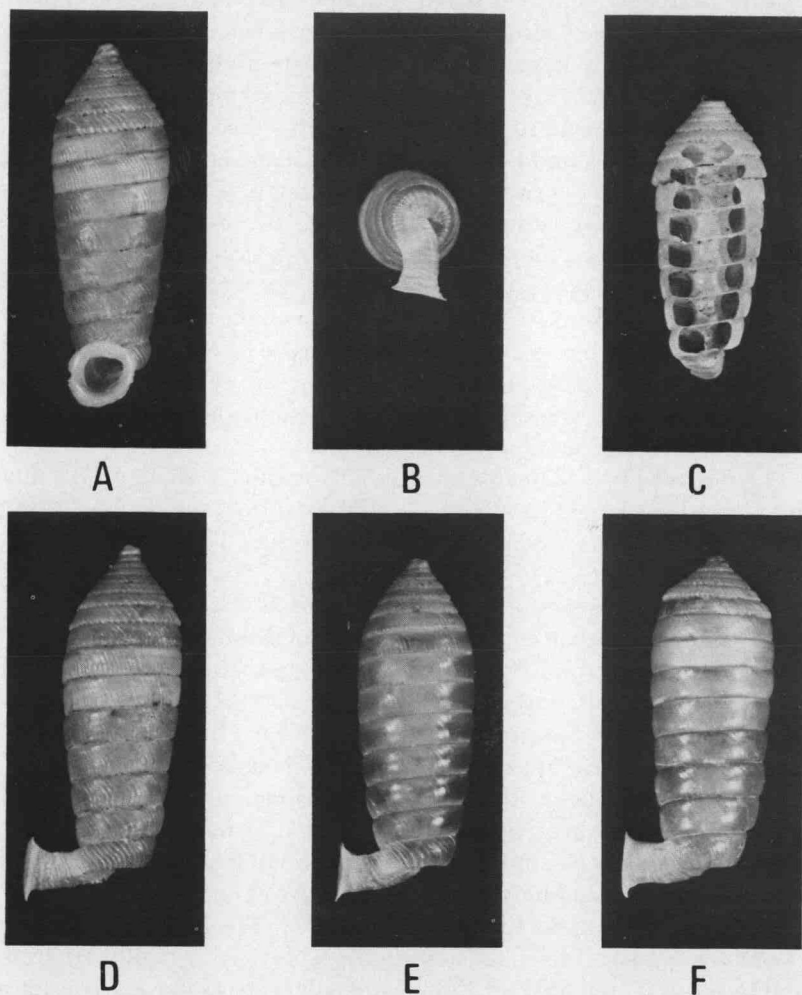


FIGURE 6. *Coclostemma anaclasta* new species. A, D. Holotype. B-C. Paratypes. E. 11.1 mi. S Colima, Colima. F. 7.2 mi. ESE Colima, Colima.

base of the last whorl is flat and bluntly angular at the periphery. The nearly quadrangular neck has a broad, shallow impression on the base and a slightly-flattened dorsal surface. There are 15.1-16.7 whorls, including 2.5-3.1 embryonic whorls. The embryonic whorls (Fig. 1, D) protrude strongly, have a deeply impressed suture and are sculptured with very fine granules. The last quarter embryonic whorl bears fine, indistinct, oblique threads that phase into the axial ribs on the succeeding whorl. The apical whorls are nearly flat, tend to be scalariform near the periphery, and bear strong, oblique ribs that are weakly crenulate along the lower suture. The post-apical whorls are nearly flat, but have a distinctly impressed suture and are sculptured with barely distinguishable axial riblets that may be obsolete on some whorls. The last whorl bears about 30 oblique arched ribs that are strongest near the base of the neck and become sharp and irregular on the neck. The aperture is ovate, has a conspicuously reflected peristome, and is about 0.2 mm broader than wide. The peristome is broadest along the basal margin and narrowest along the posterior angle. Internally the throat is subtriangular in cross-section, resulting from a weak invagination on the base of the neck and a weaker impression on the dorsal surface. The axis is broadest in the apex and decreased in size through the last whorl, although there is no appreciable change in the caliber of the lower whorls. The axis is spindle-shaped within each whorl, is smooth and marked with irregular, opaque white streaks.

Length of shell 13.0-15.5 mm (15.5), width of shell 4.7-5.1 mm (5.1), aperture height 2.3-2.8 mm (2.8), aperture width 2.5-2.8 mm (2.8). Measurements are based on the type series. Those in parenthesis pertain to the holotype.

GEOGRAPHIC VARIATION.—The type series is characterized by having a raised apex that is conspicuously concave in outline below the embryonic whorls, by having weakly distinguishable, if irregular, ribs on the lower whorls, and by having a relatively long neck on the last whorl (Fig. 6, D). Specimens of a series from 11.1 mi. S of Colima have a raised conical apex that is weakly convex below the embryonic whorls, the whorls below the apex are sculptured only with incremental striations, and the neck tends to be shorter (Fig. 6, E). Shells from 7.2 mi. ESE of Colima are similar to the last series in sculpture, but have an even shorter neck and have a suppressed spire (Fig. 6, F).

TYPE LOCALITY.—Colima, 1.9 mi. NE of Tecolapa, 700 ft. elev. (Tecolapa is a small town located on the Colima-Manzanillo Highway and is about 25 mi. SSW of Colima). Snails were found aestivating in cracks in a small limestone ledge at the head of a small ravine about 300 yards west of the highway. The vegetation consisted of a dense

xeric scrub forest. HOLOTYPE: UF 20927, collected 1 June, 1966 by Fred G. Thompson. PARATYPES: UF 20928 (20); Dept. Zoologia, Instituto Politécnico Nacional, Mexico (4); same data as the holotype.

OTHER LOCALITIES.—COLIMA:— 11.1 mi. S of Colima, 1400 ft. elev. (UF 20926); 7.2 mi. ESE of Colima, 1200 ft. elev. (UF 20925).

REMARKS.—*C. anacasta* is readily distinguished from all other species by its general external appearance and its smooth spindle-shaped axis. Of the other known species with a smooth axis it resembles *C. fusca* most closely. It differs from *C. fusca* by its claviform shape, its long, reflexed neck, and its costulate sculpture on the apical whorls. *C. anacasta* is remarkably like *C. bembix* in its long, reflexed neck and its smooth axis, but the similarities between the two species are secondary and do not indicate phylogenetic relationships. These characters also occur in *Metastoma roemeri* (Pfeiffer), a species that is considered only remotely related.

ETYMOLOGY.—The specific epithet is taken from the Greek *anaklastos*, meaning bent back or reflected, and refers to the flexed neck of the aperture in this species.

Coelostemma fusca (Martens)

Holospira fusca Martens, 1897; Biol. Cent. Amer.: 281; pl. 16, figs. 20-24 (not 19).

(Type locality: Omilteme, Guerrero).

Holospira (*Haplocion*) *fusca* Martens, Pilsbry, 1902; Man. Conch., Ser. II, 15: 95-96, pl. 25, figs. 8-10, 12-14.—Bartsch, 1906; Proc. U. S. Nat. Mus., 31: 146.

Haplocion fusca (Martens), Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 56.

Holospira (*Megaxis*) *fusca* Martens, Pilsbry, 1946; Monogr. Acad. Nat. Sci. Phila., (3), II: 123.

Coelostemma fusca (Martens), Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 156.

The species is commonly distributed from 6500-8000 feet elevation in the mountains to the east and west of Chilpancingo, Guerrero. Within this area it is found in mesic oak and mixed oak-conifer forests, where it is found characteristically on limestone. It undergoes considerable local variation in size. The variation is not correlated with elevation but is characteristic of particular colonies. All other aspects of the shell, including sculpture, show little variability between populations.

Measurements of three population samples are given in Table 3. The series from 0.6 mi. ESE of Omilteme (UF 20916) is considered topotypic and encompasses most of the measurements given by Martens (1897: 281). Measurements that he gives for his largest specimens

and his first figure (Pl. 16, Fig. 19) represent a species of *Holospira* (s.s.) presently undescribed.

TABLE 3. MEASUREMENTS (in mm) OF THREE POPULATION SAMPLES OF *C. fusca*.

Number	Length	Width	Aper. H.	Aper. W.	Whorls
20911 (45)	11.8-16.3	3.6-4.2	2.0-2.4	1.9-2.3	15.7-20.0
20916 (40)	9.3-14.6	3.1-3.7	1.7-2.3	1.7-2.1	14.2-20.1
20913 (58)	10.4-12.4	3.0-3.7	1.8-2.0	1.8-2.0	13.7-18.5

The sculpturing of the first four whorls is illustrated (Fig. 1, C). The embryonic whorls bear dense minute granulations, which are replaced on the following whorls by irregular, fine, oblique striations.

TYPE LOCALITY.—Omiteme, Guerrero. LECTOTYPE by present designation: British Museum (Natural History) 1901.6.22.1051, collected by H. H. Smith. The British Museum has eight syntypes of this species. Four specimens of *Holospira* sp. are also included in the type series (Mrs. Angela Crane, pers. comm.).

OTHER LOCALITIES.—GUERRERO:—11.2 mi. E of Tixtla, 6500 ft. elev. (UF 20911); 9.8 mi. SW of Chilpancingo, 7100 ft. elev. (UF 20917); 11.4 mi. W of Chilpancingo, 8400 ft. elev. (UF 20912); 12.4 mi. SW of Chilpancingo, 8400 ft. elev. (UF 20918); 6.2 mi. ESE of Omiteme, 6800 ft. elev. (UF 20913); 5.5 mi. ESE of Omiteme, 7000 ft. elev. (UF 20914); 3.5 mi. ESE of Omiteme, 7200 ft. elev. (UF 20915); 0.6 mi. ESE of Omiteme, 7900 ft. elev. (UF 20916).

Coelostemma richardi new species

DIAGNOSIS.—A small claviform species (about 11-15 mm long) with a moderately-wide umbilicus, strong, close costulate sculpture throughout the length of the shell, 3-4 upper whorls that are weakly scalariform and on which the ribs form nodular crenulations along the outer edge, and a hollow axis that is spindleform within each whorl and bears irregular, oblique thread-riblets.

SHELL (Fig. 7, A-E).—The shell is small and claviform. The umbilical opening is moderately large and elliptical in shape. The color of the spire is grayish-white. The embryonic whorls are tan, as are the next three or four apical whorls, which have nearly white, crenulated ribs along the outer edge. Whorls 13.3-16.3 (15.2 in holotype). Embryonic whorls 2.3-3.1 (2.7 in holotype); protruding and nipple-shaped. The

first two embryonic whorls (Fig. 1, H) are sculptured with minute granulations. The following one-half whorl or so is crossed by very faint thread riblets that tend to grade into the costulate sculpture of the succeeding postembryonic whorl. The first 3-4 postembryonic whorls form a low dome-shaped apex. The 4th through the 8th postembryonic whorls are scalariform and form the widest part of the shell. The following whorls are flat-sided, while the aperture is extended forward from the body whorl on a moderately-long neck. The neck is nearly round,

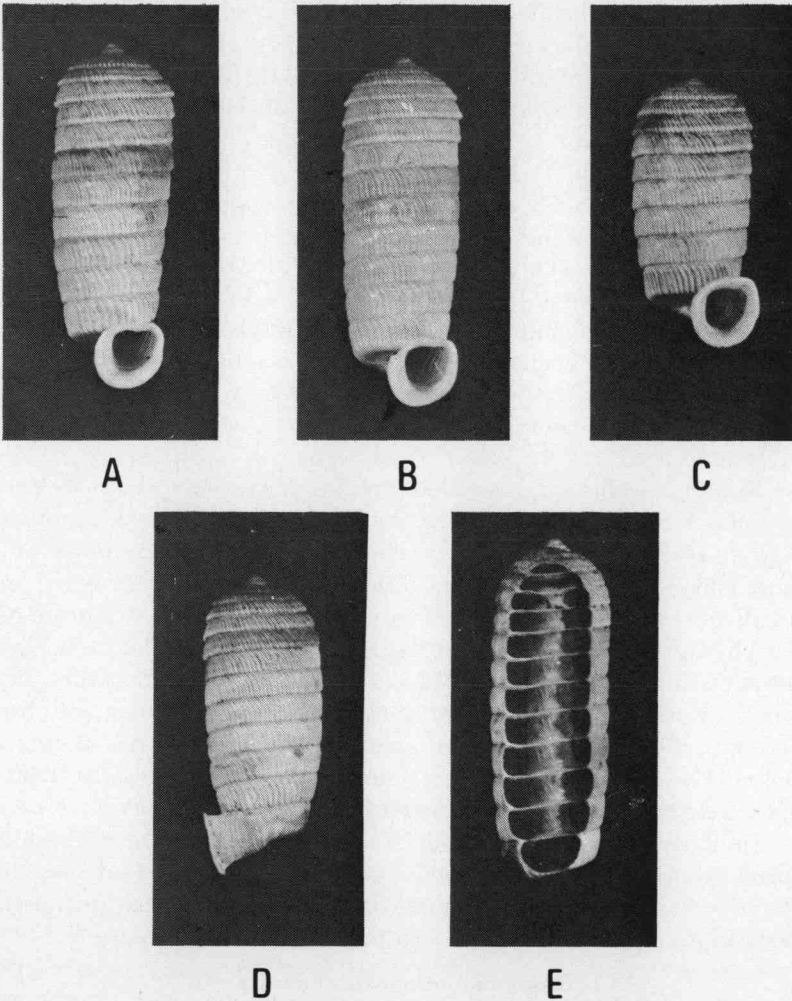


FIGURE 7. *Coelostemma richardi* new species. A. Holotype. B-E. Paratypes.

being weakly compressed on the dorsal surface. The postembryonic whorls are sculptured with strong, close, slightly oblique and arched axial ribs, which on the apex form weak nodes or crenulations along the lower ends. There are 50-64 ribs on the penultimate whorl (51 in holotype). The ribs become sharp and irregular on the neck of the aperture, and hardly extend onto the base of the last whorl. The aperture is irregularly ovate in shape. Internally it is pinched at the posterior corner. The peristome is moderately-reflected, being widest along the basal and columellar margins and narrowest around the posterior corner. The axis is about one-third the diameter of the shell. It is widest in the apex and becomes greatly reduced in the whorl. Within each whorl it is spindle-shaped and bears irregular, slightly oblique thread-riblets. There are about 25 riblets per whorl near the center of the spire and they are spaced about 5/mm.

Length of shell 11.2-15.0 mm (13.9), width 4.5-5.3 mm (5.0), aperture height 2.5-2.8 mm (2.7), aperture width 2.6-2.9 mm (2.8). Measurements in parenthesis pertain to holotype.

TYPE LOCALITY.—Oaxaca, 1.3 mi. NE of Tonalá, 5000 ft. elev. Snails were collected at the base of a limestone hillside among clusters of a small fern growing on the stone in slightly damp areas. HOLOTYPE: UF 20905, collected 4 July 1966 by my son, Richard L. Thompson, after whom the species is named. PARATYPES: UF 20906 (50); Dept. Zoología, Instituto Politécnico Nacional, México (5); same data as the holotype.

REMARKS.—This snail is unlike any other known species. Its compact claviform shape, sculpture, scalariform whorls, and open umbilicus serve to distinguish it from all others. It is similar in appearance to *C. adria* (Bartsch), but that species differs by having more crowded and less distinct sculpture on the shell, by having a narrowly perforate umbilicus, by having juxtaposed whorls instead of being scalariform along the apex, and by lacking crenulations along the outer edge of the apical whorls (Bartsch, 1926: 2). Unfortunately *C. adria* is known only from two specimens recovered from river drift along the Río Balsas at Balsas, Guerrero. *C. richardi* is also similar to *C. notogastor*. Differences between the two are discussed under the latter species.

Similarities between *C. richardi* and *C. bembix* in the scalariform apical whorls are overshadowed by the many other differences that characterize *C. bembix*, including the smooth columella. Similarities between *C. richardi* and *C. leucostoma* are discussed above.

Coelostemma notogastor new species

DIAGNOSIS.—A narrowly umbilicate, medium-sized species (about

12-16 mm long) of cylindrical-pupoid shape. The spire is moderately extended with two protruding, telescoped embryonic whorls that are sculptured with fine granules. The remaining whorls are sculptured with closely-spaced, arched thread-riblets. The aperture extends forward on a short neck. The axis bears a slight submedian swelling and is sculptured with irregular, coarse, oblique riblets.

SHELL (Fig. 8, A-E).—The shell is medium-sized. The lower portion is nearly cylindrical, while the spire is moderately attenuate, weak-

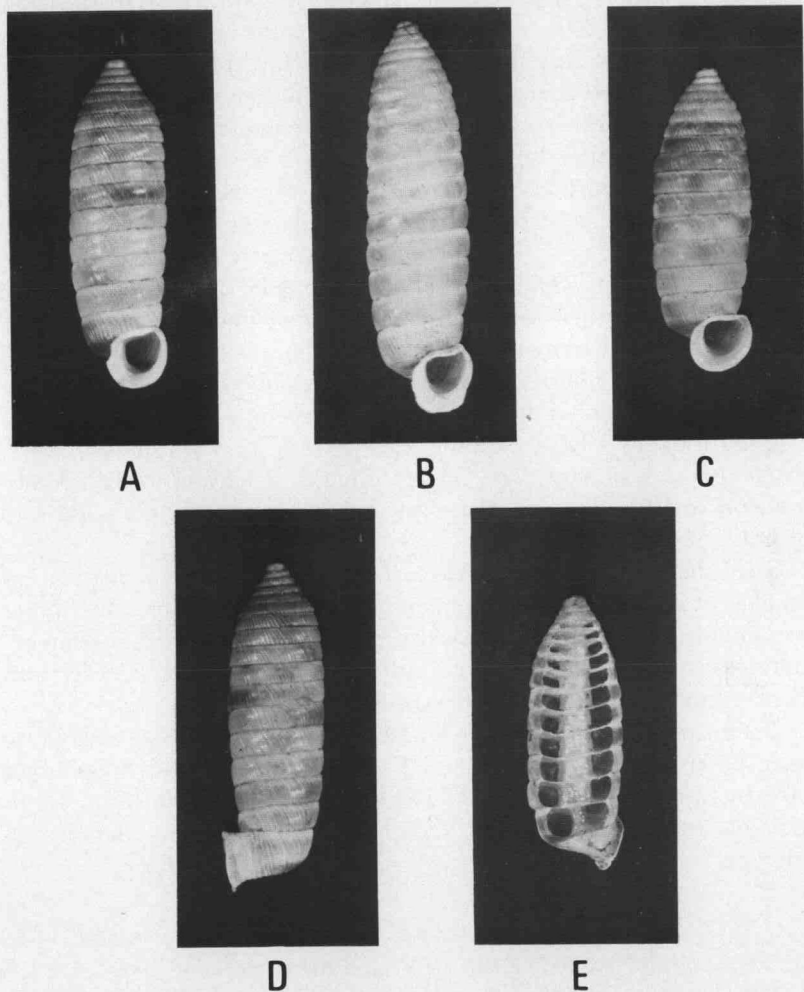


FIGURE 8. *Coclostemma notogastor* new species. A. Holotype. B-E. Paratypes.

ly convex in outline, and bears 2.3-2.8 protruding embryonic whorls (2.5 in holotype) that appear to be telescoped. The umbilical perforation is narrow and elliptical. The shell wall is moderately thick, subtranslucent when fresh, and dull fleshy-gray in color. Whorls 14.7-18.3 (17.0 in holotype). The embryonic whorls are sculptured with minute granules (Fig. 1, G). The last quarter of the second embryonic whorl bears fine, irregular threads that grade into the riblets on the succeeding whorl. The post embryonic whorls are sculptured with fine, close thread-riblets that are coarsest on the spire and the last whorl and weakest on the cylinder of the shell. The riblets on the spire tend to form nodules at their bases. The apical whorls are weakly arched, while the remaining whorls are only slightly curved. The lower two or three whorls are slightly reduced in size, the last ending in a short neck. The base of the last whorl and the neck are rounded. The aperture is subovate in shape with a flattened parietal margin and a slight protruberance from the upper lip. The interior of the aperture is broadly auriculate in cross-section. The peristome is weakly reflected along the upper lip and broadly so along the basal-columellar corner, where it appears to be drawn downward. The axis is about a third the diameter of the shell and is nearly uniform in width, except in the last whorl where it is markedly constricted. It bears a hollow, submedian spiral bulge within each whorl. The axis is sculptured with irregular, oblique, broken axial riblets between the roof of the whorls and the swelling.

Length of shell 12.0-16.4 mm (13.9), width 3.7-4.3 mm (4.1), aperture height 2.3-2.7 mm (2.6), aperture width 2.3-2.7 mm (2.4). Measurements are based on the type series, those in parenthesis pertain to the holotype.

The shell shows slight variation among the five population samples examined. Some specimens of other populations are larger than the measurements given for the type series, but broad overlap occurs between all samples. Some individuals from other samples also are claviform, but such specimens are exceptional.

TYPE LOCALITY.—Oaxaca, a limestone hill 14.2 mi. SW of Sola de Vega, 6500 ft. elev. HOLOTYPE: UF 20910, collected 13 September, 1967 by Fred G. Thompson. PARATYPES: UF 20909 (35); Dept. Zoologia, Instituto Politecnico Nacional, Mexico (5); same data as the holotype.

OTHER LOCALITIES.—OAXACA:— 15.2 mi. SW of Sola de Vega, 6400 ft. elev. (UF 20922. 26); 5.7 mi. SW of Sola de Vega, 6300 ft. elev. (UF 20923. 75); 0.7 mi. S of Tlapacoyan, 5000 ft. elev. (UF 20921. 17); 4.9 mi. SSW of Tlapacoyan, 6100 ft. elev. (UF 20924. 24).

ECOLOGICAL NOTES.—Snails were moderately common at all localities. At the type locality they were found under limestone blocks in a submesic oak forest. At other localities they were found under limestone rubble and caliche in submesic vegetation consisting of either dwarf oaks or grasses. These habitats are not so xeric as those occupied by other species of the genus.

REMARKS.—This is the southern most known member of the genus. It is closely related to *C. richardi* Thompson as is suggested by similarities in the embryonic whorls, size, sculpture, and the open umbilicus. It differs from the latter by its general shape, finer sculpture, more attenuate spire, non-scalariform apex, spiral swelling on the axis, and coarser sculpture on the axis. The two species differ also in the shape and internal contour of their apertures as is described for each. *C. notogastor* also bears a similarity to *C. fusca* (Martens) in general appearance. *C. fusca* is readily differentiated by its smooth spindle-shaped axis, more attenuate spire, smooth-striate whorls, broader umbilicus, and smaller aperture.

ETYMOLOGY.—The name *notogastor* from the Greek *notos*, meaning south, and *agastor*, a near kinsman, refers to the geographic disposition of the species in relation to the rest of the genus.

Crycoryne new subgenus

TYPE SPECIES: *Coelostemma astraxis* new species.

The subgenus is distinguished from all other Holospirinae by having smooth embryonic whorls and large, hollow, nodular spines on the large, hollow axis. The character of the embryonic whorls relates *Crycoryne* to *Styloptyx* and *Apertaxis* the only groups of this subfamily that lack embryonic sculpturing. The axis is unlike that of any other genus or subgenus within the Holospirinae.

ETYMOLOGY.—The name *Crycoryne* is derived from the Greek *kryptos*, meaning hidden, and *koryne*, meaning a mace or war club and alludes to the characteristic axis of the subgenus. The name is of the feminine gender. The subgenus is monotypic.

Coelostemma (Crycoryne) astraxis new species

DIAGNOSIS.—A large species of *Coelostemma* readily distinguished from all others by its series of large nodular spines on the axis. It is also characterized by the combination of characters consisting of its large

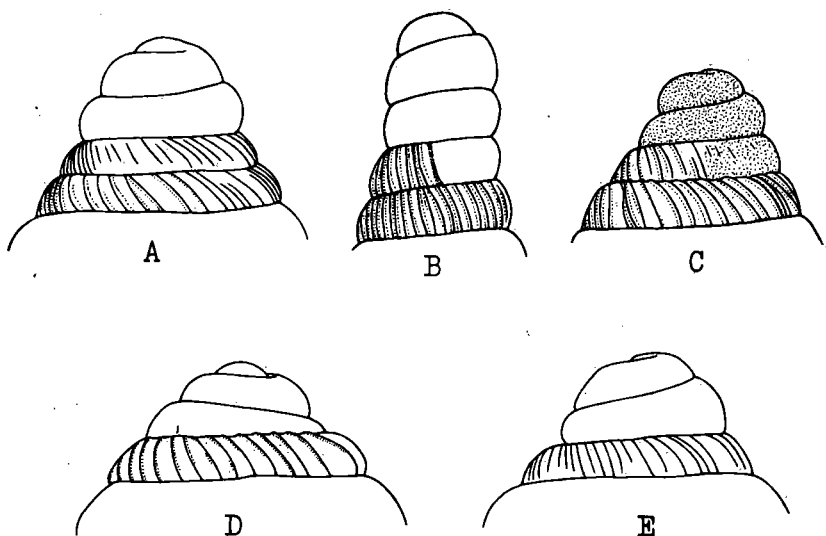


FIGURE 9. Apical sculpture of *Coclostemma* and *Metastoma*. A. *C. (Crycoryne) astraxis* new species (holotype). B. *C. (Apertaxis) coahuilensis* (Bartsch) (holotype). C. *Metastoma roemeri* (Pfeiffer). D. *C. (Styloptyx) fornax* new species (holotype). E. *C. fornax ix* new subspecies (holotype).

size, its nearly smooth cylindrical whorls, its protruding embryonic whorls, and its quadratic aperture.

SHELL (Fig. 10, A-E).—Moderately large (about 20-26 mm long) and cylindric conical in shape. The umbilicus is narrowly perforate. The shell is highly variable in obesity. Most specimens are more slender than the holotype (Fig. 10, A) and some individuals tend to be clavate in shape through reduction in size of the last few whorls. The shell is opaque and faint pinkish-white in color. Mature shells contain 17.8-21.5 weakly-arched whorls (18.5 in holotype). There are 2.1-3.0 embryonic whorls (2.2 in holotype) that protrude and are larger in caliber and width than the succeeding neanic whorl. The embryonic whorls are round, are separated by a deep suture, and are smooth (Fig. 9, A). The following 10 whorls gradually increase in size to the width of the shell and are slightly scalariform. The remaining whorls are nearly uniform in diameter, with the last two whorls slightly decreasing in width. The postembryonic whorls on the conical portion of the spire are sculptured with oblique low riblets that become obsolete at about the 10th whorl. The earlier whorls have about three ribs per mm. The cylindric

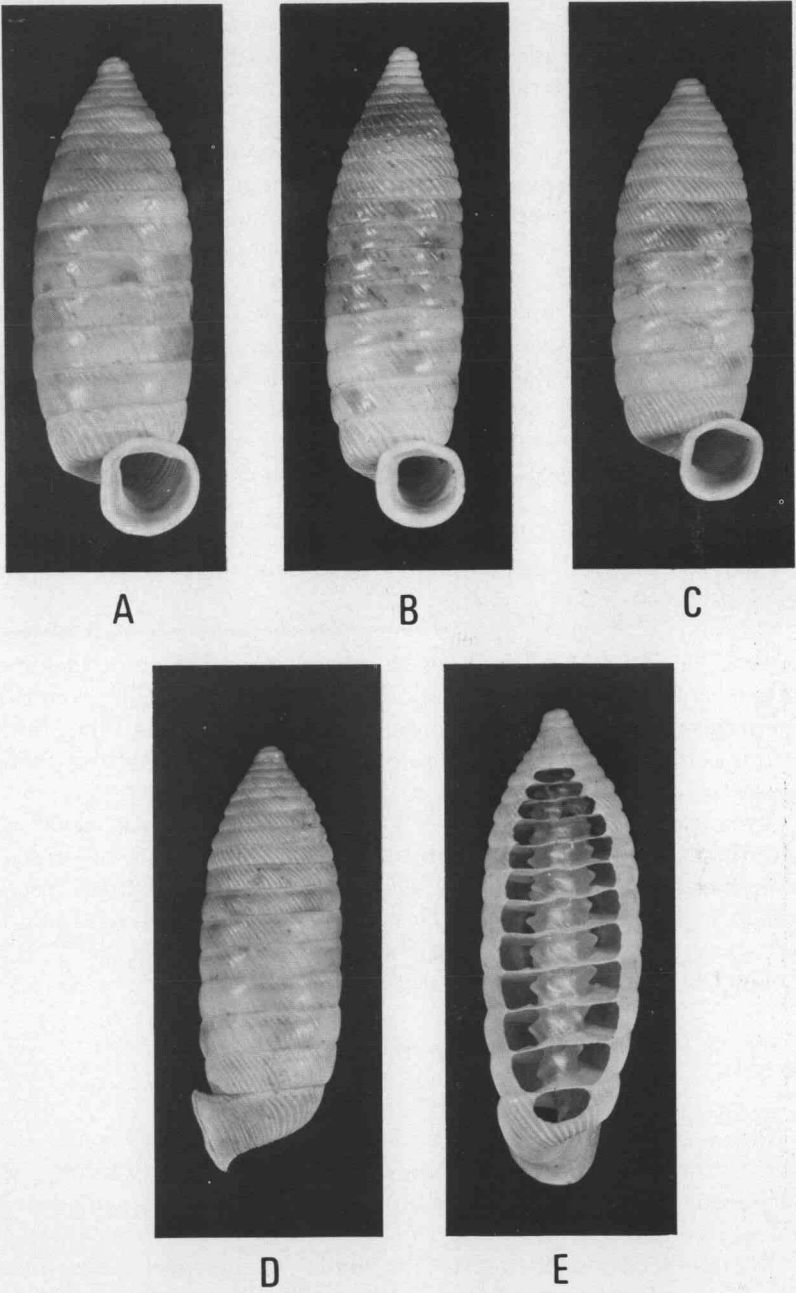


FIGURE 10. *Coelostemma astraxis* new species. A. Holotype. B-E. Paratypes.

portion of the shell is nearly smooth with irregular, fine, incremental striations. The last whorl or two have low, relatively widely-spaced ribs that become more distinct and crowded near the peristome. The aperture is extended forward so that the peristome is free from the preceding whorl. The neck of the last whorl is irregularly rounded on the base. The aperture is quadratic in shape and is about as wide as high. The parietal wall of the aperture forms a strong angle with the columellar wall. The corners of the peristome are weakly angular. The basal margin is rounded. The peristome is moderately reflected around the aperture. It is most widely expanded along the basal and columellar margins and is least expanded along the outer lip. The axis is broad and hollow, about one-third the diameter of the shell, and bears about 5-6 large, obliquely-compressed and bluntly-pointed nodes per whorl. The interior of the axis is indented under the corresponding nodes. The nodes are more numerous and sharper in the conical portion of the spire.

Length of shell 20.2-26.0 mm (22.8), width 6.7-8.0 mm (8.0), aperture height and width 4.1-4.9 mm (4.9). Measurements in parenthesis pertain to holotype.

GEOGRAPHIC VARIATION.—This species is known from two places, the type locality and a hill about 18 miles WSW of the type locality. Specimens from the second location are nearly inseparable from the type series. They have slightly fewer whorls (17.1-18.2), and they tend to be more pupiform. Considerable overlap occurs in both of these characters.

TYPE LOCALITY.—Durango, 9.0 mi. SSW of Picardias, 4400 ft. elev. (Picardias is a small town about 30 miles south of Torreon, Coahuila, and lies just west of the Durango-Coahuila state line). **HOLOTYPE:** UF 20903, collected 28 December 1969 by Fred G. Thompson. **PARATYPES:** UF 20902 (30); Direccion General de la Fauna Silvestre, Mexico (4); same data as the holotype.

OTHER LOCALITIES.—**DURANGO:**—3.1 mi. SW of Pedriceña, 5000 ft. elev. (UF 20904).

REMARKS.—This species is unique within *Coelostemma* because of the nodose ornamentation on the axis. This feature differs so much from other types of axial sculpture in the genus that subgeneric rank is accorded this species.

In superficial aspect this snail is similar to the species described below from adjacent areas to the northwest. It differs in external characters most consistently by its weakly-arched whorls, by its protrud-

ing embryonic whorls, and by its quadratic aperture as well as by its profound axial differences.

ETYMOLOGY.—The specific epithet *astraxis* is derived from the Greek *astron*, a star, and *axon*, an axis, and alludes to the appearance of the axis in cross-section of the shell.

Styloptyx new subgenus

TYPE SPECIES: *Coelostemma fornax* new species

A subgenus of *Coelostemma* consisting of species that bear two spiral lamellae upon the axis of the shell. One lamella is large and occupies about the lower five whorls, where it lies upon the center of the axis. The second lamella is very much reduced in size, is confined to the last whorl, and lies between the first lamella and the floor of the whorl. The subgenus is also peculiar in having two large, smooth embryonic whorls, the second of which is partially and obliquely submerged beneath the adjacent whorls.

The subgenus is known to include one species containing two subspecies. The species has been collected from a small area in eastern Durango near Torreón, Coahuila and extends over a NNE-SSW distance of at least 50 miles.

ETYMOLOGY.—From the Greek *stylos*, a column, and *ptyx*, a compressed fold. The name *Styloptyx* is of the feminine gender.

Coelostemma (Styloptyx) fornax new species

DIAGNOSIS.—The distinguishing characteristics are the same as those of the subgenus, which includes the two spiral lamellae on the axis and the oblique embryonic whorls. The typical subspecies is distinguished by having distinct oblique ribs on all of the postembryonic whorls and by having nearly flattened whorls.

SHELL (Fig. 11, A-E).—Moderately large (about 17-23 mm long) and moderately slender. The shell is cylindrical with an apical cone that gradually increases in diameter to the maximum width of the shell at about one-third or one-fourth of the distance from the apex. The lower whorls near the aperture are slightly reduced in diameter. The shell is opaque and light tan with oblique white ribs. The 16.1-20.2 whorls (19.3 in holotype) are slightly arched at their periphery and have a moderately-impressed suture. The base of the last whorl is irregularly rounded but tends to be impressed along the outer wall. The umbilicus is narrowly perforate. The 1.9-2.5 embryonic whorls (2.3 in holotype) lie at an oblique angle to the axis of the shell so that a portion

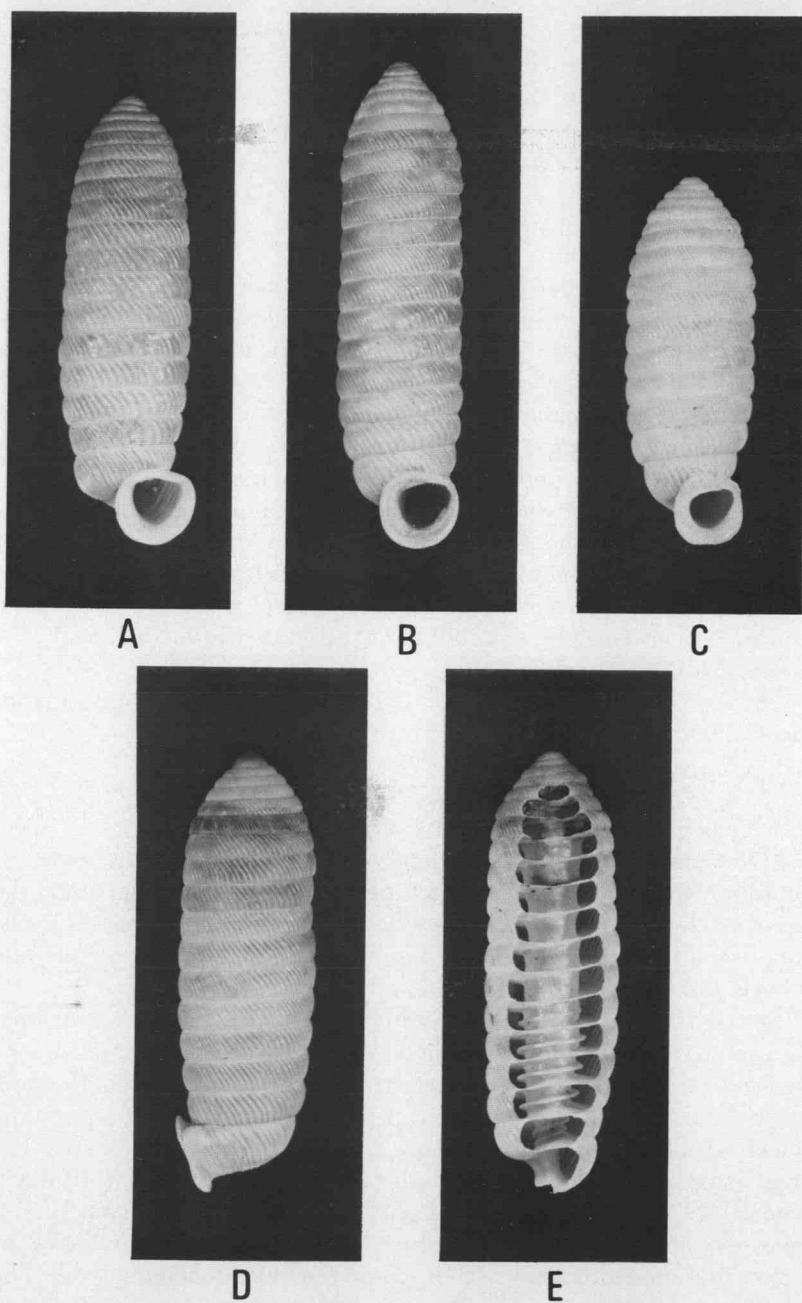


FIGURE 11. *Coelostemma fornax* new species. A. Holotype. B-E. Paratypes.

of the second embryonic whorl is suppressed below the adjacent volutions and appears reduced in size. The embryonic whorls are smooth (Fig. 9, D). The succeeding whorls are crossed with oblique, slightly-arched axial ribs that are of nearly uniform intensity and are about equally spaced through the length of the shell. The 15th whorl has 49-77 ribs (49 in holotype) that are spaced about 3 per mm. The ribs on the last whorls become stronger and closer near the aperture. The aperture usually is free from and advanced beyond the preceding whorl. It is irregularly ovate in shape and generally is as wide as, or wider than, high. The interior of the aperture is made subtriangular by the angle formed by the parietal wall and columellar wall. The peristome is moderately reflected around the aperture. It is most expanded along the columellar and basal lips and least so along the upper-outer lip. The axis is large and hollow and is almost one-half the diameter of the shell near the middle of the spire. The axis is widest in the conical apex and gradually tapers to the width of the narrow umbilical perforation in the last whorl. The axis bears two spiral lamellae. The upper lamella usually occupies the last five whorls, is located just below the middle within each whorl, and is usually higher than wide. The second lamella is confined to the last whorl where it lies midway between the first lamella and the floor of the whorl. Generally it is narrower and lower than the first lamella. Neither lamella is evident within the aperture. In addition to the lamella, the axis shows irregular, oblique white streaks that are incremental lines of growth.

Length of shell 17.5-23.0 mm (21.1), width 5.4-6.9 mm (6.3), aperture height 3.3-4.1 mm (3.8), aperture width 3.4-4.4 mm (4.0). Measurements in parenthesis pertain to the holotype.

GEOGRAPHIC VARIATION.—A series of 39 specimens was collected on a limestone hill on the opposite side of the valley from the type locality, a distance of about 5 miles NNE. Specimens of this series tend to be larger and are less conspicuously ribbed, but they show no characteristics by which they can be consistently separated from the type series.

TYPE LOCALITY.—A limestone mountainside 2.2 miles S of the Presa Francisco Zarca, Durango; 4100 ft. elev. (The Presa Francisco Zarca is a dam on the Rio Nazas about 25 mi. SSE of León Guzman and about 12 mi. NE of Pedriceña, and is about 5 mi. N of the Torreón-Durango Highway). The type locality lies at the base of a long high mountain ridge where snails were collected from under boulders and cactus in a talus slope. The area is extremely hot and dry, with only sparse, low, thorny vegetation. **HOLOTYPE:** UF 20895, collected 26 December 1969 by Fred G. Thompson. **PARATYPES:** UF 20898

(25); Direccion General de la Fauna Silvestre, Mexico (8); same data as the holotype.

OTHER LOCALITIES.—DURANGO:—limestone hill 5.5 mi. S, 1.8 mi. E of the Presa Francisco Zarca, 4200 ft. elev. (UF 20897).

REMARKS.—This species belongs to a group characterized by spiral axial lamella and oblique embryonic whorls. Two forms are known to belong to the group, *C. fornax* and the subspecies described below. *C. fornax* differs from the latter by possessing distinct axial ribs throughout the length of the shell. It also tends to be shorter and stockier, although these last characters are not consistently distinctive.

ETYMOLOGY.—The specific epithet *fornax*, taken from the Greek deity *Fornax*, the goddess of ovens, alludes to this snail's sun-scorched habitat.

Coelostemma fornax ^{sub}*ix* new species

DIAGNOSIS.—A form presumed to be subspecifically related to *C. Fornax* because of the similarity of all parameters of the shell except sculpture and whorl contour. Its sculpture differs from that of *fornax* by having weak incremental striations on the whorls of the cylindric portion of the spire in contrast to the distinctly ribbed whorl of *fornax*. The contour of its whorls differs by being more noticeably arched.

SHELL (Fig. 12, A-E).—Moderately large (about 20-26 mm long). The shell is cylindrical or elongate pupiform in shape. It is opaque, dull, and pinkish-white. There are 17.1-21.0 whorls (19.6 in holotype). The conical apex consists of 1.8-2.5 embryonic whorls (2.1 in holotype) and about 5 postembryonic whorls. The embryonic whorls are smooth and oblique (Fig. 9, E). The following 4-5 whorls are crossed by numerous, fine, oblique riblets that become crowded and indistinct with increasing whorl size. The whorls in the cylindrical portion are arched, nearly smooth, and crossed by irregular, fine, oblique striations. The last two or three whorls are reduced in size. The last one or two whorls have low widely-spaced riblets that become strongest on the periphery of the last whorl near the neck of the aperture. The neck is rounded on the base. The umbilicus is narrowly perforate. The aperture extends forward on a short neck, is broadly ovate or irregularly triangular in shape and usually is wider than high. The parietal wall of the aperture forms an obtuse angle with the columellar wall. The peristome is free from the preceding whorl and is moderately reflected.

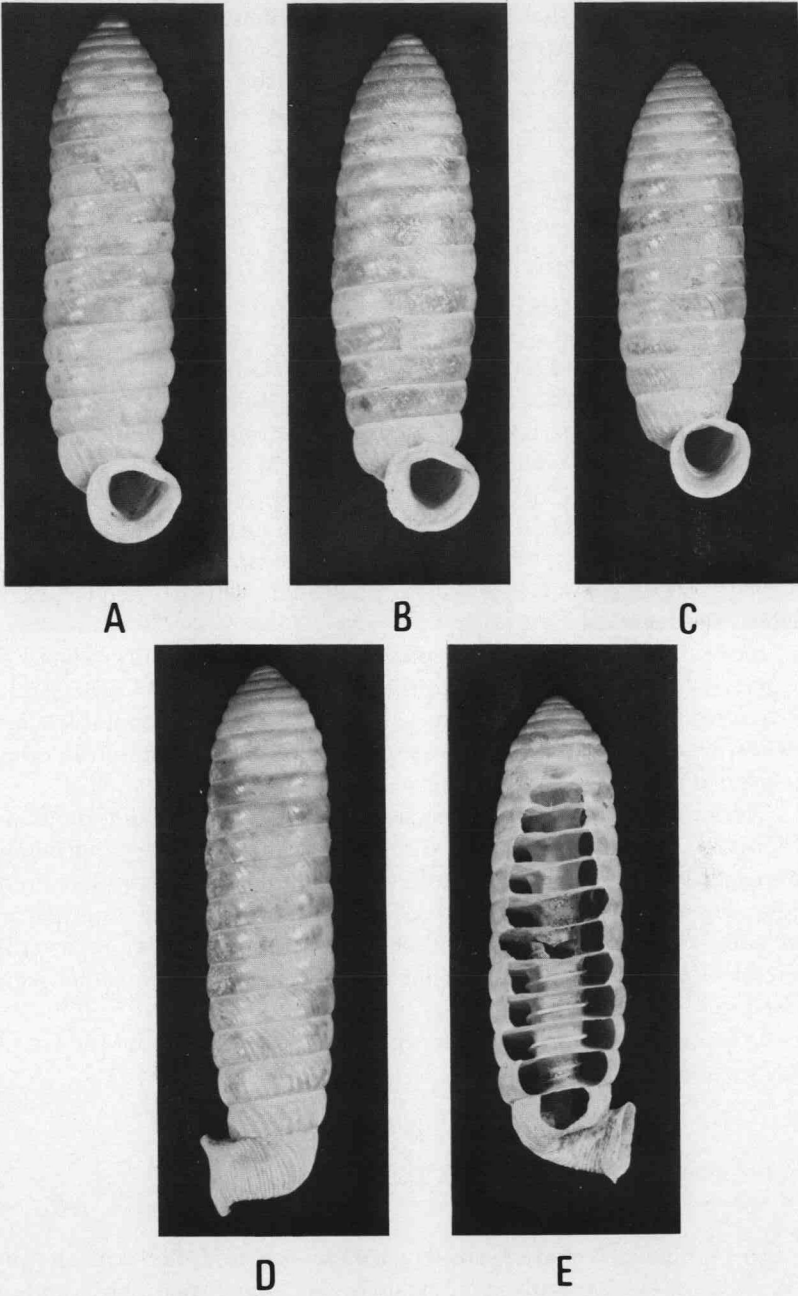


FIGURE 12. *Coclostemma fornax* ix new subspecies. A. Holotype. B-E. Paratypes.

The columellar and the basal lip are most widely expanded, while the outer lip near the posterior corner is least expanded. The axis is broad and hollow, between $\frac{1}{8}$ - $\frac{1}{2}$ the diameter of the shell, is widest near the apex, is slightly constricted near the middle, and narrows rapidly in the last two whorls to the width of the umbilicus. The last five whorls of the axis have a strong spiral lamella. The penultimate whorl has a second smaller axial lamella between the first lamella and the floor of the whorl.

Length of shell 20.0-26.0 mm (25.1), width 6.0-7.1 mm (6.4), aperture height 3.7-4.5 mm (4.2), aperture width 3.8-4.6 mm (4.5). Measurements in parenthesis pertain to holotype.

TYPE LOCALITY.—Durango, 1.0 mi. E of Dinamita, 4200 ft. elev. (Dinamita is a small town located about 30 mi. NW of Torreon, Coahuila). Snails were found on the last limestone hill facing east from the town and were collected from beneath boulders and among the roots of an *Opuntia*. The hillside has a xeric growth of low shrubs and cactae with scattered patches of grasses. HOLOTYPE: UF 20907, collected 29 December 1969 by Fred G. Thompson. PARATYPES: UF 20908 (25), Direccion General de la Fauna Silvestre, Mexico (5); same data as the holotype.

REMARKS.—This form is presumed to be subspecifically related to *C. fornax* because it is similar to the latter in most shell features. The characters that distinguish the two subspecies are rather mutable characteristics of the shell that show similar subspecific variation in other holospirid genera.

The ranges of the two subspecies apparently are discontinuous. *C. f. fornax* is known only from a complex of limestone hills and mountains south of the Rio Nazas, while *C. f. ix* occurs in an extensive limestone range north of the Rio Nazas. The localities for the two subspecies are about 50 miles apart. Several intermediate localities of apparently suitable habitat were searched for snails, but no *Coelostemma* were found.

ETYMOLOGY.—The subspecific epithet *ix* is derived from the Greek *ix*, a worm or grub.

Subgenus *Apertaxis* Pilsbry

Apertaxis Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 159. (Type species: *Coelostemma amplaxis* Pilsbry, 1953 = *Epirobia coahuilensis* Bartsch, 1906).

This subgenus is characterized by a many-whorled shell with attenuate, finely-granular embryonic whorls, an open umbilicus, and a large axial column that narrows slightly in the last whorl. The subgenus

is monotypic and is known only from the Sierra Guadalupe in Coahuila.

The shape and sculpture of the embryonic whorls are so different from other groups of *Coelostemma* that I doubt the relationship Pilsbry proposed (1953: 159) to that genus. It is left in this affiliation pending anatomical studies of this and related genera.

Coelostemma (Apertaxis) coahuilensis (Bartsch)

Epirobia coahuilensis Bartsch, 1906; Proc. U. S. Nat. Mus., 31: 121; pl. 4, fig. 3. (Type locality: Sierra Guadalupe, Coahuila).

Coelostemma amplaxis Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 159-160; pl. 3, figs. 3-3b. (Type locality: Sierra Guadalupe, back of Hacienda Guadalupe, Coahuila).

No distinction can be made between the names *coahuilensis* and *amplaxis*. Apparently Pilsbry (1953: 159-160) overlooked Bartsch's earlier description (1906: 121) of the same species.

The embryonic shell of the holotype (USNM 187505) consists of about 3.5 whorls, the second of which is noticeably enlarged (Fig. 9, B). The embryonic whorls are separated from the subsequent neapic whorl by a moderate impression and are sculptured with minute, dense granulations. The following whorls have moderately-strong, well defined ribs. No vertical sculpture is indicated on the embryonic whorls.

Metastoma Strebel

Metastoma Strebel, 1880; Beitrag Kenntnisse Mex. Land-u. Susswasser- Conch., 4: 80.- Pilsbry, 1903; Man. Conch., II, 15: 96-97.- Pilsbry, 1946; Land Moll. N. Amer., II(1): 114. (Type species by original designation: *Cylindrella roeмери* Pfeiffer, 1848).

Metastoma is diagnosed by Pilsbry (1946: 114) as follows: The oblong-cylindrical shell is smooth. The last whorl is sinuous, turning to a sinistral position. The internal column is hollow, about $\frac{1}{4}$ - $\frac{1}{3}$ of the shell's diameter, and is without sculpture or lamella. The aperture is oval and is obstructed with a strong fold within the right margin. In addition to Pilsbry's diagnosis it should be noted that the embryonic whorls bear granular sculpture as is described below under *Metastoma roeмери* and is similar to the embryonic sculpture of *Coelostemma s. s.*

The only feature that distinguishes *Metastoma* from *Coelostemma* is the presence of a strong fold on the right margin of the aperture. Other aspects of the shell also occur in different and unrelated species of *Coelostemma* and are nondiagnostic above the specific level.

Heretofore *Metastoma* has been treated as a subgenus of *Holospira*, an allocation that also has been used for most other related genera. The large hollow axis of *Metastoma* is similar to that of *Coclostemma* and indicates a close phylogenetic relationship. This character contrasts strongly with the thin, solid, lamellate axis of *Holospira*. The presence of a strong, compressed, angular fold within the aperture is unique to *Metastoma* among the Holospirinae and is herein considered sufficient basis for generic separation. The genus is monotypic. The characteristics of the apical sculpture described below for *M. roemeri* are more similar to that of the typical subgenus of *Coclostemma* than to *Crycoryne* or *Styloptyx* and indicate a phylogeny with the former subgenus.

Metastoma roemeri (Pfeiffer)

Cylindrella roemeri Pfeiffer, 1848; Monogr. Helicorum Viventium, 2: 382. (Type locality: around New Braunfels, Comal County, Texas).

Holospira roemeri (Pfeiffer), W. G. Binney, 1878; Terr. Moll., 5: 177, fig. 85.-Pilsbry, 1903; Man. Conch., II, 15: 97-98; pl. 25, figs. 1-7.-Pilsbry, 1905; Proc. Acad. Nat. Sci. Phila., 220; pl. 26, figs. 10-18.-Bartsch, 1906; Proc. U. S. Nat. Mus., 31: 148.-Pilsbry, 1946; Land Moll. N. Amer., II(1): 114-115; fig. 55.

Holospira roemeri var. *minor* Cockerell, 1898; Nautilus, II: 136.

This species is widely distributed through southwestern Texas and southern New Mexico (Pilsbry, 1946: 115). The first $2\frac{1}{2}$ embryonic whorls have minute granular sculpture (Fig. 9, C). The following $\frac{1}{4}$ embryonic whorl has very weak vertical threads that become more intense near the first postembryonic whorl.

APPENDIX

Specific and subspecific names referred to *Coclostemma* are listed below with their current systematic allocations.

adana Bartsch, (*Holospira*), 1926; Proc. U. S. Nat. Mus., 70: 3; pl. 1, fig. 14. (Type locality: streamdrift from the Rio Balsas, Balsas Station, Guerrero). = *C. (C.) adana* (Bartsch).

adria Bartsch, (*Holospira*), 1926; Proc. U. S. Nat. Mus., 70: 2-3; pl. 1, fig. 1. (Type locality: streamdrift from the Rio Balsas, Balsas Station, Guerrero). = *C. (C.) adria* (Bartsch).

amplaxis Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 159-160; pl. 3, figs. 3-3b. (Type locality: Sierra Guadalupe, back of Hacienda Guadalupe, 7500-8000 ft. alt.). = *C. (Apertaxis) coahuilensis* (Bartsch).

anaclasta new species. (Type locality: 1.9 mi. NE of Tecolapa, Colima; 700 ft. alt.).

anconai Bartsch, 1951; Jour. Wash. Acad. Sci., 41: 146; figs. 1, 3. (Type locality: Ixcaptiopan, Guerrero). = *C. (C.) anconai* Bartsch. May be a subspecies of *C. (C.) bourgeoisana* Bartsch.

antricola Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58; fig. 5. (Type locality: Las Grutas, Cacahuamilpa, Guerrero). = *C. (C.) bourgeoisana antricola* Bartsch.

- astraxis* new species. (Type locality: 9.0 mi. SSW of Picardías, Durango; 4400 ft. alt.).
- balesi* Pilsbry, 1954; *Nautilus*, 65: 82; pl. 8, fig. 4. (Type locality: Km. 175, near Chilpancingo, on road to Acapulco, Guerrero). = *C. (C.) balesi* Pilsbry.
- balsasensis* Bartsch, (*Holospira*), 1926; *Proc. U. S. Nat. Mus.*, 70: 1-2; pl. 1, fig. 16. (Type locality: streamdrift from the Rio Balsas, Balsas Station, Guerrero). = *C. (C.) balsasensis* (Bartsch).
- bembix* new species. (Type locality: 12.6 mi. N of Zumpango del Rio, Guerrero; 2300 ft. alt.).
- bourgeoisiana* Bartsch, 1942; *Jour. Wash. Acad. Sci.*, 32: 187; fig. 1. (Type locality: Ixtapan de la Sal, Mexico). = *C. (C.) bourgeoisiana bourgeoisiana* Bartsch.
- bryantwalkerii* Pilsbry, 1917; *Naut.*, 30: 124-125; pl. 4, fig. 6. (Type locality: Rio Conchos, Chihuahua); Subgeneric status uncertain.
- chilpancingensis* Pilsbry, 1953; *Proc. Acad. Nat. Sci. Phila.*, 105: 158; pl. 5, figs. 2-3a. (Type locality: between Chilpancingo and Mazatlan, Guerrero). = *C. (C.) chilpancingensis* Pilsbry.
- claviformis* Martens, (*Holospira*), 1897; *Biologia Centrali Americana*: 277; pl. 16, figs. 10-16. (Type locality: Amula, Guerrero). = *C. (C.) elizabethae* (Pilsbry).
- coahuilensis* Bartsch, (*Epirobia*), 1906; *Proc. U. S. Nat. Mus.*, 31: 121; pl. 4, fig. 3. (Type locality: Sierra Guadalupe, Coahuila). = *C. (Apertaxis) coahuilensis* (Bartsch).
- dalli* Pilsbry, (*Holospira*), 1903; *Man. Conch.*, Ser. II, 15: 100-101; pl. 26, figs. 28-31. (Type locality: Sierra de Guadalupe, Coahuila). = *C. (C.) dalli* (Pilsbry).
- eclipses* new species. (Type locality: 16.4 mi. N of Zumpango del Rio, Guerrero; 2300 ft. alt.).
- elizabethae* Pilsbry, 1889; *Proc. Acad. Nat. Sci. Phila.*: 81; pl. 3, figs. 1-5. (Type locality: Amula, Guerrero). = *C. (C.) elizabethae* (Pilsbry).
- fornax* new species. (Type locality: 2.2 mi. S of the Presa Francisco Zarca, Durango; 4100 ft. alt.).
- freytagi* Bartsch, 1950; *Jour. Wash. Acad. Sci.*, 40: 265; fig. 1. (Type locality: Chihuahuan desert, 29 mi. W of Jiménez, Chihuahua). Subgeneric status uncertain.
- fusca* Martens, (*Holospira*), 1897; *Biologia Centrali Americana*: 281; pl. 16, figs. 20-24. (Type locality: Omilteme, Guerrero). = *C. (C.) fusca* (Martens).
- greggi* Drake, 1951; *Revista de la Sociedad Malacologica*, 8: 40-41; pl. 6, figs. 3-4. (Type locality: foothills of the Sierra de Almoloya, near Cuevo Diablo, near Salaces, Chihuahua). = *Holospira (Haplocion) greggi* (Drake).
- hazela* Pilsbry, 1953; *Proc. Acad. Nat. Sci. Phila.*, 105: 159; pl. 5, fig. 4. (Type locality: between Chilpancingo and Mazatlan, Guerrero). = *C. (C.) hazela* Pilsbry.
- herrerai* Bartsch, (*Holospira*), 1906; *Proc. U. S. Nat. Mus.*, 31: 150, pl. 4, fig. 14. (Type locality: Silaca Yuapan [Silacayoapan], Oaxaca). = *C. (C.) herrerai* (Bartsch).
- igualensis* Bartsch, (*Holospira*), 1926; *Proc. U. S. Nat. Mus.*, 70: 3, pl. 1, fig. 12. (Type locality: Iquala [Iguala], Guerrero). = *C. (C.) igualensis* (Bartsch).
- imbricata* Martens, (*Cylindrella*), 1863; *Monatsber. Berl. Akad. Wissensch.*: 540. (Type locality: Mexico). = *C. (C.) imbricata* (Martens).
- ix* new subspecies. (Type locality: 1.0 mi. E of Dinamita, Durango; 4900 ft. alt.).
- leucostoma* new species. (Type locality: Ruinas de Xochicalco, Morelos; 4900 ft. alt.).

- lichenophora* Bartsch, (*Holospira*), 1906; Proc. U. S. Nat. Mus., 31: 146-147; pl. 4, fig. 7. (Type locality: Encarnacion, Hidalgo). = *C. (C.) lichenophora* (Bartsch).
- lissocentrum* Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 158-159; pl. 8, figs. 5-5b. (Type locality: Cerro Potosí, Nuevo León; 10,000 ft. alt.). = *C. (C.) lissocentrum* Pilsbry.
- marrsi* Drake, 1951; Revista de la Sociedad Malacologica, 8: 39-40; pl. 6, figs. 1-2. (Type locality: Cuevo Diablo, near Salaices, Chihuahua). Subgeneric status uncertain.
- microstoma* Pfeiffer, (*Cylindrella*), 1861; Proc. Zool. Soc. London: 27. (Type locality: unknown). Status uncertain; may be a species of *Coelostemma* (*Coelostemma*).
- notogastor* new species. (Type locality: 14.2 mi. SW of Sola de Vega, Oaxaca; 6500 ft. alt.).
- presidioensis* Bartsch, 1943; Jour. Wash. Acad. Sci., 33: 58-59; fig. 2. (Type locality: Presidio, Veracruz). = *C. (C.) presidioensis* Bartsch.
- reiteri* Drake, 1951; Revista de la Sociedad Malacologica, 8: 41-42; pl. 6, figs. 5, 6. (Type locality: Los Remedios, Distrito Jiménez, Chihuahua). Subgeneric status uncertain.
- richardi* new species. (Type locality: 1.3 mi. NE of Tonalá, Oaxaca; 5000 ft. alt.).
- saltillensis* Pilsbry, 1953; Proc. Acad. Nat. Sci. Phila., 105: 157-158; pl. 5, figs. 5-5c. (Type locality: mountains on the right of the highest pass on road from Saltillo to Diamante, Coahuila, 7900 ft. alt.). = *C. (C.) saltillensis* Pilsbry.
- strebeliana* Pilsbry, (*Holospira*), 1903; Man. Conch., 15: 101; pl. 26, figs. 24-28. (Type locality: Sierra de Guadalupe, Coahuila). = *C. (C.) dalli* (Pilsbry).
- townsendi* Bartsch, (*Holospira*), 1906; Proc. U. S. Nat. Mus., 31: 145-146; pl. 4, fig. 13. (Type locality: Cerro Chilicote, Chihuahua). Subgeneric status uncertain.

Five species, *bryantwalkeri*, *freytagi*, *marrsi*, *reiteri*, and *townsendi*, comprise a natural assemblage that probably merits subgeneric recognition. This group will be discussed elsewhere.

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