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# THE MOLLUSCA COLLECTED BY THE UNIVERSITY OF MICHIGAN-WILLIAMSON EXPEDITION IN VENEZUELA

BY H. BURRINGTON BAKER

## PART I. CURACAO

Curacao is a small island lying about 50 miles off the coast of Venezuela, in approximately 69 degrees west longitude by 12 degrees north latitude. It has always been of considerable interest to conchologists, as its molluscan fauna, as far as known, appears to indicate West Indian, rather than South American affinities.

As viewed from the steamer, it is a rocky, quite arid island, with a low cliff along the shore, at least at the northern end. Back from the ocean are seen numerous cliffs, broken ridges, and occasional peaks, which reach an altitude of perhaps 300 to 400 meters. The north end of the island appears to have considerable brush, covering especially the higher hills, but the vegetation is predominantly chapparal-like, with frequent

organ-pipe cacti. The south-east end, near Willemstad, is lower, less broken, and noticeably more arid. From its color, much of the rock outcrop at the northern end appears to be metamorphic or igneous, but the south shore is entirely of a coral-reef formation.

On March 28, and again on May 6, 1920, a few hours collecting at the east edge of Willemstad netted a considerable number of shells. The abundance of Cerion was astounding; practically every bit of vegetation was almost covered at the base with æstivating individuals. I estimated that there were about 50 specimens per square meter examined.

The place collected is Schaarlo, just behind the lagoon east of the harbor. This hill is entirely composed of porous limestone, somewhat like that around Nassau in the Bahamas. The vegetation is very scanty and consists mainly of Opuntia-like cacti and prickly pears, with some of the larger organ-pipe cacti, mimosa and evergreen thorn-bushes reaching a height of about 6 meters. Extreme dessication is the predominant feature of the landscape, and I am told that it rains very rarely. All of the living shells collected were æstivating either on the lower stems of bushes and cacti (mainly Cerion), or in crevices between and under the rocks and rock-fragments.

ANNULARIIDÆ

*Tudora megacheilos* (Potiez and Michaud).

Quite abundant; mainly under bits of coral rock and in crevices, but rarely found æstivating on the vegetation. This species is very variable, in color, size and sculpture. The males are considerably smaller than the females, and tend to be more brilliantly colored. The coloration may be classified as follows:

a. Ground-color: white to buff and old rose.

b. Inside of aperture: buff to light chocolate-brown and scarlet, corresponding to the three extremes of ground-color. The stripes of the exterior also show through the shell.

c. Tip of spire (embryonic whorls always absent in adults): purplish-black through dark chocolate-brown to the same shades as the ground-color. The shells with the pinkish general coloration often have salmon or scarlet tips.

d. Spiral bands:

1. Number: the maximum is 5; one near the suture (only in one specimen); a group of 3 near the greatest ventricosity; and 2 around the umbilicus in the region of the parietal wall of the aperture. Commonly, only one band is present; this may be the central one of the peripheral group, or, even more commonly, the upper of the umbilical pair.

2. Color: any shade of the series given for the tips, except the purplish-black.

3. Continuity: either entire or broken into square dots; narrow and sharply marked, or wide and diffuse. Sometimes the central group of 3 fuse into a single broad band.

e. Varices: the commonest form of banding consists simply of diffuse axial varices, which vary in color as do the stripes. One specimen has very distinct chocolate-brown varices, with flammulations corresponding to the position of the spiral ridges; near the aperture band 4 is entire and very prominent.

Although variable in shape, all of the specimens are quite typical of *T. megacheilos*. No specimens approaching *T. cos-*

*tata* ("Menke" Pfr.) (1846) are present in this lot, although specimens in the A. N. S. P., from both Curacao and Buen Ayre (Bland), approach the description of the latter. It will probably be found to be a local species or subspecies.

The shape of the aperture is very variable. A tendency to form a broad, angular columellar reflection, and an almost canaliculate, free upper angle is quite common.

The apical whorls of young specimens are irregularly and lightly pitted. The remainder of the whorls have fine, close-set axial riblets, which are always quite regular. These are usually crossed by heavy spiral angulations; as many as 17 may be present, or they may be so faint as to be practically absent. It is quite impossible to use this character to determine the sectional position of this lot. One shell has only one spiral thickening, which runs around the greatest ventricosity and makes all of the whorls quite markedly angular. In addition, a few shells are malleate.

Representative examples measure:

| | Altitude | Greatest diameter | Height aperture | Diameter aperture |
|---|---|---|---|---|
| male: | 12.8 mm. | 70 ( 9.0 mm.) | 52 ( 6.7 mm.) | 45 (5.8 mm.) |
| female: | 19.8 mm. | 64 (12.7 mm.) | 50 (10.0 mm.) | 45 (8.9 mm.) |

*Chondropoma* (?) *raveni* (Crosse) (1872).

Ten dead specimens from rock debris. In some specimens the aperture is scarcely solute, while in others the entire last whorl is free. None of my specimens have the operculum (compare Henderson and Bartsch, 1920), but the shell characters are certainly closest to the group of *Annularia lachneri*. The apical whorls (figs. 1-6) are practically smooth, but show irregular anastamosing wrinkles under high magnification; they are always eroded from adult specimens, but the total number of whorls must be about 9.

PUPILLIDÆ

*Pupoides simoni* (Jousseaume) (1889)?

One fresh specimen. The peristomal callus is not well developed; the parietal callus is especially weak, in fact, practically lacking. No angular tubercle nor reddish band shows on the throat of the aperture. The axial striations are distinct on the lower whorls. With 5½ whorls, the specimen measures: altitude, 3.9 mm.; greatest diameter, 46 (1.8 mm.). It appears closest to *P. modicus* (Gould) (1848), but may possibly be a youngish specimen of *P. marginatus nitidulus* (Pfr.) (1839).

ACHATINIDÆ

*Leptinaria* (*Neosubulina*) *gloynii* (Gibbons). Figs. I-1, 2, 3.

*Cionella gloynii* Gibbons (1879), (*gloynei* auct.), Curacao.
*Neosubulina harterti* Smith (1898), Buen Ayre.
*L. gloynii minuscula* Pilsbry (1907).

Thirty-seven specimens, from crevices of rock and among rock-fragments. From the variation in the lot before me, I can see no reason for the specific separation of any of the forms included in the above synonomy. From the figure, *L. harterti* appears less attenuate towards the apex. E. A. Smith, from his list of species of Curacao, was apparently not acquainted with even the description of *L. gloynii*.

The embryonic whorls of these specimens have close and fine axial striations, which become somewhat coarser on the later whorls. The egg is of quite large size, and the slender embryonic shell contains 1¼ whorls. The spiral lamellæ on the columella extend back 4 whorls from the aperture, and the parietal one is present in young shells. My specimens show considerable variation in size, apparently not entirely due to age. An individual measures:

| | Altitude | Greatest diameter | Height aperture | Diameter aperture |
|---|---|---|---|---|
| 9¾ whorls | 11.8 mm. | 23 (2.7 mm.) | 23 (2.7 mm.) | 13 (1.5 mm.) |

BULIMULIDÆ

*Drymœus multilineatus* (Say). Two dead, bleached specimens.

UROCOPTIDÆ

**Microceramus bonairensis curacoana,** new subspecies

Figs. 1-4, 5

Eighty-two specimens, some living, under bits of coral rock on outskirts of Willemstad, Curacao.

Shell distinctly rimate, turrite to lanceolate; last 4 whorls almost equal in diameter, but the penultimate slightly the broadest; earlier whorls gradually, or quite rapidly increasing in size. Color: light corneous to dark brown, usually marked with opaque, milky-white, irregular varices, which may be so extensive as to obliterate the corneous ground-color on the last whorls. Whorls: 9 to 11, somewhat convex; the first half-whorl smooth and polished; the next ones with minute, regular, closely spaced axial riblets, which are also quite well-marked on the corneous portions of the last whorls, but are almost obliterated by the thickening of the interstitial spaces on the opaque, whitish portions; these thickenings on the last whorls may develop several heavy, irregular, raised, spiral lines; last whorl with a quite well-marked, basal angulation, which gives the shell a peculiar subtruncate appearance when viewed from behind, and which is much more prominent in young shells. Aperture: nearly circular; peristome whitish, but slightly thickened and reflexed, incomplete on the parietal margin, most reflected on the columellar. Columella inside of whorls; cylindrical and quite slender, showing only a very vague spiral undulation.

I have not seen specimens of typical *bonairensis* (E. A. Smith, 1898), but it is certainly a smaller shell. The individuals of *curacoana* figured show the extremes in variation of size and shape. They measure:

| Whorls | Altitude | Greatest diameter | Height aperture | Diameter aperture |
|---|---|---|---|---|
| 11 | 9.3 mm. | 35 (3.2 mm.) | 27 (2.5 mm.) | 26 (2.4 mm.) |
| 11 | 8.9 mm. | 31 (2.7 mm.) | 22 (2.0 mm.) | 22 (1.9 mm.) |
| 9 | 7.1 mm. | 41 (2.9 mm.) | 24 (1.7 mm.) | 25 (1.7 mm.) |
| 9 | 6.7 mm. | 41 (2.7 mm.) | 25 (1.7 mm.) | 27 (1.8 mm.) |
| *bonairensis* | | | | |
| 8½ | 6.0 mm. | 42 (2.5 mm.) | 25 (1.5 mm.) | (E. A. Smith, 1898) |

The radulæ of two alcoholic specimens were examined (fig. 5). The formula is C 1/1; I 37/2 + 1/1 = 38 — 1 — 38. The central has a single heavy cusp. The laterals have a broad, thin blade (mesocone), and a stout, recurved aculeate, smaller one (entocone). The edge of the mesoconal blade from the 7th out is quite noticeably concave near the tip. The base of each of the teeth is narrow, elongate and poorly limited posteriad; that of the laterals is divided longitudinally, except near the base, by a groove which runs up to between the cusps. The outermost teeth are reduced in size; the last is little more than a mere denticle. This radula appears closest to that of *M. pontificus* (Gould), as figured by Pilsbry (1904).

*Brachypodella raveni* ("Bland" Crosse) (1872).

Thirty-two specimens, some living; from underside of rocks.

CERIONIDÆ

*Cerion uva* (Linn.) (1758).

Very abundant; cemented to the rocks and the lower portions of the vegetation. None of my specimens belong to the var. *desculptum* Pilsbry and Vanatta (1896).

## Part II. Terrestrial Operculates of Venezuela.

In order to escape useless repetition, the following habitat and station symbols (preceded by H) are used throughout this paper. The last number of these references is that of the station. Another part will describe the habitats and localities in greater detail. Many of these places have been described by E. B. Williamson, in number 130 of this series (1923). My spelling of place-names is mainly copied from the Venezuelan government maps.

### *Terrestrial Habitats*

H, I. Mountain sides; heavy forest.
- H, I, a. Rock slopes and faces.
- H, I, b. Talus and leaf mould.
- H, I, c. Root mould.
- H, I, d. Leaves and stems of trees and shrubbery.

H, II. Lowland, and stream flats; heavy forest,
(letters as in H, I).

H, III. Cultivated fields.

H, IV. Artificial savannahs.

H, V. Second growth forests, tombas, coffee and cacao plantations (montado),
(letters as in H, I).

### *Aquatic Habitats*

H, VI. Mountain brooks (quebradas).
- H, VI, a. Waterfalls and rapids.
- H, VI, b. Pools.
- H, VI, c. Spring swamps, or separate pools on flats.

H, VII. Mountain creeks (rios),
(letters as in H, VI).

H, VIII. Lowland or valley brooks (caños and quebradas), (letters as in H, VI).

H, IX. Lowland or valley creeks (rios), (letters as in H, VI).

H, X. Rivers (rios).

H, XI. Large lagoons (lagunas).

H, XII. Savannah ponds (lagunas).

H, XIII. Forest pools, mainly temporary.

H, XIV. Brackish water lagoon.

H, XV. Breakwater (ocean).

*Stations*

La Guaira, Federal District.
(L 11, 66; coast.)[1]

1. Valley of Rio Macuto.

San Esteban, Estado Carabobo.
(L 11, 67; about 100 meters altitude.)

2. Along Rio San Esteban, near the village.
3. Quebrada Grande; opposite and about 2 kilometers above the town.
4. Ridge east of town.
5. Ravina de las Palmas; opposite and just below the village.
6. Sides of Cumbre Chiquito; above and opposite Las Quiguas.

Bejuma, Estado Carabobo.
(L 10, 67; about 600 meters altitude?)

7. Banco Largo.
8. Rio Bejuma Valley.

[1] Throughout this paper, the numbers in parentheses preceded by the letter (L) indicate north latitude and west longitude to the nearest degree. The altitudes in the list of stations are those of the towns.

9. Laguna de Ramón Coronel.
10. Rio Aguirre and Sábanas de Aguirre.
11. Quebrada west of Banco Largo.
12. Rio Bejuma at Bejuma.
13. Rio La Mona (Caserio Silva).
14. Rio Chirgua (near Caserio Silva).
15. Cerro Chiriguara.

Miranda, Estado Carabobo.
(L 10, 68.)

16. Miranda.

Nirgua, Estado Yaracuy. (L 10, 68; 867 meters altitude).

17. Wooded ridges of La Chapa (1109 meters altitude).
18. Rio Piña, above intake (headwaters of Rio Nirgua).
19. Rio Nirgua and savannahs near town.

San Felipe, Estado Yaracuy.
(L 11, 68; 226.5 meters altitude).

Palma Sola, Estado Yaracuy.
(L 11, 68; 226.5 meters altitude).

20. Around town and towards Caño Minapam.
21. Along Rio Aroa.
22. Hills along railroad towards San Felipe.

Aroa, Estado Yaracuy. (L 11, 68; 212 meters).

23. Quebrada Carampampa (?); west of Aroa.
24. Mines of Aroa and above. (Quebradas Honda and Las Minas).

Boquerón, Estado Yaracuy.
(L 11, 68; about 125 meters altitude.)

25. Rio Aroa.
26. Quebrada Vaca (tributary of Quebrada Carabobo).

26a. Quebrada Cobre.

27. Woods around Boquerón.
27a. Rio Yumarito.
28. Near Quebrada Seca, Cerritos de Yumarito.
29. Quebrada Sucremo.

Tucacas, Estado Falcón.
(L 11, 68; coast.)

30. Laguna near Tucacas.
31. Around intake on Rio Tuca.

Puerto Cabello, Estado Carabobo.
(L 11, 67; coast.)

32. Breakwater.

Maracaibo, Estado Zulia.
(L 9, 72; coast.)

33. Brackish water lagoon in suburbs.

Rio Catatumbo, Estado Zulia.
(L 9, 72; coast.)

34. Boca Norte del Rio Catatumbo, Laguna de Maracaibo.

Estación Táchira, Estado Táchira.
(L 8, 72; 364 meters altitude by barometer.)

35. Brook, on opposite side of Rio Lobaterita, just above town.
36. Quebrada Uracá.
37. Camino Real, near mouth of Quebrada Uracá.
38. Quebrada just west of town, and right side of cañon of Rio Lobaterita.

La Fria, Estado Táchira.
(L 8, 72; 140 meters altitude.)

39. Caño de las Brujas, Cerritos de las Brujas.
40. Heavy, lowland forest, between railroad track and Rio La Grita.

41. Quebrada La Fría, near Camino Real.
42. Quebrada Santa Aguita, near Camino Real.
43. Between Quebrada Las Pipas and Rio Oropito.
44. The "tombas" at the railroad bridge across Rio La Grita.

El Guayabo, Estado Zulia.
(L 8, 72; 68 meters altitude.)

45. Near Rio Zulia (El Caño Fraile).

Encontrados, Estado Zulia.
(L 9, 72; 42 meters altitude.)

46. Ponds and river flats near Rio Catatumbo, northwest of town.

NERITIDÆ

*Neritina virginea reclivata* (Say).

Seventeen specimens from slightly brackish lagoon near Maracaibo (E. B. Williamson). These specimens resemble closely those from Florida, although they somewhat approach *N. v. microstoma* from Cuba. A few show more widely-spaced hair-lines than is common in typical *N. v. reclivata*. The general coloration is dark olive-green to olive-brown. The radula of specimens from this lot have been figured in another paper (1923, Proc. Acad. Nat. Sci., Philadelphia). Individuals measure:[2]

| altitude | major diameter |
|---|---|
| 13.7 | 97 (13.3). |
| 12.2 | 102 (12.5). |
| 10.8 | 99 (10.7) |

[2] Throughout this paper, the altitude of the shells is given in millimeters. The other dimensions are expressed as an index, the dimension divided by the altitude, in percentages of the latter. The dimension index is followed by the actual measurement in millimeters (in parentheses).

*Nerita tessellata* Gmelin.

The radula of specimens, from the break-water at Puerto Cabello (H, XV, 32), has been discussed in another paper (l. c.).

HELICINIDÆ

**Oligyra (Alcadia Sericea) riparia tachirensis,** new subspecies

Eighteen specimens; Estación Táchira and La Fría, from leaves of trees and shrubs, and on ground in rich humus (aestivating), on mountain sides and in lowland jungle (H, I, bd, 35; II, bd, 40). This species is usually found nearer the ground than is *Helicina concentrica.*

In the A. N. S. P. is a set (no. 14612) of three, bleached specimens of *H. riparia* Pfr. (1854), from near Calamar, Colombia (L 10, 75, the type locality). They still show signs of the spiral lines and the peculiar indentation of the basal edge of the peristome, and appear to be quite closely related to *O. sericea* (Drouet, 1859), from Cayenne. Other forms of the latter species are *O. sericea paraensis* (Pfr., 1859), from Para, Brazil, and *O. sericea kuehni* (Pfr., 1872), from Surinam. However, *O. riparia* is a larger, more depressed shell, with a tendency towards more definite, spiral lines, and more rapidly enlarging whorls. Fresh specimens, of a brown color form, from Aracataca, Colombia (L 11, 74), a few miles northeast of the type locality (A. N. S. P. no. 46579, Rehn and Hebard, 1920), show the hairy epidermis of the group.

*O. r. tachirensis* is very similar to the typical form, but is usually larger, higher, and with a tendency towards less marked spiral lines. Two, quite distinct, color forms occur: dull chestnut brown (10 specimens) and pale lemon yellow (8 speci-

mens). All of the shells are unicolor. The growth lines are markedly definite and regular; in some cases, spiral lines are also quite prominent, but this character is variable. The short (.5 mm.), reddish-brown hairs are often removed with the incrusting dirt, but, in perfect specimens, are arranged so as to form spiral rows and also rows parallel to the growth-lines. The heavy, basal callus has a peripheral thickening, where it appears as a projection at the base of the columella. In young specimens, just outside of this projection is a definite, triangular slit, which is represented by a well-marked indentation in fully mature shells with slightly reflected and thickened peristome. The heavy and well-developed, calcareous plate of the operculum is similar to that of *O. sericea* (Cf. Wagner, 1907, X-4), but bears a more definite, longitudinal ridge on the inner surface, running from the nucleus to the basal angle. The angular region is also especially thickened. The very thin, horny plate is slightly pinkish in color; during removal of the animal, it is usually separated from the calcareous plate, as it adheres closely to the foot.

The type belongs to the brown color-form, and was collected on leaves of trees near La Fría (H, II, d, 40).

| | Whorls | Height | Maj. Diam. | Min. Diam. | |
|---|---|---|---|---|---|
| *O. sericea* | 4½ | 5.0 | 120 (6.0) | 100 (5.0) | Wagner, (1907) |
| *O. riparia* | 5½ | 5.0 | 140 (7.0) | 125 (6.2) | Pfeiffer (1854) |
| A. N. S. P. 46579 | 5· | 4.8 | 140 (6.7) | 119 (5.7) | Aracataca, Col. |
| *O. r. tachirensis* | 4½ | 5.6 | 127 (7.1) | 114 (6.4) | Female (type). |
| | 4½ | 5.0 | 128 (6.4) | 110 (5.5) | Male. |

The radular formula of *O. r. tachirensis* is given in another paper (1922), and characteristic teeth are figured here (fig. iii-14). The very broad, rachidian plate distinguishes it from Alcadia s. s. Other species of Oligyra from northern South America are: *O.* (*Analcadia*) *dysoni dysoni* (Pfr., 1859),

from Cumana, Venezuela (L. 11, 64); *O. dysoni barbata* (Guppy, 1864) from Trinidad; *O.* (*Succincta*) *cacaguelita* (Pilsbry and Clapp, 1902) from Cacaguelita, Santa Marta Mts., Colombia (L. 11, 74); and *O.* (*?*) *pellucida* (Sowerby, 1842) from Surinam, Guiana.

The radular formula of a dried specimen of *O. dysoni barbata* (A. N. S. P. 14917, Trinidad, Swift Collection) is given below and samples of the teeth are figured (fig. iii-12). The

| | | | | | Uncini with | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | 3-cusps; | 4-cusps | Total | Each row |
| *O. dysoni barbata* | 3-4 | 5 | 4 | 7-8 | 8 | 4 | 64 | 139 |
| *O. rufa* | 3-4 | 5 | 4-5 | 7-8 | 6 | 4 | 75 | 161 |

centrals are quite similar to those of Oligyra s. s., but the shell characters approach those of Alcadia; Analcadia is perhaps best retained as a subgenus between the two subgenera Oligyra and Alcadia. The radular formula of two dried specimens of *O.* (*Analcadia*) *rufa* (Pfr., 1857) from Yuma River, Haiti (A. N. S. P. 60953), is given for comparison (fig. iii-11). The inner marginals have two large cusps and a vestigial, outer one, very much as in Idesa and Alcadia s. s. Otherwise, this radula is very similar to that of the South American species.

The radular formula and probable position of *O. cacaguelita* have been discussed in a former paper (1922). I have not seen specimens of *O. pellucida,* but it also appears to belong in Succincta. However, other writers have noted its similarity to *H. tamsiana* Pfr.

For comparison with the above, the radula of *O.* (*Alcadia Idesa*) *rotunda* (Orbigny, 1845) from Marianao, Cuba, is figured (fig. iii-13). The formula is given in another paper (1922). It agrees with Alcadia s. s. in the shape of the centrals, but the pointed cusps of the D-plate resemble those of Sericea or Analcadia. The first marginal is practically bicuspid.

*Helicina* (*Tristramia Oxyrhombus*) *concentrica* Pfr. (1849), and approaching var. *pandiensis* A. J. Wagner (1905).

Sixty-eight specimens; Estación Táchira and La Fría, from leaves of trees, palms and shrubs, and from the ground (aestivating), mainly in rich humus, but also in the root mould (H, I, abd, 35, 42, 43; II, bd, 40, 43).

The type locality of *H. concentrica concentrica* is near Merida, Venezuela (L 8, 71). while that of *H. c. pandiensis* is Pandi, Colombia (L 4, 75). These lots, from an intermediate region, contain specimens that appear to be very close to both of these subspecies. The growth lines are rather widely spaced; under the lens, all of my specimens also show fine, anastomosing lines, which tend to run spirally. In addition, a few obscure, but quite regular, spiral furrows are usually, but not always present, both on the apical and basal sides of the whorls. The thread carina is usually sharp. The columellar angle of the peristome is usually rounded, but is often quite sharply angulate. The smooth apex is greenish to golden-yellow in color; the callus, peristome, and the edge of the carina are whitish to yellowish. The ground-color varies, in the series, from light, chestnut brown to lemon yellow; it is often darker towards the carina and sometimes is broken by obscure, spiral bands or lines. As shown by the measurements, this species shows considerable variation in size and shape. Some of the specimens have a slightly scalariform tendency. The specimens from Estación Táchira are small and depressed.

| | Whorls | Height | Maj. Diam. | Min. Diam. | |
|---|---|---|---|---|---|
| *H. c. concentrica* | 4½ | 6.0 | 167 (10.0) | 133 (8.0) | Pfr. (1852). |
| | 4½ | 6.5 | 138 ( 9.0) | 123 (8.0) | A. J. Wagner, (1905). |
| *H. c. pandiensis* | 5 | 6.5 | 139 ( 9.0) | 115 (7.5) | A. J. Wagner, (1905). |
| H, I, b, 35 | 5 | 5.9 | 171 (10.1) | 149 (8.8) | Estación Táchira. |
| | 5 | 6.4 | 170 (10.9) | 140 (9.0) | |
| H, II, bd, 40 | 5 | 6.2 | 156 ( 9.7) | 134 (8.3) | La Fría. |
| | 5 | 6.6 | 144 ( 9.5) | 124 (8.2) | |
| | 5 | 7.1 | 151 (10.7) | 128 (9.1) | |
| | 5 | 7.3 | 159 (11.6) | 138(10.3) | |
| | 5 | 7.5 | 144 (10.8) | 126 (9.4) | |
| | 5 | 8.0 | 153 (12.3) | 131(10.5) | |

The radular formula of *H. concentrica* is given in another paper (1922), and is figured here (fig. iv-15). A surprisingly large number of forms, apparently belonging to this group, have been described from the northern Andes.

*Helicina* (*Tristramia Angulata*) *rhynchostoma ernesti* von Martens (1873), and approaching var. *infesta* A. J. Wagner (1905).

Twenty-five specimens; San Esteban, Palma Sola, and Boquerón, from leaves of vegetation and in rich humus on the ground (aestivating), in mountain and lowland forests (H, I, b, 7; II, bd, 20, 27, 28). This species appears to be more truly arboreal than is *H. tamsiana,* and is usually found farther from the ground.

The shape of these specimens is quite variable. The basal callus is rather light, and is bounded by a distinct sulcus. The basal angle of the peristome is either rounded, or thickened so as to be quite angular. The spiral lines may be deeply impressed and numerous, or almost absent. The color is usually lemon yellow, with a pinkish purple band above and below the thread of white on the carina.

| | Height | Maj. Diam. | Min. Diam. | |
|---|---|---|---|---|
| *H. r. ernesti* | 10.0 | 180 (18.0) | 140 (14.0) | von Martens (1873). |
| | 8.0 | 175 (14.0) | 137 (16.0) | |
| *H. r. infesta* | 11.0 | 164 (18.0) | 145 (16.0) | A. J. Wagner (1905). |
| A. N. S. P. 14629 | 8.9 | 192 (17.1) | 160 (14.2) | Puerto Cabello. |
| | 9.6 | 167 (16.0) | 147 (14.1) | Cf. *infesta*. |
| H, I, b, 7 | 7.2 | 200 (14.4) | 165 (11.9) | San Esteban. |
| | 8.0 | 196 (15.7) | 166 (13.3) | |
| H, II, d, 20 | 7.5 | 200 (15.0) | 167 (12.5) | |
| | 8.5 | 187 (15.9) | 160 (13.6) | |
| H, II, b, 28 | 7.4 | 185 (13.7) | 160 (11.8) | Boquerón. |
| | 8.6 | 197 (16.9) | 166 (14.3) | |

This form has often been confused with *H. candeana* Sowerby (1842), from Honduras. After comparison of the description and figures with the specimens before me, *H. infesta* seems little more than an extreme form-variation of *H. r. ernesti*. Other species from northern South America are: *H. rhynchostoma rhynchostoma* "Shuttleworth" Pfr. (1865) from Campanera, Colombia (L ???); *H. ocanensis* A. J. Wagner (1905) from Ocana, Colombia (L 8, 73); *H. steindachneri* and the cotypical form *superstructa* A. J. Wagner (1905) from Frontino, Colombia (L 7, 77); *H. colombiae* E. A. Smith (1878) from San Sebastian, New Granada (L 11, 74?); and *H. gonochila* Pfr. (1849) (+*gonocheila* Sowerby, 1874) from Venezuela (Caracas?). I have seen no authentic specimens of any of them, but, from descriptions and figures, the second appears to be quite distinct, the third rather close to *H. rhynchostoma;* the fourth is unfigured, but seems to differ from the first by its smaller size and higher spire. *H. gonochila* closely resembles *H. braziliensis* Gray (1824), and its Venezuelan habitat appears open to doubt.

The radular formulae of *H. r. ernesti* and *H. caracolla* are given in another paper (1922); examples of the teeth are figured here (figs. iv-16, 18).

*Helicina* (*Tristramia Tamsiana*) *tamsiana* Pfr. (1850), and approaching var. *appuni* von Martens (1873).

Eighty-two specimens; San Esteban, Palma Sola, Aroa, and Boquerón, from leaves of vegetation and from ground (aestivating), usually in rich leaf mould, in the mountain and lowland forests (H, I, ab, 2, 5, 23; II, bd, 20, 22, 28).

The sculpture of this species consists of fine, regular, closely-spaced growth-lines, crossed by numerous, fine, spiral lines, which are usually very regular in arrangement. The considerable color variation may be analyzed as follows:

a. Apex: golden yellow to creamy white.

b. Peristome: white.

c. Basal callus: whitish.

d. Ground color: (1) fulvous, varying to reddish orange (typical form); (2) greenish yellow; (3) creamy white. Stripes are absent with the first class of ground color, present or absent with the second, and present with the third.

e. Pattern: (1) Darker shading on apical side of whorls; when brown, this may form a distinct, dark band or be light and diffuse; when greenish yellow, it is always the latter.

(2) The band of (1) may be narrowed by the presence of a creamy white band, just below the suture (very common form).

(3) A slight infuscation may be present on the base, so as to mark off a narrow, light band around the greatest convexity of the last whorl.

The relative numbers of the different color forms vary with the locality. In one or two places, all of the shells collected were of a single form, but, in other localities, all of the kinds occurred together.

| | Height | Maj. Diam. | Min. Diam. | |
|---|---|---|---|---|
| *H. t. tamsiana* | 6.0 | 150 ( 9.0) | 129 (7.7) | Pfeiffer (1852). |
| | 7.5 | 120 ( 9.0) | 103 (7.7) | A. J. Wagner (1907). |
| *H. t. appuni* | 11.0 | 127 (14.0) | | von Martens (1873). |
| H, I, b, 23 | 6.8 | 122 ( 8.3) | 102 (6.9) | Aroa. |
| H, II, d, 20 | 7.1 | 117 ( 8.3) | 96 (6.8) | Palma Sola. |
| | 8.2 | 113 ( 9.3) | 96 (7.9) | |
| | 9.4 | 113 (10.6) | 99 (9.3) | |
| H, I, b, 5 | 7.7 | 120 ( 9.2) | 103 (7.9) | San Esteban. |
| | 8.6 | 120 (10.3) | 103 (8.9) | |
| H, I, b, 2 | 9.4 | 105 ( 9.9) | 94 (8.8) | San Esteban. |

While these specimens vary considerably in size, none are as large as typical *H. t. appuni* (type locality given as Puerto Cabello). The undulation of the basal wall of the peristome,

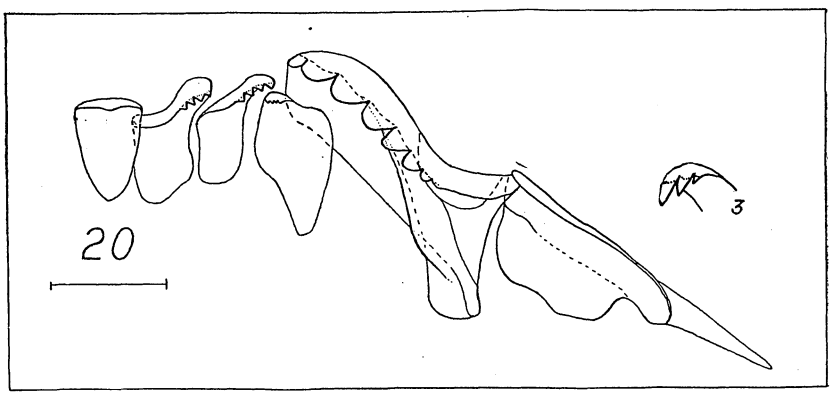


Figure 20. *Helicina* (*Tamsiana*) *tamsiana.* Centrals, laterals and tip of 3rd uncinus. The scale indicates a length of 50 microns.

which caused Wagner (1907) to include this group in Alcadia, is seldom distinct, and usually very obscure. I have not seen specimens of *H. columbiana* Philippi (1847) from Colombia, but suspect that the larger *H. sanctaemarthae* Pilsbry and Clapp (1902) from Libano, Santa Marta Mts., Colombia (L. 11, 74), is closely related. The last is more nearly conical than

*tamsiana,* has spiral rows of punctations instead of solid lines, and the calcareous plate of its operculum is also much heavier and more opaque. *H. nemoralis* Guppy (1866) (+ *H. zonata* Guppy, 1868, not Lesson) from Trinidad, also belongs in this group. The radular formulae of *H. tamsiana* and *H. nemoralis* are given in another paper (1922); teeth of the former are shown in the text figure (fig. 20).

*H. kieneri* Pfr. (1849) was originally described without locality; in the Conch. Cab., it was ascribed to Guadeloupe; and, in 1852, to Caracas. From the descriptions and figures, it seems to be a form of the protean *H. rhodostoma* Gray (1825) from Guadeloupe. In this connection, it may be remarked that there is a group of Caracas Islands off the coast of Cumana (L. 10, 65). *H. crassilabris* Philippi (1847) is undoubtedly a Pacific species, probably from Sandwich Island, New Hebrides.

**Lucidella (Lindsleya?) venezuelensis,** new species

Twelve specimens from damp leaf-mould in a hollow left by a temporary forest pool, near Caño Minapam, Palma Sola (H, xiii, 20).

Shell: minute, conic-globose, perforate. Color: whitish horn, tinged with orange towards the apex. Whorls: 5½, convex; apical ¾ whorl, minutely raised-punctuate; the remainder with fine, closely-spaced, spiral riblets, which extend on to the base of the shell; last whorl tapers toward aperture and is free (solute) for a short distance. Aperture: kidney-shaped, with oblique, almost straight, parietal wall; upper angle rounded. Peristome; free, simple, and very slightly expanded. Operculum: concentric, with calcareous plate thicker than the horny one, and markedly concave externally; spiral nucleus almost central; horny plate almost flat, so that its edge is markedly separate from the calcareous one.

The type (fig. ii-7) measures:

| Height | Maj. Diam. | Altitude Aperture | Diam. Aperture | Length Operculum | Width Operculum[3] |
|---|---|---|---|---|---|
| 3.05 | 93 (2.85) | 38 (1.15) | 104 (1.20) | 46 (1.40) | 72 (1.00) |

The systematic position of this species has been discussed in an earlier paper (1922), where a preliminary description of the radula is given. The figure of the teeth, included here (fig. iv-17), shows its close relationship to Lucidella. The shell is certainly closest to that of *Stoastoma domingensis* Vanatta (1920), but it is slightly larger, more depressed, and has a larger number of finer, spiral riblets than the species from Santo Domingo.

*Lucidella* (*Poenia*) *lirata* (Pfr., 1847).

Widely distributed, but especially abundant in damp and in disturbed places: San Esteban, Palma Sola, Aroa, Estación Táchira, and La Fría; from damp, rich humus on mountain slopes, in lowland forests and cacao plantations, in a spring swamp, and in the damp depressions occupied by forest pools during the wet seasons (H, I, b, 2, 5, 23, 35; II, b, 40; V, b, 2, 41; VI, c, 38; XIII, 20). These specimens are mainly quite characteristic of *L. lirata lirata,* but a few show some approach to *L. lirata lamellosa* (Guppy, 1867) from Trinidad.

For comparison, the radular formula (fig. iv-19) of two dried specimens (A. N. S. P. 62062, St. Kitts, W. H. Rush, 1891) of *L. plicatula christophori* Pilsbry (1897) is given:

R; A1/1; B1/6-7; C1/5; D1/9; E; M11/3+ (42/4+)=53; (117).

[3] The altitude and diameter of the aperture are measured parallel to the long and transverse axes of the shell. The length and width of the operculum are measured along its long axis and at right angles to it. The index of the diameter of the aperture is that dimension divided by the altitude of the aperture. The index of the width of the operculum is the width divided by the length.

The radula of this species is quite close to that of Poenia s.s., but the shell sculpture consists of axial, instead of spiral riblets. This seems a valid basis for the separation of a new section: **Poeniella**, type *H. (plicatula) christophori* Pilsbry (1897) from St. Kitts. *L. ignicoma* (Guppy, 1868) from Trinidad, appears to be a member of this group.

In addition to the above Helicininae, *Eutrochatella* (subgenus s.s.) *semilirata* (Pfr., 1849) has been described from Venezuela. As it has not been reported since, the presence of this subgenus in South America still remains very doubtful, although a member of the subgenus Pyrgodomus might be expected.

PROSERPINIDÆ

*Proserpina* (*Linidiella*) *swifti* Bland (1863).

One specimen, without animal, from leaf-mould in corner of buttressed tree, along Rio San Esteban (H, I, b, 2). It measures: height 4.6 mm.; maj. diam. 187 (8.6 mm.).

POMATIASIDÆ

*Tudora plicatula* (Pfeiffer).

*Cyclostoma plicatulum* Pfeiffer (1846). Puerto Cabello, Venezuela.
*?Cyclostoma tamsiana* Pfeiffer (1850). Puerto Cabello.
*?Cyclostoma cumanense* Pfeiffer (1851). Cumana, Venezuela (L. 11, 64).
*?Cyclostoma venezuelense* Pfeiffer (1853). Venezuela.

Ninety-six specimens; mainly from rather well-drained forest (H, II); at Palma Sola (stations 20, 22), and Boquerón (stations 27, 28); the most abundant large snail, wherever found. This species aestivates under leaves in rich leaf-humus (H, II, b), but, during rains, soon travels up into the vegetation (H, II, d), as high as 3 meters above the ground. Its jerky movements are more rapid than those of most snails,

and it snaps quickly into its shell when disturbed. It occasionally suspends itself from leaves, by a mucous thread 2 or 3 centimeters in length.

The operculum of *T. plicatula* has been described as like that of Chondropoma (Cf. Henderson and Bartsch, 1920), but fresh specimens have a well-developed, calcareous portion, parallel to the "chondroid" plate, and the outer, calcareous plate is supported by fine, vertical lamellae parallel to the growth lines. Each whorl of the calcareous portion is not quite so wide as the underlying whorl of the horny, basal plate. On account of its thin, fragile nature, the calcareous plate is quite easily crushed and brushed away, so that only the chondroid portion is left. Its fragility may be correlated, in part, with the acidity of the leaf-mould, and the absence of limestone in the region studied. Structurally, this operculum does not differ greatly from that of *T. williamsoni* (see below), but its whorls increase more rapidly in size, so that the nucleus is more eccentric. (See fig. ii-9.)

The shells are very variable in color and texture. Usually, spiral bands (as many as 10), of chestnut brown to purplish, are present, but these are almost always broken into dots. The dots tend to be arranged in vertical rows and, in a few specimens, these are joined together by dark varices, so that the bands become vertical instead of spiral. The ground-color varies from light cream to dark fulvous. Most of the specimens from the edge of the hills (stations 22, 28) are dark colored, and are very commonly quite unicolor.

The sculpture varies from rounded ridges parallel to the growth lines, to marked, thread-like riblets. Usually some buttress-like denticulations are present in the sutures, but their number and size is very variable. The strength of the umbil-

ical spiral is also variable, but, in all of my specimens, at least two can be detected. In addition, traces of spirals are present on the sides of the earlier whorls. The aperture of adult specimens is always solute, angulate above, and with the peristome free and slightly expanded. This expansion is most noticeable on the lower portion of the palatal wall, but is least extensive along the base.

The females are considerably larger than the males: representative examples of each measure:

| | Altitude | Maj. Diam. | Altitude Aperture | Diam. Aperture |
|---|---|---|---|---|
| Female | 17.3 | 53 (9.2) | 38 (6.5) | 85 (5.5) |
| Males | 14.5 | 54 (7.8) | 36 (5.2) | 87 (4.5) |
| | 12.4 | 55 (6.8) | 34 (4.2) | 91 (3.8) |

Pfeiffer also described *Cyclostoma tamsiana* from Puerto Cabello. According to his description, the calcareous plate of the operculum is the only important character that separates it from *C. plicatulum.* As detailed above, this character is a doubtful one. However, he emphasizes the central position of the nucleus of the operculum of *C. tamsiana,* and it is just possible that he had immature specimens (peristome simplex) of *T. williamsoni secana* (see below) before him. Pfeiffer's own figure (Conch. Cab., xxxvii-19, 20) might represent the latter, but Reeve's (1863, Conch. Icon.) is certainly *T. plicatula,* and Pfeiffer (1865) recognized it as authentic. All of the Puerto Cabello specimens in the A. N. S. P. are *T. plicatula,* although some of the lots, with better preserved opercula, have been labeled *tamsiana.* In this connection, attention should be called to the habit of earlier collectors, who very commonly named, as the locality of their specimens, some large, well-known town in the general region. Labels such as Puerto Cabello and Caracas may mean but little more than labels like Venezuela or New Granada.

From the variation in color and sculpture of my specimens, I very much question the specific rank of *C. cumanense* and *C. venezuelense,* but have seen no authentic examples. *Ch? subauriculatum* Pfr. (1862) was also described from Cumana (Bland). Specimens from Bland (original lot?) in the A. N. S. P., show this to be a heavier form near *C. biforme* Pfr. (1858), from Turks Island, Bahamas. Bland's locality is probably incorrect.

**Tudora williamsoni,** new species

Eighty-five specimens from damp, bare, rock faces along quebradas in Aroa Mountains (H, I, a, 23 (type), 24). The most abundant shell present in these places, although *Brachypodella hanleyana* is almost as common.

The shape of these shells is very similar to that of *T. plicatula,* but the 6½ to 6¾ whorls are more convex, and the sutures more deeply impressed. The shells are heavier; the growth riblets are high, but compressed, and tend to occur in pairs, or more rarely in groups of 3 or 4. The buttress-like, sutural prolongations of the riblets are fine, but prominent. The spiral, umbilical sculpture is present, but is obscured by the crowded riblets (fig. ii-8). The last whorl is free (solute) for a very short distance. The aperture is almost circular. The peristome is quite broadly (.8 mm.) reflected on all sides, but most prominently on the columellar lip, which is often undulate. The parietal portion is produced into an angular auriculation, which is adnate to the preceding whorl. In adult shells, the reflection consists of several layers of varying extent, so that a polyplex condition is produced. The color-markings are similar to those of *T. plicatula,* but the higher riblets give the shell a duller appearance.

The structure of the operculum (fig. ii-8) is quite similar to that of *T. plicatula* (fig. ii-9), but the calcareous plate is heavier and more extensive, and is less apt to disintegrate in the dried specimens. The whorls of the operculum increase in size very gradually, so that the outline is almost circular, and the nucleus practically central. Its appearance is almost as close to that of Annularia as to that of *Tudora megacheilos* (fig. ii-10).

The general appearance of this species is closest to that of *T. aripensis* (Guppy, 1864) from Trinidad. The latter has more regularly spaced riblets and the shape of its operculum is more or less intermediate between that of *T. plicatula* and that of *T. williamsoni.*

Specimens measure:

| | Altitude | Maj. Diam. | Height inside of Aperture | Diam. inside of Aperture |
|---|---|---|---|---|
| Largest female | 12.1 | 55 (6.6) | 26 (3.2) | 100 (3.2) |
| Another female | 10.6 | 57 (6.0) | 25 (2.7) | 96 (2.6) |
| Male; type | 7.2 | 67 (4.8) | 33 (2.4) | 100 (2.4) |

**Tudora williamsoni secana,** new subspecies

Eleven specimens; on rocks and bare clay banks of an arroyo in the Cerritos de Yumarito, near Quebrada Seca (H, II, a, 28). With it occurred *Brachypodella hanleyana,* and, in the leaf humus nearby, *Tudora plicatula.*

This subspecies differs, from the typical form, mainly in its larger size. In addition, it is usually heavier, with darker ground color and more obscure color pattern. The males of this lowland form are of about the same size as the females of the mountain one. Representative specimens measure:

| | Altitude | Maj. Diam. | Height inside of Aperture | Diam. inside of Aperture |
|---|---|---|---|---|
| Female (type) | 14.1 | 54 (7.6) | 26 (3.7) | 100 (3.7) |
| Male | 10.7 | 62 (6.6) | 25 (2.7) | 100 (2.7) |

## CYCLOPHORIDAE

### APEROSTOMATINAE

The synonymy of the major groups of this subfamily has been reviewed in an earlier paper.[4] Of the South American genera, Buckleyia appears to extend only as far north as southern Colombia. Besides the numerous species of Amphicyclotus from Central America and northwestern South America, *A. cayennensis* (Shuttleworth, 1852), from Cayenne, Guiana, appears to belong to the same group as the species from the Lesser Antilles. With the exception of the doubtful *Cyclostoma psilomitum* (see below), the subgenus Neocyclotus, of the genus Poteria, is the only group that has been reported from Venezuela.

A brief synopsis of the mainland species of Neocyclotus will be presented. All of the species included here, with the exception of *P. corpulenta* (Smith), have been figured. The most recent bibliographies are found in Kobelt (1902, Thierreich) and Kobelt-Schwanheim (1912, Conch. Cab.). In the following synopsis, those species preceded by an exclamation point (!) are not included in either of these monographs, but are figured by their authors. Those preceded by an asterisk (*) are not in the Conch. Cab.

Although Pfeiffer (Conch. Cab.) describes the operculum as calcareous, I very much doubt the position of *Cyclostoma prominula* "Ferussac" Orbigny (1835) (+ *Cyclostoma brasiliense* Sowerby, 184—, + *C. planorbulum* Sowerby, 1842), as a member of the subgenus Neocyclotus. The apical whorls are those of the Lesser Antillean group of Amphicyclotus, while the solute last whorl is quite distinctive, although it oc-

[4] "Aperostomatinae," *The Nautilus,* XXXV, July, 1922.

curs as an abnormality in other species. The type locality is Minas Geraes, Brazil. It is just possible that this species is related to *Cyclostoma disjunctum* Moricand (1846), also from Brazil.[5]

The opercula of (*) *Cyclostoma psilomitum* Pfr. (1851) from Venezuela, *Aperostoma connivens* H. Adams (1866) from Eastern Peru, and *Cyclostoma distinctum* Sowerby (1843) from the Bay of Montija, Panama, are unknown, but these Crocidopoma-like species certainly do not belong in Neocyclotus. (*) *Cyclotus cooperi* Tryon (1863) from Mazatlan, Mexico, is clearly an Amphicyclotus, close to *A. lutescens* (Pfr., 1851); while (*) *Cyclotus boucardi* Angas (1878) from San Carlos, Costa Rica, not *A. boucardi* (Pfr., 1856) is evidently close to *A. ponderosus* (Pfr., 1851). (!) *N. inflatus,* from Santa Marta, and (!) *N. solutus,* from New Granada, both "Mousson" Kobelt and Moellendorff (1897, Nach. D. Malac. Ges.) appear to be nude names, as is also (!) *N. chrysacme* "Bartsch" Fluck (1906, Naut.), from Wani, Nicaragua. *Cyclostoma suturale* and *C. discoideum,* both Sowerby (1843), are extralimital species, incorrectly cited from Demerara, Guiana.

The mainland species of the subgenus Neocyclotus may be divided into four, quite distinct groups, as follows:

1. Group of *Cyclostoma translucidum* Sowerby (1843). Shell turbinate, usually unicolor; growth lines very prominent and often crossed by spiral striations; basal portion of peristome usually slightly emarginate. Mexico to Trinidad and Peru.

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[5] *C. disjunctum* is the type of Cyclopoma Troschel (1847), not Agassiz (1833); this preoccupied name was inadvertently omitted from my 1922 paper. It is a synonym of Amphicyclotus.

2. Group of *Cyclostoma stramineum* Reeve (1842). Shell turbinate or depressed, usually unicolor; growth lines crossed by oblique grooves and plicae, which break the sculpture into rugae or granulations. Ecuador (?); Panama to Lesser Antilles.

3. Group of *Cyclostoma inca* Orbigny (1835). Shell depressed conoid, or with last whorl descending markedly (Cf. *Poteria confusa*); usually with darker, spiral bands; growth-lines comparatively delicate and regular. Central America to Brazil.

4. Group of *Cyclostoma incomptum* Sowerby (1849) from Brazil. Shell similar to that of group 3, but with siphon-like development of the upper edge of the peristome. Colombia to Brazil. *N. pergrandis* Kobelt-Schwanheim (1912), from "New Granada," is a larger shell than the typical species.

In the localities studied, the forms of Poteria were found to be remarkably limited in their distribution. In only one place did two species occur together, and there the mixture occurred only at the junction of two distinct habitats (H, I, II, 42). In other localities, they showed a distinct tendency to form small colonies. For instance, in all of the collections made around Palma Sola, specimens of this genus were found only in a single locality, and there appeared to be restricted to an area about 20 meters across. The general appearance of this area was the same as in many other portions of the surrounding forest, which makes it especially difficult to account for this peculiar localization. In all places, they were the only snails that were common in the root humus (H, I, II, c); they seemed to favor especially the corners between the radiating roots and buttresses of the larger trees.

*Potcria translucida translucida* (Sowerby, 1843).

One almost adult shell and 5 young specimens from near the Rio Oropito, at the edge of the Cerritos de las Brujas (H, I, bc, 39), appear to be quite close to this typical form. They are light-colored, comparatively fine-textured shells. Measurements of similar shells from Cucutá, Colombia (L 8, 73; A. N. S. P. 12963), from Puerto Cabello, Venezuela (A. N. S. P. 12961; C. F. Starke), and from La Guaira, Venezuela (A. N. S. P. 12986) are also given (see fig. v-A). This subspecies appears to be characteristic of the lowlands; in the mountains, the species is represented by various, closely related forms. *P. translucida trinitensis* (Guppy) has similar dimensions, but most of the specimens can be separated by the key (see below). The measurements of a characteristic example of each sex (see fig. v-B, C) from Cariaquito, Venezuela (L 10, 63; A. N. S. P. 104631; Bond Expedition, 1911), are given. In all of the subspecies, the adults examined have close to 4½ whorls.

*Dimensions of Poteria translucida*

| | Height | Maj Diam. | |
|---|---|---|---|
| *P. t. translucida* | 16.0 | 127 (20.4) | Figure, Thesaurus. |
| Young shell | 12.2 | 121 (14.8) | H, I, c, 39; La Fría, Ven. |
| A. N. S. P. 12963 | 12.6 | 131 (16.5) | Cucutá, Colombia. |
| 12961 | 12.8 | 127 (16.2) | Puerto Cabello, Ven. |
| | 14.5 | 130 (18.8) | |
| 12986 (Fig. v-A) | 16.0 | 133 (21.2) | La Guaira, Ven. |
| *P. t. trinitensis* (Figs. v-B, C) | 13.8 | 130 (17.9) | Male; Cariaquito, Ven. |
| A. N. S. P. 104631 | 16.9 | 122 (20.5) | Female; ditto. |
| *P. t. bejumensis* (Fig. v-D) | 17.2 | 105 (18.1) | H, I, b, 7; type; Bejuma, Ven. |
| | 14.8 | 117 (17.3) | |
| (Fig. v-E) | 14.3 | 128 (18.3) | |
| (Fig. v-F) | 12.0 | 118 (14.2) | |
| (Fig. v-G) | 17.3 | 118 (20.4) | H, I, c, 15; Cerro Chiriguara. |
| Means: 34 specimens | 14.9 | 117 (17.5) | |
| Extremes: ditto | 12.0–17.3 | 105–128 (14.2–20.4) | |

| | Height | Maj Diam. | |
|---|---|---|---|
| *P. t. major;* A N. S. P. 12990 | 21.3 | 116 (26.3) | Type; Caracas, Ven. (Fig. v-**H**). |
| *P. t. santaguitensis* (Fig. v-J) | 12.3 | 136 (16.7) | H, l, b, 42; smallest male. |
| (Fig. v-I) | 17.8 | 128 (22.7) | Type; largest female. |
| A. N. S. P. 12993 | 19.2 | 126 (24.2) | Cucutá, Colombia (Bouquet). |

The following artificial key to the mainland forms of this typical group may assist in their separation, although a comparison of authentic specimens, or at least a study of the original figures and descriptions, is the only practicable means for their identification. The localities given are those of the original descriptions, except in a few cases where the original locality was omitted or was later shown to be absolutely incorrect. The figures give the altitude in millimeters, the major diameter index in percentages (followed by the actual dimension in millimeters), and the number of whorls. As the earlier writer determined the altitude in a different manner from that at present customary, many of these measurements are not those of the author, but are those of his figure. In a very few cases, the measurements are necessarily taken from later authors, but such cases were checked up with original data. The names given are those of the original authorities, and I do not vouch for the specific separation of many of them. As will be detailed later, the individual variation is often very great, even in shells from a single locality.

A. Costa around umbilicus; operculum unknown. Eastern Peru. 14; 150(21); 6. .....*Aperostoma bartletti* H. Adams (1860).

AA. Sides of umbilicus evenly rounded.

B. Peristome emarginate above and below; shell large. Costa Rica. 31; 124(38.5); 5...*Cyclotus bisinuatus* Martens (1864).

BB. Peristome not emarginate above; shell smaller.

C. Shell with comparatively weak, quite regular, growth lines; color light greenish to yellowish, translucid.

D. Shell more depressed; sutures distinctly impressed; whorls convex. Coloras Island, Gulf of Paria, Trinidad. 16.8; 136(22.9). ..... .....*Cyclostoma trinitensis* Guppy (1864).

DD. Shell medium; sutures less distinct; whorls less rounded. Colombia. 16; 127(20.4); 5..... .....*Cyclostoma translucidum* Sowerby (1843).

DDD. Shell more elevated; heavier.

E. Smaller. Bejuma, Venezuela. 14.9; 117(17.5) 4½. ....(!) *P. translucida bejumensis,* new subspecies.

EE. Larger. Caracas, Venezuela. 21.3; 116(26.3); 4½. .....(!) *P. translucida,* var. *major,* Bland MSS.

CC. Growth lines prominent, usually undulate; shell heavier; adults darker in color.

F. Growth lines with epidermal ridgelets, usually simply undulate; color of adults pronounced.

G. Color of adults dark olive green; lower lip with slight emargination. La Fría, Venezuela. 17.8; 128 (22.7); 4½. ..... ..(!) *P. translucida santaguitensis,* new subspecies.

GG. Color of adults dark reddish; lower lip quite entire. El Libano, 6500 ft., Santa Marta Mts., Col. (L. 11, 74). 14.5; 135(19.5); 4. .....(!) *Aperostoma smithi* Pils. and Clapp (1902) Nautilus.

FF. Growth lines usually anastamosing, so as to approach the next group (*P. straminea*) in sculpture..... .....*Poteria dysoni* (Pfr.)

H. Peristome double, solute. Mirador, Mexico. 16; 140(22.5); 5. .....*Cyclotus berendti* Pfr. (1861).

HH. Peristome simple, but often slightly solute.

I. Later whorls with spiral stripes of lighter color. Cave at Tabi, Yucatan. ..(!) *C. dysoni* (form) *multilineatus* Pils. (1891). Proc. Acad. Nat. Sci., Philadelphia.

II. Unicolor.

J. Smaller. Tabi, Yucatan. Maj. diam. 16 mm. (!) *Cyclotus dysoni,* var. *minor* Mart. (1890).[6]

[6] *Biol. C. A.;* plate 1. This is apparently a description and not a name.

JJ. Larger.

K. More depressed; color castaneous. Bugaba, South Panama. 15; 133(20).....*Cyclotus dysoni, var. affinis* Mart. (1890).

KK. More depressed; growth lines more regular. Soledad, Mexico. 16; 144(23).....*Cyclotus dysoni,* var. *ambiguus* Mart. (1890).

KKK. Everything else. Honduras. 21.3; 125(26.5); 4½..... ..... *Cyclostoma dysoni* Pfr. (1851).

**Poteria translucida bejumensis,** new subspecies

Figs. v-D, E, F, G.

Thirty-three adults and 50 immature specimens from rock-talus on ledge near top of small, rock wall of cañon-like valley of Banco Largo, near Bejuma, Venezuela (H, I, b, 7); and 1 adult (the largest) from leached-out, root humus near top of Cerro Chiriguara (H, I, c, 15).

Shell: heavier and more turbinate than *P. t. translucida;* growth lines prominent, but fine, regular and crowded. Color of epidermis: unicolor, yellowish horn, apex lighter. Shell substance: chalky, except near apex (usually eroded), where it is closer in texture and often tinged with rosaceous. Whorls: a little less than 4½; convex, quite rapidly increasing in diameter. Sutures: prominent, but not impressed. Aperture: almost vertical; circular except for upper angle; sometimes briefly solute. Basal lip of peristome: with one or two emarginations. Umbilicus: 1/7 of major diameter.

The young shells, as is quite usual in the genus, are more depressed than the adults. The females are slightly larger than the males, and their average major diameter index is slightly greater (more depressed shell), but the individual variation is so great that the sexes cannot be separated by their shape and size.

Pfeiffer's figure in the Conch. Cab. resembles this subspecies more than it does the original figure of *P. t. translucida,* in the

Thesaurus. A set of specimens (A. N. S. P. 12990), labeled Caracas, Venezuela (L 11, 67), are very similar in shape to *P. t. bejumensis,* but their considerably larger size seems to indicate at least racial significance. They are labeled var. **Major** in Thomas Bland's handwriting, so, with the kind permission of Dr. Pilsbry, that name is published here (see key, and fig. v-H).

**Poteria translucida santaguitensis,** new subspecies

Figs. v-I, J.

Four adults and 10 younger specimens, from root-humus around bases of trees on the steep valley sides of Quebrada Santa Aguita (H, I, c, 42), near La Fria, Venezuela.

Shell: heavier than *P. t. translucida,* and growth lines rendered more prominent by fine, undulating, epidermal riblets. Color of adults: olive-green, translucid. Apex: tinged with rose. Last whorl: impressed just below suture, and often with a few, weak, spiral striae. Basal lip of peristome: with a definite emargination, as seems characteristic of *P. translucida.* Umbilicus: 1/7 of the major diameter.

The immature specimens of this subspecies are often yellowish in color. In many respects, the adults resemble *P. smithi* (Pilsbry and Clapp, Nautilus, 1902), as indicated in the key. A bleached specimen in the A. N. S. P. (no. 12993), from Cucutá, Colombia (L. 8, 73), probably also belongs to *P. t. santaguitensis.*

*Poteria straminea* (Reeve, 1843). Figs. v-N, O.

Thirty adults and 48 immature specimens, from root-humus on the hill-sides and around the bases of trees, in the San Esteban valley (H, I, c, 2, 3, 4).

The inside of the aperture of these greenish-yellow shells is pearly, but without dark iridescence. The peristome is often noticeably thickened, and even flares outward, with several, heavy varices, so as to be almost campanulate. Its basal lip is quite even, and the aperture is almost circular. The exterior surface of the operculum is quite markedly concave, and the internal boss is prominent. The specimens have between 4½ and 5 whorls, and the umbilicus is a little over ¼ the major diameter.

A set of specimens of *Poteria granadensis rugata* (Guppy), from Cariaquito, Venezuela (A. N. S. P. no. 104625; S. Brown, 1911) show that this Trinidad shell also reaches the mainland. Measurements of seven males and seven females are summarized in the accompanying table (cf. figs. v-P, Q).

*Dimensions in Group of P. straminea*

| | Altitude | Maj. Diam. | |
|---|---|---|---|
| *P. straminea* | 15.7 | 142 (22.3) | Figure, Thesaurus. |
| Means; 30 specimens | 12.5 | 147 (18.3) | H, I, c, 2, 3, 4; San Esteban. |
| Extremes; ditto | 9.7–15.9 | 131–158 (14.7–22.6) | Figs. v-N, O. |
| *P. granadensis rugata* | 10.2(sic) | (17.8) | Guppy, (1864). |
| A. N. S. P. 104625. | | | |
| Means: 7 females | 8.6 | 146 (12.5) | Cariaquito, Venezuela. |
| Extremes: ditto | 8.3–9.2 | 138–156 (11.9–13.4) | Fig. v-P. |
| Means: 7 males | 7.8 | 142 (11.1) | |
| Extremes: ditto | 7.3–8.2 | 132–148 (10.2–11.4) | Fig. v-Q. |
| *P. glaucostoma* | 12.8 | 142 (11.4) | Figure, Reeve, Conch. Icon. |
| *P. g. aulari* | | | |
| Means: 4 specimens | 15.5 | 146 (22.7) | H, II, bc, 20; Palma Sola. |
| Extremes: ditto | 14.1–16.8 | 142–154 (20.8–24.6) | Fig. v-M. |
| Means: 6 specimens | 14.6 | 154 (22.6) | H, II, bc, 28; Quebrada Seca. |
| Extremes: ditto | 13.3–16.2 | 149-161 (21.3–24.8) | Figs. v-K, L. |

The following, artificial key, to the members of the group of *P. straminea,* is presented. The remarks, which precede the key to the first group, also apply here. The first species is included with considerable doubt.

A. Shell with irregular granulations; last whorl whitish with dark, chestnut-brown, spiral band. Ecuador. 18; 139(25); 5½..... .....*Cyclotus granulatus* Pfr. (1862).

AA. Shell with comparatively regular, impressed lines, which cross the growth lines obliquely in two series, so as to mark off rugae or diamond-shaped corrugations; without definite color bands.

B. Large species: granulations arranged in quincunx; apex light brown; lower whorls darker; unevenly black-striped. Alejandria, Colombia (L 6, 76). 30; 132(39.5); 5..... .....*Neocyclotus peilei* Gude (1912).

BB. Smaller species; more depressed.

C. Shells medium in size; plicae and striae comparatively regular and covering practically all of last whorl.

D. Very prominent and quite regular striae meet the suture at an acute angle, while the short, curved series, that cross the first at approximately right angles, are present only near the suture; color yellowish; interior of aperture only slightly iridescent. Merida, Venezuela (L 8, 71). 15.7; 142(22.3); 4½..... .....*Cyclostoma stramineum* Reeve (1843).

DD. Both series of striae comparatively weak, but almost equally prominent; color olive-brown to castaneous, lighter below; interior of aperture with bluish to purplish iridescence.

E. Smaller; color castaneous. Venezuela. 12.8; 142 (18.2); 4.(*)*Cyclostoma glaucostomum* Pfr.(1855).

EE. Larger; color olive-brown. Quebrada Seca, Venezuela. 14.6; 154(22.6); 4½..... .....(!) *P. glaucostoma aulari,* new subspecies.

CC. Shells smallest; both sets of striae irregular, and obscure or absent on lower side of last whorl.

F. "Obscure retuse corrugati"; golden unicolor. Chiriqui, Panama. 10; 150(15); 4½. ..... .....*Neocyclotus panamensis* DaCosta (1904).

FF. Sutural side of last whorl with irregular, but prominent, striations and rugae; umbilical side obscurely granulate or without oblique striations; color yellowish. Northern Hills of Trinidad. (Other similar forms in Lesser Antilles; compare *Cyclostoma granadense* Shuttleworth, 1857). Maj. diam. 17.8..... .....*Cyclotus rugatus* Guppy (1864).

**Poteria glaucostoma aulari,** new subspecies

Figs. v-K, L, M.

Six adults and 12 immature specimens from the edge of the Cerritos de Yumarito, near Quebrada Seca, Estado Yaracuy, Venezuela (H, II, bc, 28; type locality), and 4 adults and 3 young from small colony in heavy forest, 2 kilometers south of Palma Sola (H, II, bc, 20).

Shell: large, but thin. Color: above, dark olive-brown with chestnut tinge; below, olive-green, the line of demarcation either distinct or obscure; apex, fulvous amber; inside of aperture bluish-purple by reflected light, although no color is visible by transmitted light. Whorls: 4½ to 4¾; flatter and with sutures less deeply impressed than in *P. straminea.* Sculpture: weak, but with both series of oblique striae equally prominent; although, in patches on the apical side, one set may dominate over the other, while, on the umbilical side, they cross each other so as to produce a malleate appearance. Aperture: oval; peristome simply and slightly thickened. Umbilicus: a little more than ¼ the major diameter. Operculum: exterior, flat to slightly convex; interior with central boss less prominent than in *P. straminea.*

The form from Palma Sola (fig. v-M) is considerably more elevated, shows more prominent corrugations, and is lighter in color than the typical form (figs. v-K, L). The apex is light amber, while the later whorls are brownish-amber above and amber below. The bluish iridescence inside of the aperture is considerably lighter.

From Pfeiffer's original description, and Reeve's figure (1865, Conch. Icon., vii-35b), which agrees in all particulars and apparently represents the type, *P. g. glaucostoma* is a very

similar shell to this subspecies. However, the typical form is considerably smaller and the color is more pronounced.

I did not collect this form at Aroa, but a set in the A. N. S. P. (no. 12965), labeled as from that locality (C. F. Starke, 1872), agrees quite closely with the shells from the Cerritos de Yumarito.

*Poteria dunkeri* (Pfr.) and approaching var. *perezi* (Hidalgo). Figs. v-S, U.

Four adults and 17 immature specimens; from the brook flats of a small tributary of Rio Lobaterita, near Estación Táchira (H, I, b, 35), and from the steep valley-sides of the larger stream itself (H, I, c, 38).

As will be seen from the table of measurements, these small lots of specimens show a great deal of variation, both in size and shape. All of the specimens are more elevated than either typical *dunkeri* or *perezi*. One specimen (fig. v-U) is much larger than the others, and, in this particular approaches *P. d. dunkeri*. The growth lines of all are well-marked, but regular and closely spaced. The peristome is thickend and often narrowly reflected, especially on the palatal wall. The number of whorls varies from 4¼ to 4¾; the umbilicus is from 1/3 to 1/4 of the major diameter. The ground color varies from light olive-green to brownish-olive. The light, peripheral band is poorly marked, but is bordered below by a broad band of darker color, which tends to be accentuated at its upper and lower borders, or even to break up into a number of rather indefinite bands. In some specimens, an additional dark band is present on the umbilical side, as is characteristic of *P. d. perezi*, while the sutural region also may be darkened.

Four specimens, labeled Venezuela (A. N. S. P. 12971), connect this series with typical *P. d. dunkeri*. Their measure-

ments are given in the accompanying table. Besides the usually more depressed form, *P. dunkeri* differs from *P. quitensis* (Pfr.) in color (see key). In addition, the growth lines of the latter are developed into plications in the umbilical region. However, *P. gigantea* ("Gray" Sowerby) has both reddish and green color-forms, and *P. gigantea fischeri* (Hidalgo) shows the umbilical prominence of the growth lines. In reality, no very distinct characters, for the specific separation of many of the forms in the group of *P. inca* (Orbigny), have been found as yet.

*Measurements in the Group of P. inca*

| | Altitude | Maj. Diam. | |
|---|---|---|---|
| *P. d. dunkeri* | 17.8 | 198 (35.2) | Conch. Cab. (1912); fig. 140-14. |
| A. N. S. P. 12971 | | | |
| Means: (4 specimens) | 17.6 | 177 (31.1) | Venezuela. |
| Extremes: ditto | 15.7–19.9 | 170–195 (29.6–34.6) | |
| H, I, b, 35 (fig. v-U) | 20.7 | 168 (34.8) | Estación Táchira, Ven. |
| | 12.0 | 177 (21.3) | |
| *P. d. perezi* | 13.6 | 180 (24.5) | Figure, Hidalgo (1866). |
| H, I, b, 38 | 14.3 | 171 (24.4) | Baeza, Ecuador. |
| (fig. v-S) | 18.0 | 160 (28.8) | Estación Táchira, Ven. |
| *P. d. cardozi*, H, I, b, 40 | 13.3 | 159 (21.2) | La Fría, Venezuela. |
| | 10.8 | 182 (19.7) | |
| (type: fig. v-R) | 9.4 | 181 (17.0) | |
| *P. dunkeri* var.; H, I, b, 40 | 13.1 | 163 (21.3) | Quebrada Santa Aguita, Ven. |
| | 14.7 | 159 (23.4) | |
| (fig. v-T) | 16.5 | 146 (24.1) | |
| *P. p. popayana* | 15.5 | 136 (21.0) | Figure, Lea (1838). |
| A. N. S. P. 12980 | 17.8 | 122 (21.7) | "New Granada." |
| A. N. S. P. 12973 | | | |
| Means: (3 specimens) | 13.4 | 146 (19.5) | Cucutá, Colombia (Penny). |
| Extremes: ditto | 11.7–14.9 | 139–152 (17.8–21.8) | |
| A. N. S. P. 12977 | | | |
| Means: (7 specimens) | 16.9 | 149 (25.1) | Mendez, Colombia (T. Bland). |
| Extremes: ditto | 14.5–18.7 | 125–157 (22.6–27.1) | |
| *P. p. fasciata* (2 shells) | 16.5–17.0 | 141–158 (24.0–26.0) | Kobelt (1922) Puerto Cabello. |
| A. N. S. P. 12972 (12974) | | | |
| Means: (16 specimens) | 17.0 | 139 (23.1) | Puerto Cabello (C. F. Starke). |
| Extremes: ditto | 14.6–18.7 | 121–153 (20.7–26.2) | |

The following, very artificial key, to the names in the group of *P. inca,* is presented. The remarks, preceding the key to the group of *P. translucida,* also apply here. As the earlier descriptions are very monotonous reading, and often difficult of interpretation, the characterization of each fresh lot as a new species appears to be the customary procedure in this group.

A. Basal lip of peristome with a marked indentation, corresponding to subcanaliculate last whorl (teratological?; Cf. von Martens, 1890).

B. With a dark, spiral band just below periphery and another on base of the last whorl. Province Cauca, Colombia (about L. 5, 77). 17.7; 169 (30); 4..... .....*Neocyclotus caucaensis* DaCosta (1901.)

BB. No bands mentioned in descriptions.

C. Smaller, distinctly flattened, less vaulted. Bay of Salinas, Costa Rica. 16.5; 176(29)..... .....(!) *Cyclotus irregularis,* var. *pittieri* Mart. (1890).

CC. Larger; the oldest name. Costa Rica. 26; 162(42); 5 (von Martens, 1890).....(*) *Cyclostoma irregulare* Pfr. (1855).

AA. Basal lip of peristome normally entire.

D. Periphery of last whorl angulate or subangulate.

E. Obscure, cord-like development on periphery of last whorl; color olive-brown, somewhat lighter below. Ambato, Ecuador. 13.2; 163(21.6); 4½. *Cyclotus pazi* Crosse(1866).

EE. Angulation more prominent; last whorl at least subcarinate.

F. Shell much depressed; growth-lines very prominent.

G. Most depressed, rapidly increasing whorls; castaneo-fulvous with blackish carina. Colombia. 18.1; 202 (36.6); 4½...*Cyclostoma laxatum* Sowerby (1849).

GG. Depressed; olivaceous with light, peripheral stripe and darker band below it. Bogotá, Colombia. 20; 180(36). ...(!) *Cyclotus filoliratus* Sowerby (1892, P. Z. S.).

FF. Less depressed shell; growth lines fine above, but coarse below (Cf. *fischeri*).

H. Shell shaped like *P. gigantea;* blackish fuscous with yellowish brown, peripheral stripe. Ecuador. 23; 165(38); 4½. .....
...*N.* (*giganteus* var?) *subcingulatus* Kobert (1912).

HH. Shell more elevated; olivaceo-castaneous, with light stripe at periphery and darker band below. Colombia. 29.5; 144(42.6); 4½. .....
.....*Cyclostoma cingulatum* Sowerby (1843).

DD. Periphery of last whorl rounded.

I. Shells very large; major diameter more than 45 mm.

J. Last whorl descending, with upper angle canaliculate; dark band below periphery. Vera Paz, Guatemala (?) 35.1; 139(48.7). .....
..(!) *Aperostoma confusum* Sykes (1901) Jour. Malac.

JJ. More depressed; descent of last whorl less pronounced.

K. Color rich chestnut-brown; lighter at suture and base, but no spiral bands. Zaragoza, Colombia (L. 7, 75). 32; 159(51); 5.
.....*Neocyclotus belli* Beddome (1908).

KK. Dark, spiral band below lighter stripe at periphery.

L. Slightly more elevated; growth lines much coarser towards umbilicus than on sutural side of last whorl. Ecuador. 32.3; 161(51.9); 5.....*Cyclotus fischeri* Hidalgo (1867).

LL. Most depressed; growth lines not markedly coarser below. Near Panama City, Panama. 36; 166(59.8); 5½. .....
.....*Cyclostoma giganteum* "Gray" Sowerby (1843).
(+ *C. cumingii* Jay, 1850).

II. Shells smaller; major diameter less than 40 mm.

M. Much depressed, rapidly increasing whorls; color brownish-olive, with light stripe above periphery, bordered by dark brown above and below. Peru. 13; 212(27.5); 4. .....
.....*Neocyclotus depressus* DaCosta (1906).

MM. Less depressed; not more than twice as broad as high.

N. Color predominantly reddish; usually distinctly larger and heavier shells, with prominent growth lines, at least around umbilicus.

O. More depressed; chestnut-brown above, dark-brown below, with narrow, peripheral stripe of light color; growth lines weak. Pozuzo, Eastern Peru. 20.4; 183 (38); 4½. ....*Neocyclotus peruvianus* DaCosta (1906).

OO. Less depressed, major index around 160.

P. Rich chestnut in color with yellowish streaks and darker lines at irregular intervals, but slight trace of bands; growth lines prominent. Las Nubes, 4000 ft., Santa Marta Mts., Colombia (L. 11, 74). 20; 157 (31.5); 4⅓. .....(!) *Aperostoma sanctaemarthae* Pilsbry and Clapp (1902) Nautilus.

PP. Fulvous chestnut, with light, peripheral stripe, usually bordered below by dark band.

Q. Slightly more depressed; black band above and below peripheral stripe; apex rose. Near Bogotá, Colombia. 20; 167(33.5); 5. ..... .....*Neocyclotus colombiensis* DaCosta (1901).

QQ. Slightly more elevated; greenish around umbilicus; growth lines plicate below. Quito, Ecuador. 21.8; 157(34.2); 4½. ..... .....*Cyclostoma quitensis* Pfeiffer (1851).

NN. Color predominantly greenish; usually smaller and thinner shells (but see *dunkeri* and *corpulentus*).

R. Much depressed shells; major diameter index over 180.

S. Large and heavy shells.

T. Last whorl swollen, almost solute; color dark olive brown with numerous, dark, spiral lines; growth lines prominent. San Sebastian, Colombia (L. 11, 74). 19; 184(35). (*) *Cyclotus corpulentus* E. A. Smith (1878).

TT. Last whorl normal; color olive with light, peripheral stripe, bordered by dark band below. New Granada; Riobamba, Ecuador. 17.8; 198(35.2); 4½. ..... .....*Cyclotus dunkeri* Pfr. (1856).

SS. Smaller and thinner shells; fusco-olivaceous with black band around periphery and another at base.

U. Larger. Baeza, Ecuador. 13.6; 180(24.5); 4. ..... ..... *Cyclotus perezi* Hidalgo (1866).

UU. Smallest. La Fría, Venezuela. 9.4; 181(17.0); 3¾. .....(!) *P. dunkeri cardozi* new.

RR. More elevated shells; major diameter less than 170(30); olive-brown with light, peripheral stripe usually bordered by dark band below.

V. Major diameter index around 160.

W. Shell malleate below; brownish green. Bogotá, Colombia. 14; 157(22); 4½. ...*Cyclostoma bogotensis* Pfr. (1855).

WW. Growth lines fine and quite regular; olive brown.

X. Aperture normal; shell slightly more (or less) depressed. Bolivia. 19; 163(31); 5. .....*Cyclostoma inca* Orbigny (1835). .....(+ *C. colombiensis* "Fer." Orb., 1835). .....(+ *C. nobile* "Fer." Pot. and Mich., 1838).

XX. Original figure (poorly drawn) shows somewhat solute aperture and slightly more elevated shell. Coxoeira Woods, Bahia, Brazil. 18:3; 155(28.3)..... .....*Cyclostoma blanchetianum* Moricand (1838).

VV. Major diameter index varies around 140.

Y. Bands more pronounced. Puerto Cabello, Venezuela. 17.0; 137(23.1); 4-5 (see table). ..... .....*N. popayana fasciata* Kobelt-Schwanheim (1912).

YY. Dark, spiral band. Popayan, Colombia. 15.5: 136(21); 4½. .....*Cyclostoma popayana* Lea (1838).

YYY. Two reddish bands. 11.6; 129(14.9); 4-5..... .....*Cyclostoma inconspicuum* Sowerby (1843).

**Poteria dunkeri cardozi,** new subspecies

Fig. v-R.

Three adults and 10 immature specimens from the lowland forest around La Fría (H, II, b, 40). These specimens from the rich, luxuriant jungles are, peculiarly enough, considerably smaller than the remainder. The description of the type (fig. v-R) of this form follows:

Shell: depressed, thin, translucid. Growth lines: regular, compressed. Color: brownish horn, apex tinged with fulvous; periphery of last whorl lighter, bordered below by a diffuse, brownish band, which is somewhat darker at its upper and lower borders; another, narrower band on the umbilical side. Whorls: 3¾; flattened above and rapidly increasing. Umbilicus: a little more than ¼ the major diameter. Aperture:

oblique, transversely elliptical. Peristome: thickened and slightly reflected, especially on the palatal wall.

While this variety seems simply a dwarfed form of *P. dunkeri,* it appears to be at least an ecological race. While the type is clearly an adult shell, the smaller number of whorls appears to indicate arrested development as well as actual reduction in size. The largest adult from this locality is considerably more elevated, and thus approaches the next form in shape. Both of the larger shells have 4¼ whorls.

Attention is called to the fact that the type of this form is less than ½ as large as *P. dunkeri,* or the largest shell in the Estación Táchira series; while these latter are almost 2/3 as large as *P. gigantea* (Sowerby). The correspondence of *P. dunkeri* and *P. quitensis* with the forms of *P. gigantea* and *P. g. fischeri,* has already been noted. In addition, the last two forms usually have a larger number of whorls than do the smaller shells.

*Poteria dunkeri,* var. approaching *P. popayana* (Lea).

Fig. v-T.

Three adults and 8 immature specimens from the creek flats of Quebrada Santa Aguita, near La Fría (H, I, b, 42). These shells are quite heavy and are considerably more elevated than most of the others from the same general region. The ground color of the adults is dark brown, so that the spiral banding is partially obscured. The shell substance at the apex is rosaceous to coral red. The aperture is nearly circular, and the peristome is thickened but not at all reflected. The umbilicus is about ¼ the major diameter.

As will be seen from the table of dimensions, this form approaches *P. popayana* in shape. However, in the specimens

measured, the umbilicus of the latter is considerably smaller, around 1/5 the major diameter, although that of a very much elevated specimen from "New Granada" (A. N. S. P. 12950) is about 2/9. Von Martens (1873) has called attention to the intergradation in shape between *P. inca* and *P. popayana.* He has also pointed out that actual specimens of *C. blanchetianum,* obtained through Moricand, are more depressed than *P. inca,* instead of more elevated, as would appear from Moricand's figure (see the preceding key). Specimens in the A. N. S. P. (no. 12968, Brazil, from Moricand) agree with Von Martens' statement. To be perfectly candid, the difference in locality is about the only remaining excuse for the specific separation of the forms from the Brazilian region and those from the Colombian.

Besides those already mentioned, measurements of sets in the A. N. S. P. from Cucutá, Colombia (L 8, 73), Mendez, Colombia (L 10, 75), and Puerto Cabello, Venezuela, are included in the table of dimensions. The extremes of variation in the major diameter index are especially noteworthy. Kobelt-Schwanheim (1912), in the description of *Poteria popayana fasciata,* has called attention to the color variation in "Puerto Cabello" specimens, but apparently his series did not show as much variation in shape as the set in the Acad. of Nat. Sci. of Philadelphia. It is interesting, at least, that the larger forms, of the *confusa-belli-fischeri-gigantea* series, show similar differences in shape (see key).

### Diplommatininae

*Adelopoma occidentale* (Guppy, 1872).

Very abundant; at Quebrada La Fría, in rich leaf mould on an abandoned cacao plantation, that has returned ("mon-

tado") to practically the same conditions as the original forest (H, V, b, 41). Such isolated occurrence in second-growth seems to favor the hypothesis that this is an introduced species.

The columellar denticle in these shells is quite low and rounded, but in no sense vestigial. The first 1½ whorls are lightly and irregularly pitted. In addition to the prominent, growth ribs, the surface of their interspaces is covered with microscopic sculpture. The latter consists of rounded spiral riblets, which are broken, by impressed growth lines, into series of bead-like prominences.

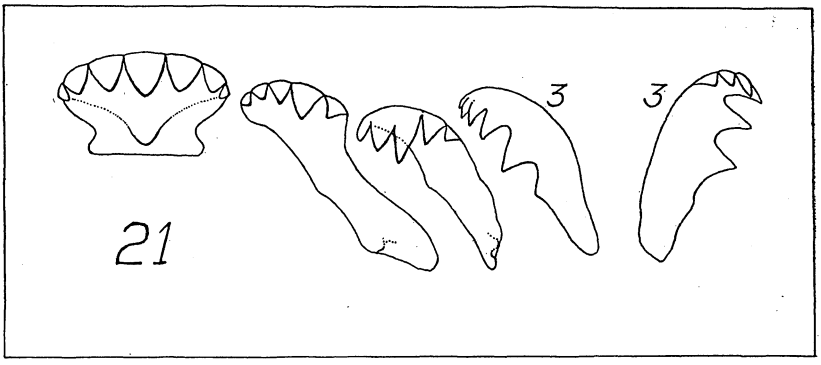



Figure 21. *Adelopoma occidentale.* Teeth of half-row, separated laterad. At the right is shown a ventral view of another of the outermost teeth. The scale indicates a length of 50 microns.

Figure 21 shows a half row from the radula of this species, with the teeth separated laterad, so as to better show their form. As usually seen, the first lateral overlaps the central, while the bases of all of the laterals and marginals are crowded closely together. The right-hand figure of the marginal tooth shows the ventral side uppermost. The denticle, near the center of the base of the rachidian tooth, is very prominent and distinctly reminiscent of the Amnicolidae. As will

be seen from the scale (50 microns), some of the cusps approach the limits of microscopic visibility. This radula appears to be similar to that of *Adelopoma tucma* Doehring (1884); it certainly does not resemble those of the Aperostomatinae.

## Description of Plates

All drawings are made with the aid of the camera lucida. Under the number of each figure, is a hair line, which represents an actual length of one millimeter in plate II, and 50 microns (.05 mm.) in plates III and IV, and in the text-figures.

## PLATE I.

All drawings were made with the aid of the camera lucida. The scales in figures 1, 2, 3, 4, and 6 represent an actual length of 1 mm.; that of figure 5, 10 microns (1.01 mm.).

Figure 1. *Leptinaria* (*Neosubulina*) *gloynii.*

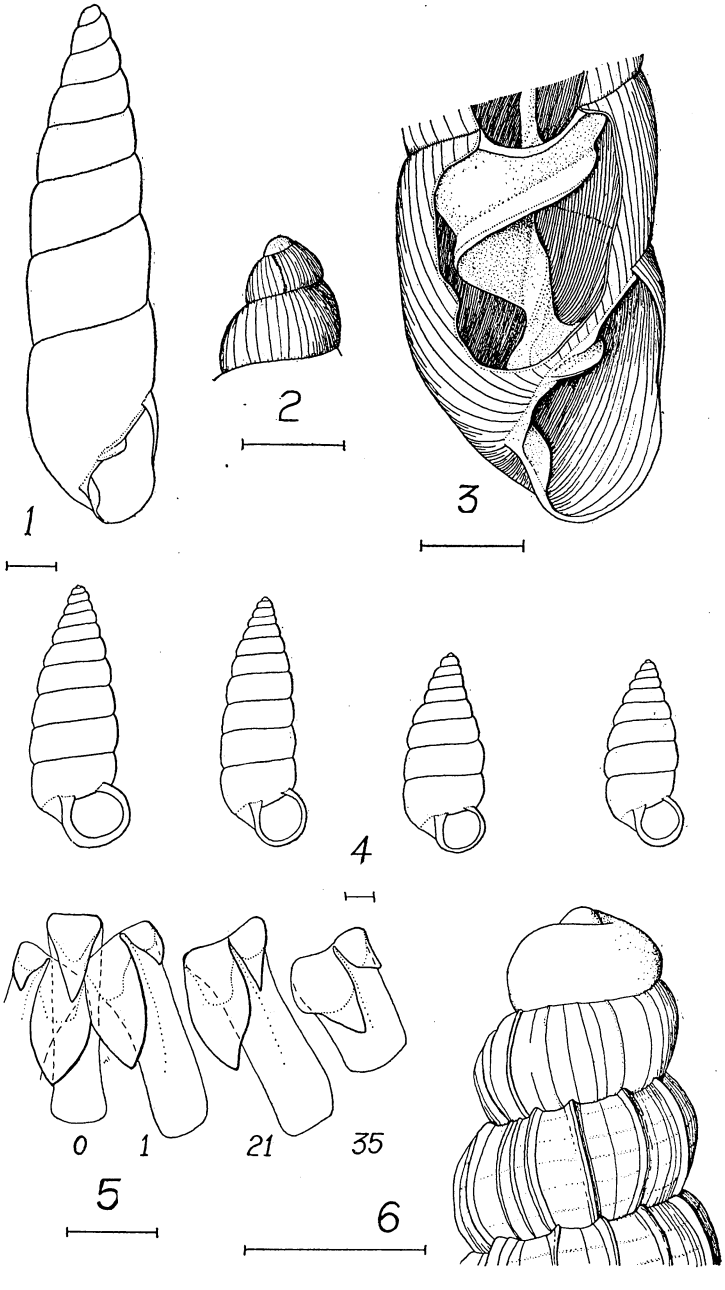
Figure 2. *L. gloynii.* Apical whorls.

Figure 3. *L. gloynii.* Last whorl, opened to show arrangement of columnellar and parietal lamellæ.

Figure 4. *Microcramus bonairensis curacoana.* Outline of 4 individuals of type lot to show extreme variation in shape and size.

Figure 5. *M. b. curacoana.* Radula; central and first laterals in place, 21st and 35th laterals. The curved line below the scale shows the shape of a single transverse row.

Figure 6. *Chondropoma* (?) *raveni.* Apical whorls of young shell.


1
2
3
4
0
1
21
35
5
6

## PLATE II

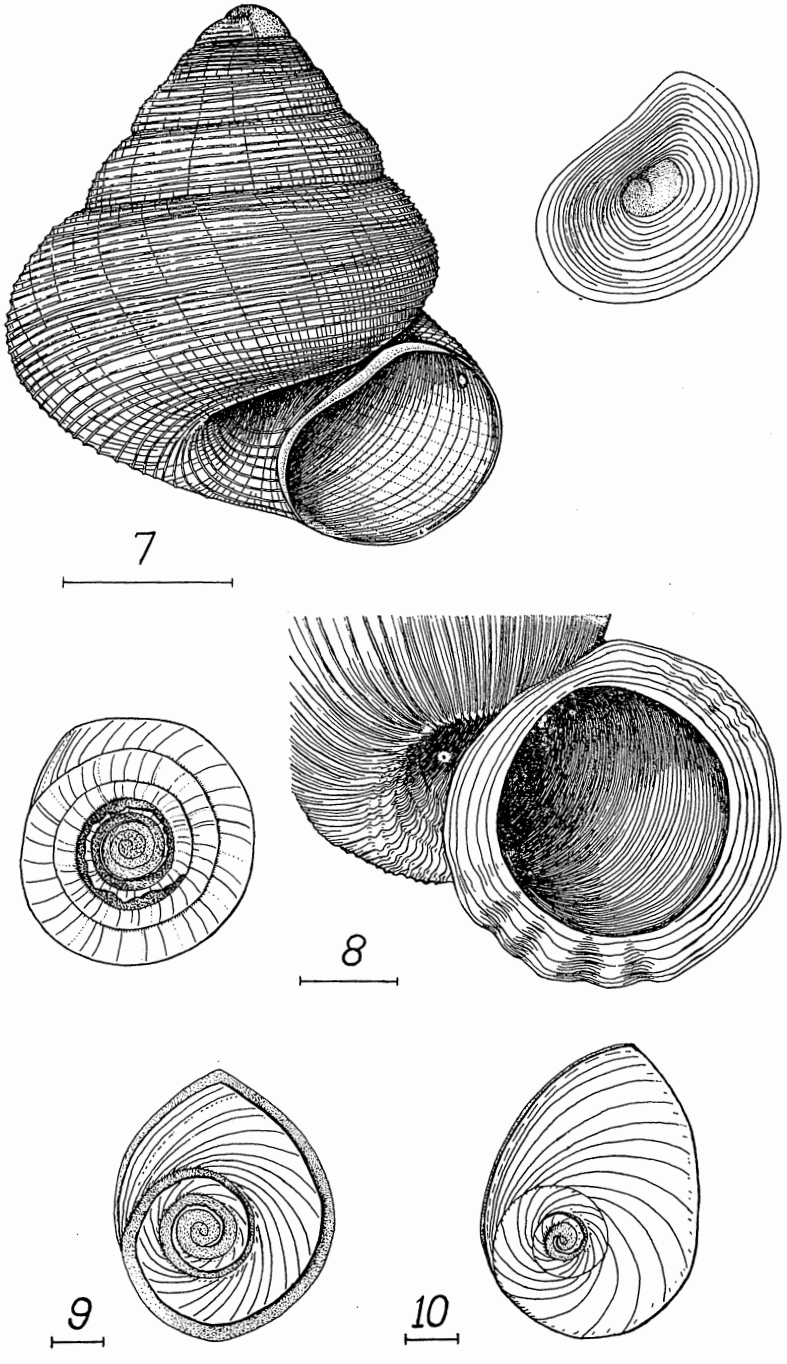
The scales indicate a length of one millimeter.

Fig. 7. *Lucidella venezuelensis.* Front view of shell and outer view of operculum (calcareous plate).

Fig. 8. *Tudora williamsoni.* Outer view of operculum and front view of last whorl of type specimen (male).

Fig. 9. *Tudora plicatula.* Outer view of operculum.

Fig. 10. *Tudora megacheilos.* Outer view of operculum.


7
8
9
10

## PLATE III

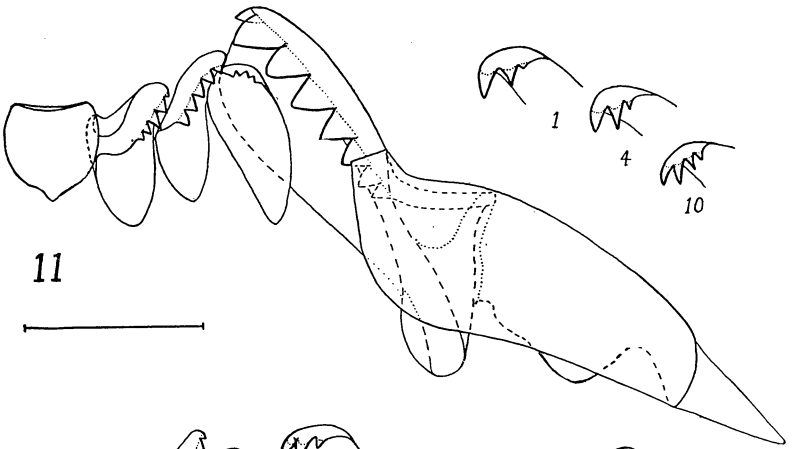
The scales indicate a length of fifty microns. The relationships of the centrals and laterals are represented as viewed.

Fig. 11. *Oligyra* (*Analcadia*) *rufa.* Centrals, laterals, and tips of 1st, 4th, and 10th uncini.

Fig. 12. *Oligyra* (*Analcadia*) *dysoni barbata.* Centrals, and tips of 1st and 4th uncini.

Fig. 13. *Oligyra* (*Idesa*) *rotunda.* Centrals, and top of 1st uncinus.

Fig. 14. *Oligyra* (*Sericea*) *riparia tachirensis.* Centrals, laterals, and tips of 1st, 4th and 7th uncini.


1
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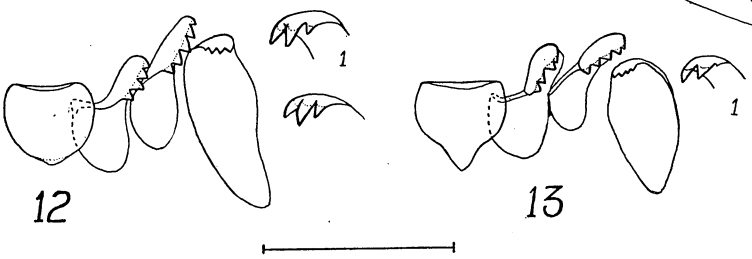
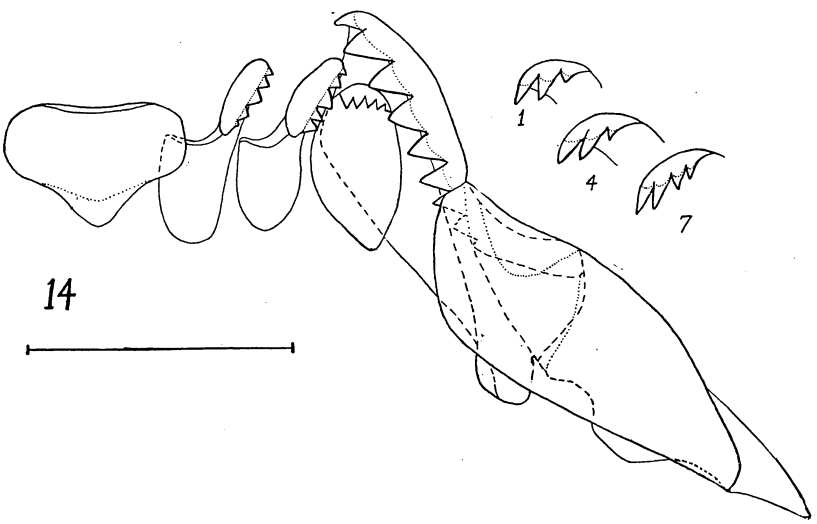
11


1
12
1
13


1
4
7
14

## PLATE IV

The scales indicate a length of fifty microns. The relationships of the centrals and laterals are represented as viewed.

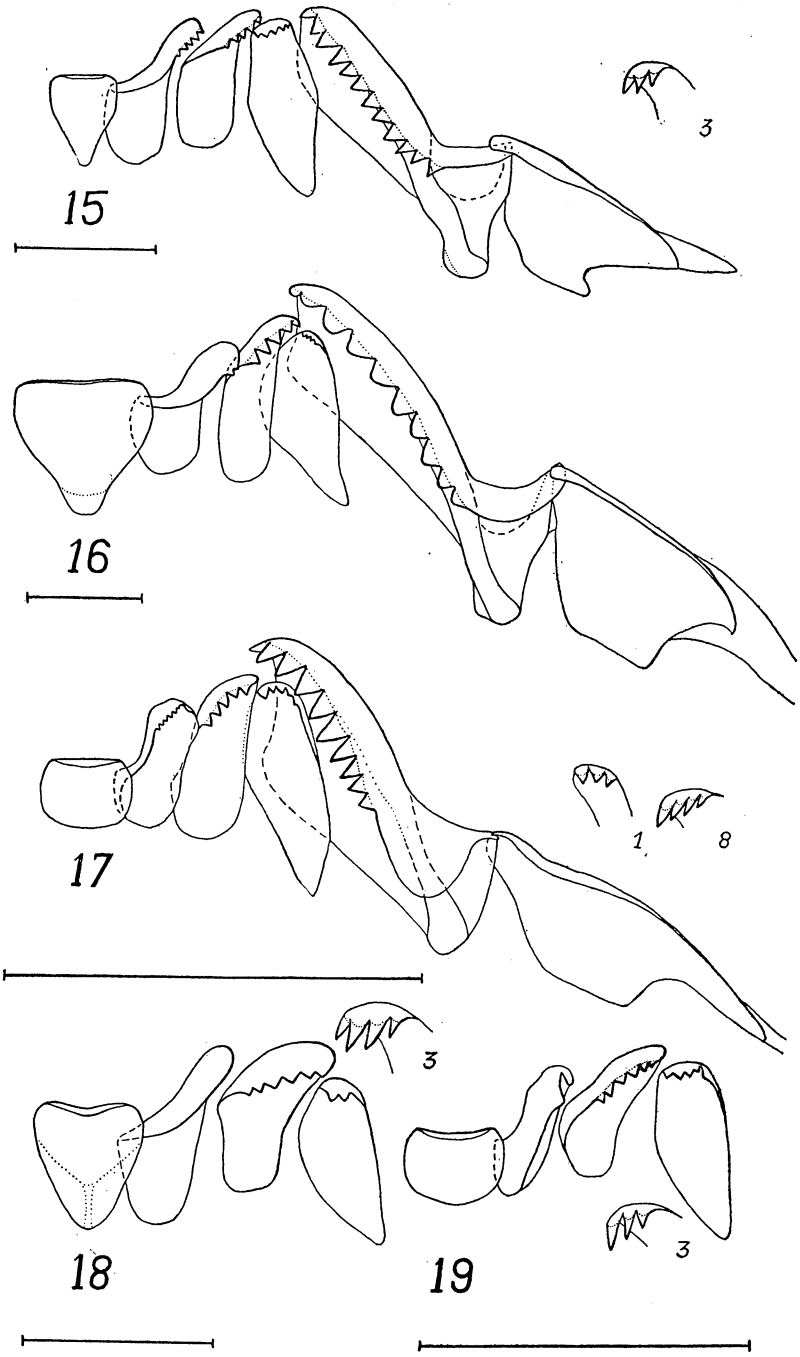
Fig. 15. *Helicina* (*Oxyrhombus*) *concentrica.* Centrals, laterals, and tip of 3rd uncinus.

Fig. 16. *Helicina* (*Angulata*) *caracolla.* Centrals and laterals.

Fig. 17. *Lucidella* (*Lindsleya?*) *venezuelensis.* Centrals, and tips of 1st and 8th uncini.

Fig. 18. *Helicina* (*Angulata*) *rhynchostoma ernesti.* Centrals and tip of 3rd uncinus.

Fig. 19. *Lucidella* (*Poeniella*) *plicatula.* Centrals and tip of 3rd marginal.


3
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19
3

## PLATE V

Reproduced approximately natural size.

A. *Poteria translucida translucida.* La Guaira, Venezuela.

B. *Poteria translucida trinitensis.* Male; Cariaquito, Venezuela.

C. *Poteria translucida trinitensis.* Female; Cariaquito, Venezuela.

D. *Poteria translucida bejumensis.* Type; female; station 7.

E. *Poteria translucida bejumensis.* Most depressed female; station 7.

F. *Poteria translucida bejumensis.* Smallest male; station 7.

G. *Poteria translucida bejumensis.* Largest female; station 15.

H. *Poteria translucida major.* Type; Caracas, Venezuela.

I. *Poteria translucida santaguitensis.* Male; station 42.

J. *Poteria translucida santaguitensis.* Type; female; station 42.

K. *Poteria glaucostoma aulari.* Male; station 28.

L. *Poteria glaucostoma aulari.* Type; female; station 28.

M. *Poteria glaucostoma aulari.* Female; station 20.

N. *Poteria straminea.* Female; station 3.

O. *Poteria straminea.* Male; station 3.

P. *Poteria granadensis rugata.* Female; Cariaquito, Venezuela.

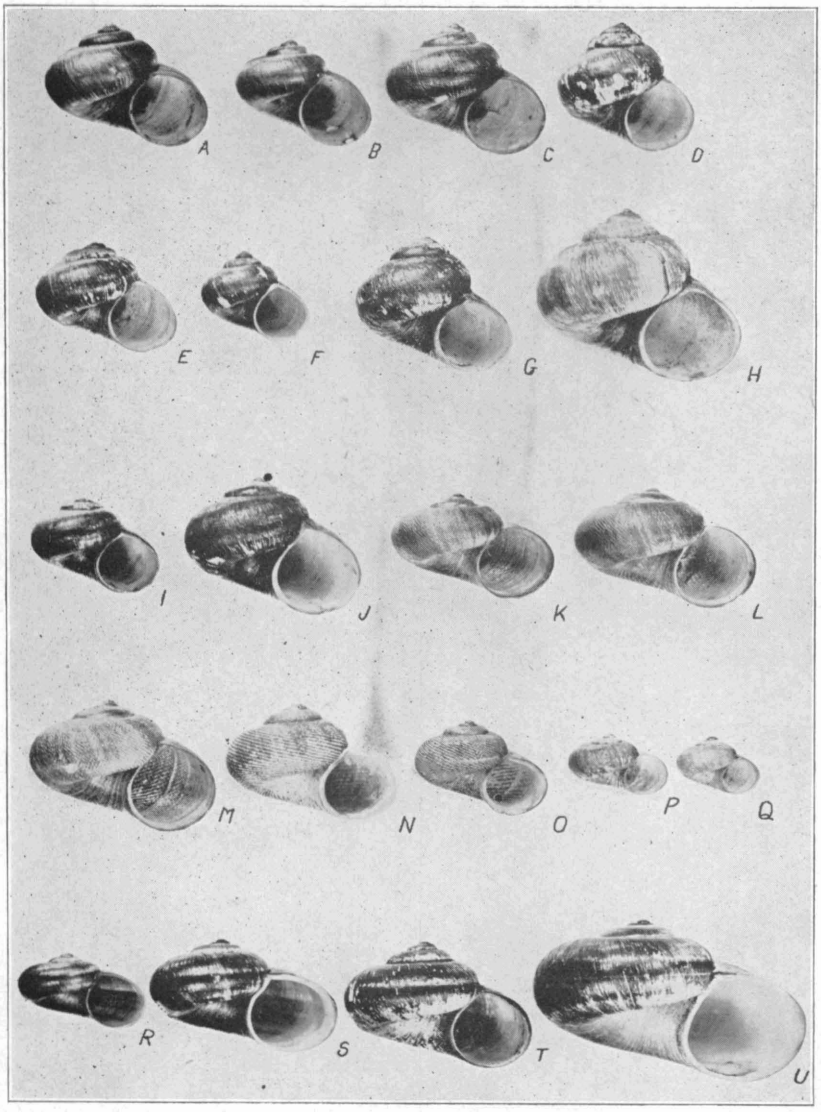
Q. *Poteria granadensis rugata.* Male; Cariaquito, Venezuela.

R. *Poteria dunkeri cardozi.* Type; male; station 40.

S. *Poteria dunkeri,* near *perezi.* Station 38.

T. *Poteria dunkeri,* approaching *P. popayana.* Station 42.

U. *Poteria dunkeri dunkeri.* Largest female; station 35.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