

it tapers rather abruptly to the vas deferens no trace of a flagellum was found. The spermatheca has a swollen duct with very thick walls (Fig. e, section of spermathecal duct and free oviduct). Length of penis 3 mm., spermatheca and duct 3.5 mm., vagina 1 mm.; the penial retractor is less than one mm. long.

The mantle is reticulate-spotted with black. Foot uniform light colored, the eye-stalks light gray.

This species differs conspicuously from *T. loricata* by the far larger penis with projecting summit and differently ribbed cavity, and by the swollen duct of the spermatheca.

Trilobopsis penitens (Hanna & Rixford)

Fig. 472.

Polygyra penitens Hanna & Rixford, 1923, Proc. Cal. Acad. Sci., (4), 12: 47, pl. 4, figs. 1, 2, 3, 8.

“Shell dark brown when alive, aperture with a violet tinge; a little more than five well-rounded whorls; spire about evenly rounded above and below; uppermost two or three whorls smooth, remainder hirsute; hairs in rows which follow the growth lines and fairly evenly spaced so that they are also in irregular, diagonal rows; individual “hairs” are in reality flat, lamella-



Fig. 472. *Trilobopsis penitens*, after Hanna. (× 4.)

like projections of epidermis; umbilicus very wide, contained only four times in greatest diameter of shell. Apertural teeth three; all weakly developed for this group of *Polygyra*; palatal and basal, rounded tubercles; parietal somewhat lamellar but not curved as in many species of the genus; peristome reflected but not so abruptly as in the *P. devius* group.” (Hanna & Rixford.)

Height 3.5 mm., diameter 7.9 mm. Figured type.

Height 3.2 mm., diameter 8 mm. Figured paratype.

Height 3.5 mm., diameter 8 mm. Figured paratype.

CALIFORNIA: South bank of the south fork of American River near the hamlet Mormon Island, Sacramento County (Hanna & Rixford), Type 692 C.A.S.

“The locality is about $\frac{1}{3}$ mile west of the road which leads north at that point, and just before the wagon bridge is reached. It is $1\frac{1}{2}$ miles east of Folsom Penitentiary; this proximity suggested the name *penitens*. American River at this point is a swift, narrow, rocky stream, and the snails were

found living among rocks and plant debris on a dry but shady hillside. *Epiphragmophora mormonum* and *E. tudiculata cypreophila* were associated with them.

"This species is closer related to *Polygyra roperi* (Pilsbry) than any other. That species is hirsute and has a wide umbilicus, but is less elevated (it was described as subdiscoidal), the whorls increase less rapidly in size, the constriction is less marked behind the aperture and the aperture is less oblique. The palatal tooth in *penitens* is rounded-tubercular, not quadrate as in *roperi*. The basal tooth is nearer the center of the basal margin in *penitens*, and the parietal tooth is not long and curved as in *roperi*. But the greatest difference between the two species lies in the character of the epidermis. *P. roperi* is truly hirsute, the projections being actual hairs, although short; in *penitens* they are flat and lamella-like." (Hanna & Rixford.)

Dr. Hanna's figure of the genitalia (Fig. 466: 5) is reproduced. It resembles *T. loricata* by the short, stout penis.

Subfamily TRIODOPSINAE

The penis is partially covered with a sheath adnate to the base (sometimes quite imperfectly developed), and terminates in an epiphallus upon which the penial retractor is inserted (or in *Allogona* inserted on penis also). The epiphallus bears a very short or a concealed flagellum or sometimes none. A penial retentor muscle connects epiphallus with penis at upper border of the sheath. The duct of the spermatheca is usually swollen (except in *Ashmunella* and *Allogona*).

The genera of this subfamily are confined to the United States and adjacent border of British America, with the exception of *Ashmunella*, which extends below our borders into the Mexican State of Chihuahua.

In part of the species of *Triodopsis* there is no epiphallus differentiated from the vas deferens, but the subgenus *Cryptomastix* and the other Triodopsine genera have a distinct epiphallus. It is now believed that the genera having an epiphallus and flagellum retain earlier structures of the family, which have been lost in most of the Polygyrinae and a few Triodopsinae; these being the more evolved stocks, though secondarily simplified in penial structure.¹

Excepting the structurally isolated Pacific coastal genera *Trilobopsis* and *Vespericola*, and *Ashmunella* of the southern mountains, it seems likely that other western Polygyridae (*Cryptomastix* and *Allogona*) are relatively recent (Neocene) migrants from the eastern stocks, either by way of the Missouri-Columbia valley, or probably farther north. These immigrant

¹ When I segregated the Polygyras as a group "Protogona" (Man. Conch., 9, 1895) the anatomy was known in only the simplified forms, then thought to be primitive; an opinion now relinquished.

stocks have not spread materially south of the Columbia River valley. The California Polygyridae belong to the genera *Trilobopsis* and *Vespericola*, which are presumably autochthonous, or at least far more ancient inhabitants of the West Coast.

TRIODOPSIS Rafinesque

Triodopsis Rafinesque, 1819, Journ. de Physique, de Chimie, d'Hist. Nat., 88: 425.
Cf. Férussac, 1821, Tabl. Syst. Fam. Limaçons, p. 34, no. 105 (*Triodopsis lunula* Raf. in synonymy of *Helix tridentata* Say).

Menomphis Rafinesque, 1831, Enum. and Acc., etc., p. 3. (Subgenus of *Triodopsis* for *Triodopsis lunula* Raf.).

Triodontopsis Agassiz, 1846, Nomenclator Zool., Index Universalis, p. 378. (Emendation of *Triodopsis*.)

Triodopsis Rafq., in part, Beck, 1837, Index Molluscorum, p. 24.

The shell of moderate or large size is either umbilicate or imperforate, and varies in form from depressed and carinate to subglobose-conic. The surface may be striate, with or without spiral lines, or hirsute. The aperture is trilobed or lunate; the peristome is reflected, thickened within, with three teeth or none; parietal tooth when present not v-shaped.

Reproductive system characterized by the presence of a sheath enveloping part or all of the penis, to which it is adnate at the base. The upper cavity of the penis contains a large pilaster often of irregular shape, lower cavity smaller, longitudinally ridged, without a stimulator. Penial retractor muscle inserted on the lower part of the vas deferens (or epiphallus, when this is differentiated), and continued in a retentor muscle to the penis at the upper limit of the sheath (or the retentor may be attached to the vas deferens above, not obviously continuous with the penial retractor). There is no trace of a flagellum where the epiphallus, when present, passes into the vas deferens.¹ The duct of the spermatheca is short and conspicuously swollen. Other organs as in Polygyridae generally.

TYPE: *Triodopsis lunula* Raf. = *Helix tridentata* Say.

Distribution.—Humid eastern United States and Canada, east of the 100th meridian; the subgenus *Cryptomastix* from Montana west of the continental divide to British Columbia and Oregon. The range of the eastern herd of *Triodopsis* is nearly coincident with that of *Stenotrema* and *Mesodon*, but unlike the former, the species are not more numerous in mountainous districts.

Tryon, 1867, Binney & Bland, 1869, and later authors, following Von Martens, 1860, used *Triodopsis* for all of the depressed, two- or three-toothed helices of the eastern United States, and *Mesodon* for the more capacious, subglobose species with a small parietal tooth, or toothless. But by anatomic criteria this obvious and convenient grouping requires modification, as the *albolabris* group has anatomic characters of *Triodopsis*, and *inflecta*, *appressa* and their allies are Mesodons.

(Τρεῖς, ὀδοῦς, ὄψις, three-toothed face.)

¹ Except in the western subgenus *Cryptomastix*.

Subgenera of Triodopsis

1. The concealed vestige of a flagellum is found at junction of epiphallus and vas deferens; shell with reflected, recurved lip, the embryonic whorls with the radiating striae somewhat irregular and in part or wholly broken into long granules; western.*Cryptomastix*
 No trace of a flagellum; shell with flatly reflected lip; embryonic whorls either covered with fine striae radiating from the suture or varying to a belt of short striae below suture, or to smooth; eastern.....2
2. Shell depressed, umbilicate, the aperture with three teeth, or the two lip teeth may be wanting.*Triodopsis*
 Shell depressed, imperforate or nearly so; a laminar ridge runs along inner margin of the basal lip and is truncate at junction with outer arc of the lip; a parietal tooth and usually an upper lip-tooth present.....*Xolotrema*
 Capacious, imperforate shells, the aperture toothless or with a small parietal tooth and sometimes a blunt prominence on basal lip near the columella.....*Neohelix*

Subgenus TRIODOPSIS *s. str.*

The shell is typically three-toothed, but in some forms the lip teeth are very small or entirely wanting. It is regularly striate, with weak spiral lines or none. Embryonic whorls either with radial striae or almost smooth. There is usually some minute granulation behind the lip and at margin of the umbilicus.

In this typical subgenus the upper part of the penis contains a large longitudinal fleshy ridge which has several rows of nipple-like tubercles, a smaller similar ridge and several longitudinal rows of tubercles sometimes present, as in *T. tridentata*. In other species such as *T. hopetonensis*, the main ridge is irregularly lobed or deeply divided. In *T. soelneri* the ridge does not extend to the apex of the penis (Fig. 5 a). In preserved specimens the upper part of the penis is usually bent or bowed by the tension of the penial retentor muscle, as in Figures 1, 2, 4, 5. The main internal ridge, which determined the direction of the curve, lies within the outside arc.

Key to Species of Triodopsis s. str.

- A. Without teeth in the lip.
 - B. Diameter 22 mm.; northern West Virginia.....*T. platysayoides*
 - BB. Diameter 12-13 mm.*T. tridentata edentilabris*
- AA. Having two lip teeth.
 - B. Outer lip tooth, as well as the basal, marginal.
 - C. Outer lip tooth buttressed below.....*T. rugosa*
 - CC. Outer lip tooth not buttressed below.
 - D. Outer end of parietal tooth directed to a point below outer lip tooth.*T. tridentata*
 - DD. Outer end of parietal tooth directed towards or above the outer lip tooth.
 - E. Lip having a callous ridge from basal tooth towards the columella; diameter 9-13 mm.; Virginia to Alabama.
T. hopetonensis

- EE. No callous ridge between basal tooth and columella.
 F. Diameter 12-19 mm.; mainly east of mountains, New Jersey to South Carolina.....*T. t. juxtidentis*
 FF. Ohio to eastern Missouri.....*T. t. discoidea*
- BB. Outer lip tooth receding or bent inward.
 C. Umbilicus rather wide, readily showing first whorl.
 D. Diameter 13-20 mm.; eastern Missouri to Virginia..*T. fraudulentata*
 DD. Diameter 10-13 mm.; Ozarks and outliers.....*T. neglecta*
- CC. Umbilicus rather narrow.
 D. Eastern; diameter 11-14 mm.
 E. Whorls 6-6½, closely coiled, South Carolina to Alabama.
T. vannostrandii
 EE. Whorls 5½, less closely coiled, Pennsylvania to Georgia.
T. jallaz
- DD. Western; Kansas and Missouri to Louisiana and Texas.
 E. A ridge on face of basal lip, the basal tooth not visible in a basal view.*T. vultuosa*
 EE. Basal lip convex, not ridged, the basal tooth partly visible in a basal view*T. cragini*

Triodopsis tridentata (Say)

Figs. 474 a-i; 476 a.

Helix tridentata Say, 1816, Nicholson's Encycl., 1st. American Edit., art. Conchology, Helix no. 3, pl. 2, fig. 1 ("Middle States").—Binney, 1851, Terr. Moll., 2: 183, pl. 27.

Triodopsis tridentata Say, W. G. Binney, 1878, Terr. Moll., 5: 308, pl. 27; pl. vii, fig. m, and pl. xv, fig. d (teeth and genitalia).—Wetherby, 1894, Journ. Cincinnati Soc. Nat. Hist., 16: 211 (Roan Mt.).—Call, 1900, Indiana Dept. Geol. and Nat. Res. Ann. Rep., 24: 387, fig. 8 (small variety).

Polygyra tridentata (Say), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 117, (Great Smoky Mts.).—Walker, 1902, Proc. Acad. Nat. Sci. Phila., p. 421, (western N. C.).—Sterki, 1900, 8th. Ann. Rep. Ohio State Acad. Sci., p. 31; 1907, Proc. Ohio State Acad. Sci., 4: 376.—Walker, 1906, Ill. Cat. Moll. Mich., p. 462; 1928, Terr. Moll. Alabama, p. 21, figs. 23, 24.—F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 114; 1898, Trans. Acad. Sci. St. Louis, 8: 84, with *P. tridentata bidentata*, p. 85, pl. 10, fig. 2, and *P. t. unidentata*, pl. 10, fig. 5, (all from "Pinnacle Hill," southeast Rochester, N. Y.).—Johnson, 1915, Occ. Pap. Boston Soc. Nat. Hist., vii, Fauna of New England, 13: 195.—Archer, 1934, Nautilus, 48: 22, pl. 1, fig. 1.

Triodopsis lunula Rafinesque, 1831, Enum. and Acc., etc., p. 13.

The shell is umbilicate, the umbilicus contained nearly 7 times in the diameter, depressed, dilute cinnamon-buff, slightly glossy. Embryonic 1½ whorls with fine curved radial striae extending across the whorl in some examples, in others the striae are short, partly obsolete, leaving a smooth outer band.¹ Last whorl with close thread-like rounded striae, equal to their intervals, the latter nearly smooth except around umbilicus where they

Fig. 473. 1, *Triodopsis tridentata juxtidentis*, Cavetown, Md. 1a, more enlarged view of talon. 2-2b, *T. t. juxtidentis*, Wilmington, N. C., with sections of penis; 2c, upper end of penis from above; 2d, talon. 3-3b, *T. hopetonensis*, Columbia, S. C., with section of penis. 4-4b, *T. tridentata*, Tannersville, N. Y., with sections of penis. 5, *T. soelneri*, paratype, with upper cavity of penis opened, 5a, and section of penis, 5b. 6-6b, *T. notata*, Carrolltown, Pa., with sections of penis. 7-7c, *T. fosteri*, Stolle, Ill., with sections of penis. (Scale lines = 1 mm.)

¹ These variations sometimes occur in the same lot, with intergrades.

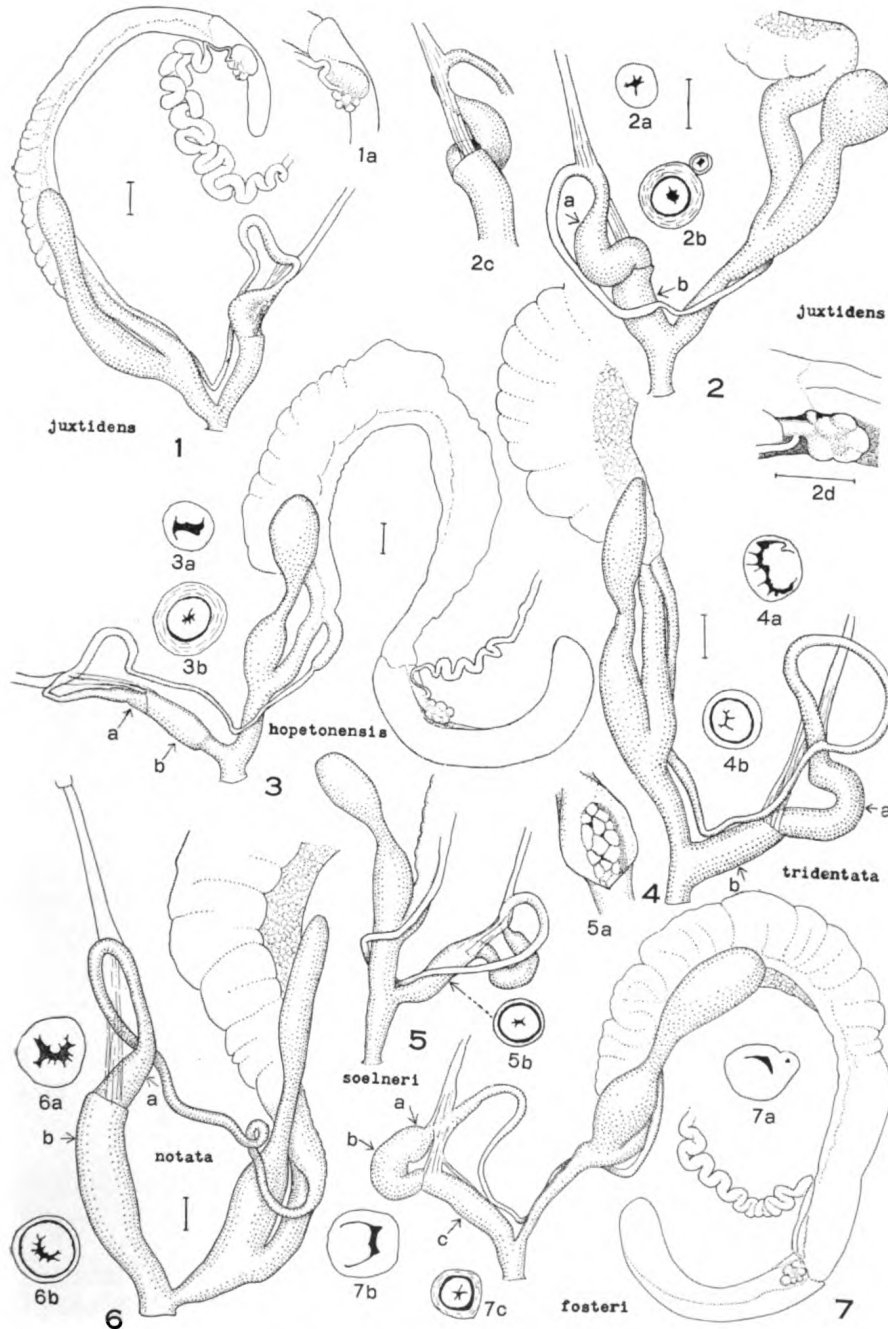


Fig. 473. See bottom of p. 792 for legend.

are minutely papillose (or sometimes there are some papillae on the upper surface also). Last whorl is rounded at periphery, scarcely descends in front, and is contracted behind the lip. The trilobed aperture has a rather flatly reflected lip, thickened within, divided into three subequal parts by two small teeth, on the outer and the basal margins. Parietal callus bears an oblique tooth, the distal end of which is directed towards a part of the peristome below the upper tooth.

“Half an inch wide.” (Say.)

Height 7 mm., diameter 12.8 mm.; 5 whorls. Neotype.

Height 7.7 mm., diameter 14.5 mm. Chestnut Hill, Philadelphia.

Height 6.4 mm., diameter 12.3 mm. Chestnut Hill, Philadelphia.

ONTARIO: Brant, Lincoln, Wellington, Welland, and York counties (J. Oughton).
Hamilton.

NEW HAMPSHIRE: Concord, Squam Lake (Johnson).

VERMONT: Willoughby Lake, Orleans Co. (A. D. Brown). Burlington; St. Johnsbury; Newport; Coventry; Mt. Equinox; Sudbury; Mt. Ascutney (Johnson). McNeil's Bay, Chittenden Co. (Pilsbry).

MASSACHUSETTS: North Adams; Williamstown; Bashbish Falls; Chester (Johnson).

CONNECTICUT: Fairfield Co. (A. F. Archer); Stratford and Greenwich (Johnson).

NEW YORK: Cortland, Columbia, Dutchess, Erie, Essex, Greene, Hamilton, Herkimer, Madison, Monroe, Onondaga, Niagara, Rennselaer, Schuyler, St. Lawrence, Tompkins, Westchester, Wayne and Yates counties.

NEW JERSEY: Bergen, Burlington, Hudson, Hunterdon, Mercer, Sussex, and Warren counties.

PENNSYLVANIA: Adams, Allegheny, Beaver, Berks, Bucks, Cambria, Chester, Clarion, Clinton, Cumberland, Delaware, Fayette, Fulton, Greene, Indiana, Lehigh, McKean, Montgomery, Monroe, Northampton, Philadelphia, Potter, Somerset, Sullivan, Susquehanna, Union, Westmoreland, Wyoming and York counties.

VIRGINIA: Allegheny, Amherst, Augusta, Bedford, Craig, Jackson, Montgomery, Nelson, Page, Roanoke, Rockbridge and Wythe counties.

WEST VIRGINIA: Mercer, Morgan and Wirt counties.

OHIO: Adams, Ashtabula, Belmont, Brown, Columbiana, Delaware, Fairfield, Franklin, Hamilton, Highland, Hocking, Jefferson, Licking, Lorain, Lucas, Ross, Shelby, Warren and Wyandotte counties (Archer, Sterki *et al.*).

MICHIGAN: Saginaw-Grand valley and southeastward, north to Lapear Co. (Walker).

INDIANA: “All over the state” (Call); Madison, Dearborn Co.; near Milan and North Vernon, a small form (Call). Lawrence Co. (Goodrich).

ILLINOIS: Cook, Hancock and Pope counties (F. C. Baker).

KENTUCKY: Barren, Breathitt, Edmonson, Harlan, McCreary and Warren counties.

NORTH CAROLINA: Buncombe, Cherokee, Davidson, Haywood, Jackson, Macon, Madison, Stokes, Swain and Watauga counties.

SOUTH CAROLINA: East of Gaffney, Cherokee Co. (A. F. Archer).

Fig. 474. a, *Triodopsis tridentata*, neotype, Montgomery Co., Pa.; b, Allegheny Co., Pa.; c, Rochester, N. Y.; d, Lawrenceburg, Ind.; e, Quicksand, Ky.; f, Cade's Cove, Tenn.; g, Natural Bridge, Va.; h, Roan Mt., Carter Co., Tenn.; i, Lafayette, Va. j, *Triodopsis tridentata edentilabris*, type and paratype. k, *Triodopsis tridentata juxtidentis*, type and paratype; l, Montgomery Co., Pa.; m, *Triodopsis rugosa anteridon*, Nicolas Co., Ky.; n, *T. t. juxtidentis*, Foul Rift, Pa. o, *Triodopsis tridentata* form *frisoni*, Fountain Bluff, Ill.; p, Fern Glen, St. Louis Co., Mo.; q, Meramec Highlands, St. Louis Co., Mo. r, *Triodopsis tridentata* form *perpolita*, Cincinnati. s, *Triodopsis tridentata* form *discoidea*, type and paratypes. t, *Triodopsis tridentata complanata*, type and paratype. u, *Triodopsis tridentata tennesseensis*, cotype.

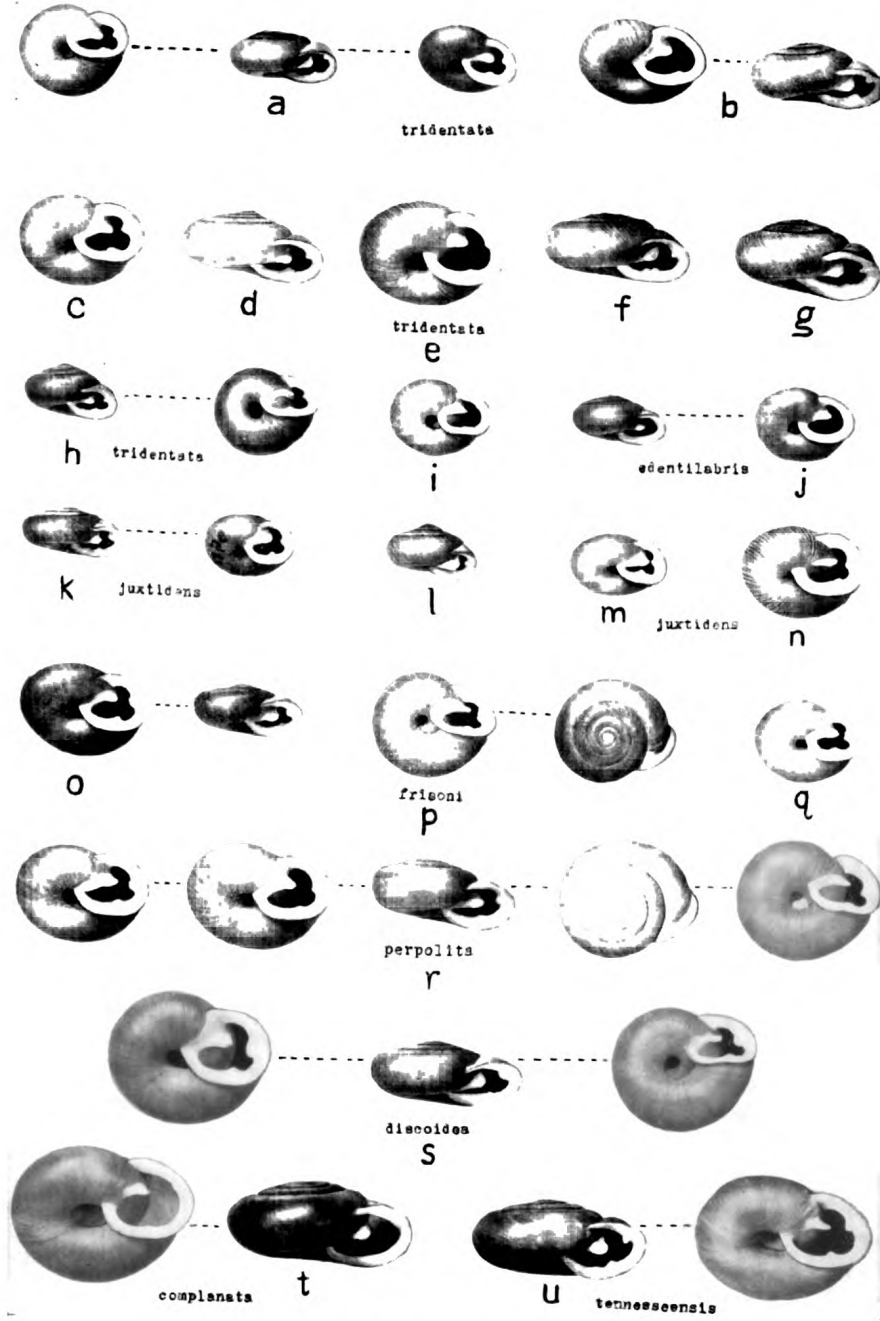


Fig. 474. See bottom of p. 794 for legend.

GEORGIA: Fannin, Towns and Union counties.

TENNESSEE: Bledsoe, Blount, Carter, Cumberland, DeKalb, Fentress, Franklin, Green, Hamilton, Marion, Polk, Sevier, Sullivan, Unicoi and Washington counties.

ALABAMA: Bibb, Blount, Cherokee, Clay, DeKalb, Elmore, Etowah, Fayette, Franklin, Jackson, Jefferson, Lauderdale, Madison, Marion, Mobile, Randolph, Shelby, St. Clair, Talladega, Tuscaloosa, and Walker counties (Walker).

MISSISSIPPI: Adams Co. (A. D. Brown).

Say's locality was "Middle States", but he evidently described the small form common on the gneiss around Philadelphia. A specimen from Montgomery County, near the northern edge of Philadelphia (Fig. 474 a) has been selected as neotype. On calcareous soils through the state it is often larger, as in Figure 474 b, Pittsburgh, and up to 18.5 mm. diameter, York Furnace.

Albino shells of sea-foam yellow or sea-foam green tint are not uncommon in some places (Fig. 474 d Lawrenceburg, Indiana). The living animal is usually payne's gray or more bluish, but occasionally it lacks dark pigment.

T. tridentata is more abundant on limestone soils, but it lives everywhere, wherever there is some shade, with moderate moisture, herbage, dead leaves or wood shelter. Though hilly country is preferred, it is not found in the higher Appalachians.

Throughout the New England and Middle States, in Michigan, the greater part of Ohio, and south to Lawrenceburg, Indiana (diameter 16.5 to 18.5 mm.), and Kentucky, the same forms prevail as described for Pennsylvania. Call (1899, p. 388, fig. 8) figured a small variety, not half the usual size, near Milan, Indiana. East of the mountains *T. tridentata* extends south into northern Georgia, Alabama and Mississippi, but not on the coastal plain.

In eastern Tennessee and western North Carolina the shells are often rather large, and in the lower slopes of the Great Smoky Mountains the basal tooth is often bifid, or buttressed on the right side (Fig. 474 f, Cade Cove, Blount Co., Tenn.).

There are also small forms, down to 12 mm. in diameter, in some places, as on a mountain northwest of Waynesville, Haywood County, North Carolina. On the northern outliers of Roan Mt., Carter County, Tennessee, Dr. Baker found a peculiar small, compact form (Fig. h), diameter 11.7 to 14 mm., 5 to 5½ whorls.

The varieties *bidentata*, lacking a parietal tooth, and *unidentata*, without lip teeth, described by F. C. Baker from Rochester, New York, are, I think, pathologic or teratologic individuals and not races.

Triodopsis tridentata edentilabris (Pilsbry)

Fig. 474 j.

Polygyra tridentata edentilabris Pilsbry, 1894, *Nautilus*, 7: 140.—Archer, 1934, *Nautilus*, 48: 26, pl. 1, fig. 5.

The shell is like the typical form of *tridentata* in size, shape, sculpture and color, and in the development of the parietal tooth; but it differs by wholly lacking teeth in the lip.

Height 6.6 mm., diameter 12.2 mm.

“Cumberland mountains.” Type and two paratypes 57255 A.N.S.P., collector unknown.

Three similar shells were in the old collection of the Academy, labelled “*H. tridentata* Say, Cumberland Mts.” Nothing is known of their history. Specimens with toothless, or almost toothless lip occur rarely among normal *tridentata*. F. C. Baker found specimens in which “the peristome is perfectly plain and rounded” at Rochester, N. Y., which he described as *P. tridentata unidentata*. Dr. V. Sterki remarked that “specimens from various places [in Ohio] have the peristome without teeth, or with mere traces of such, but do not constitute a variety.” Whether the specimens I described as *edentilabris* over forty-five years ago are such individual mutations, or a little local race, is still uncertain.

Triodopsis tridentata tennesseensis (Walker)

Fig. 474 u.

Polygyra tridentata tennesseensis Walker and Pilsbry, 1902, *Proc. Acad. Nat. Sci. Phila.*, p. 422.—Walker, 1928, *Terr. Moll. Alabama*, p. 22.—Archer, 1934, *Nautilus*, 48: 25, pl. 1, fig. 3.

The shell is large, diameter 19 to 24 mm., depressed, with the form and large umbilicus of *T. t. complanata*, but the surface is regularly thread-striate as in *tridentata*. Under the microscope it shows many minute papillae among the striae. Aperture as in *tridentata* but with smaller teeth. Parietal tooth short, high and pointed.

Height 10 mm., diameter 21.8 mm. Lectotype.

Height 10.3 mm., diameter 23.2 mm. Paratype.

Height 10.4 mm., diameter 23 mm. Chattanooga.

TENNESSEE: Foot of high bluffs on south side French Broad River below Paint-rock, N. C. (Walker and Ferriss), Cotypes 84022 A.N.S.P. and in Walker Collection, University of Michigan. Oakdale, Morgan Co., and Concord, Knox Co. (G. H. Clapp). Elizabethton, Carter Co. (B. Walker). Holston River 1 mi. above junction with French Broad, Knox Co. (S. N. Rhoads). Chattanooga (H. G. Richards).

KENTUCKY: Quicksand, Breathitt Co. (W. D. Funkhouser).

ALABAMA: Pratts Ferry, Bibb Co.; Sand Mountain, Jackson Co.; Horseblock Mt., Cleburne Co. (Walker).

This is a rather weakly characterized race, although readily recognizable typically. In some lots, as that from Breathitt County, Kentucky, the lip teeth are as small as in *T. t. complanata*. Two measure: 10.3 x 19.8 mm., and 8.3 x 18.8 mm.

Triodopsis tridentata juxtidentens (Pilsbry)

Figs. 474 k, l, n; 476 b.

Polygyra tridentata juxtidentens Pilsbry, 1894, Proc. Acad. Nat. Sci. Phila., p. 20, pl. 1, fig. 8.—Archer, 1934, Nautilus, 48: 24, pl. 1, fig. 2.

Polygyra tridentata juxtigens F. C. Baker, 1898, Trans. St. Louis Acad. Sci., 8: 84, pl. 10, fig. 3; 1906, Bull. Ill. State Lab. Nat. Hist., 7: 114.

The shell has the color and sculpture of *T. tridentata*. The upper tooth is situated lower, bringing the two lip teeth closer together, the distance on the lip between them being shorter than the distance from either tooth to the end of the lip. The peripheral end of the parietal tooth slants towards or above the upper lip-tooth—the chief recognition mark of the subspecies.

Height 6.7 mm., diameter 11.9 mm.; 5 whorls. Type, Cavetown, Md.

Height 6.6 mm., diameter 12.5 mm. Paratype.

Height 9.7 mm., diameter 18.8 mm.; 5½ whorls. Delaware Water Gap.

Height 10.2 mm., diameter 19.1 mm. Natural Bridge, Va.

Height 9 mm., diameter 17.6 mm. Lexington, Va.

NEW YORK: Staten Island (A. D. Brown).

NEW JERSEY: Somerville, Somerset Co. (H. W. Fowler). Near Foul Rift, Warren Co.; Lake Hopatcong (J. B. Clark, S. N. Rhoads), and Boonton (Geo. Greene), Morris Co. Cedar Lake and White Pond, Warren Co. (Pilsbry). 2 mi. east of Bordentown, Burlington Co. (Bayard Long).

PENNSYLVANIA: Pike Co. at Dingman's Ferry (H. T. Wolf), and Porter's Lake, 1900 ft. elev. (Rhoads). Clinton Co. (A. D. Brown). Delaware Water Gap, Monroe Co. (Pilsbry). Bellefonte, Center Co. (A. D. Brown). Indian Trail Park, near Bath, and South Bethlehem, Northampton Co. (J. B. Clark). Blairsville (E. H. Horn), and Indiana (Wehrle), Indiana Co. Cresson (Rhoads), and Carrollton (W. Stone), Cambria Co. Bucks Co. at Nockamixon (W. Huber), Brownsburg (B. Long), Nashaminy Falls (J. B. Clark). Gettysburg, Adams Co. (Pilsbry). Willow Grove, Collegeville, Lansdale, Bethayres and elsewhere, Montgomery Co. Philadelphia Co., Cumberland Co., Lancaster Co., York Co., Delaware Co., in all suitable places.

MARYLAND: Cavetown, Washington Co. (Pilsbry), type and paratypes 64720 A.N.S.P. Near Bittinger, Garrett Co. (J. B. Clark). Green and Polish Mts. (Pilsbry), and Cumberland, Allegheny Co. (H. Shriver). Chewsville, Washington Co.; Buckeystown, Frederick Co. (Clench and Rehder). Near Mayo, Anne Arundel Co. (H. W. Fowler). Great Falls, Montgomery Co., and Harpers Ferry (Pilsbry). Gunpowder Falls, 16 mi. north-east of Baltimore (J. L. Baily). Betterton, Kent Co. (Pilsbry).

DISTRICT OF COLUMBIA: Washington (Lehnert). Plumpoint (Archer).

VIRGINIA: Great Falls, Fairfax Co. (Pilsbry). Norfolk (H. B. Meredith). Newport News (S. N. Rhoads). Near New Market, Shenandoah Co., and Staunton, Augusta Co. (J. B. Clark). Near Snowden (H. B. Baker), and 8 mi. west of Lynchburg (Clench), Amherst Co. Natural Bridge (J. B. Clark). Lexington (Jas. A. Morrison). Salem, Roanoke Co., Bedford, Bedford Co., and southwest of Middletown, Frederick Co. (Clench and Archer). Dorchester Mt., Norton (O. S. Lewis), and Big Stone Gap (Clench), Wise Co. Lee Co. (G. H. Clapp).

WEST VIRGINIA: Wirt Co. (Wm. J. Fox). Morgan Co. opposite Hancock, Md., and Shenandoah Junction (Pilsbry).

OHIO: Gallipolis (Goodrich).

NORTH CAROLINA: Black Mountains (Hemphill). Near Wilmington and Lake Waccamaw, Columbus Co. (Pilsbry).

SOUTH CAROLINA: Eutaw Springs, St. Johns, Berkeley Co. (Clench, Rehder and Archer).¹

This race is as variable in size as *T. tridentata tridentata*. It was described from a small form which was found in abundance in a limestone district. Around Philadelphia the diameter runs from 11.5 to 14 mm.

It is a common snail in the hilly northern part of New Jersey and along the Delaware southward, in the eastern half of Pennsylvania, west to Somerset County in the south. In any suitable place either *tridentata* or *juxtidentens* is to be found, but never the two together, in my experience; however, A. F. Archer reports finding them together at Lambertville, N. J. Southward it extends through Maryland, Virginia, North Carolina and as far as Berkeley County, South Carolina. Its range lies mainly east of that of *tridentata*, and down to the coast, as at Newport News, Va. and Wilmington, N. C. It is not known to occur west of the mountains.

Triodopsis tridentata discoidea Pilsbry

Fig. 474 o, p, q, r, s.

[Helix] tridentata polita Wetherby, 1894, *Nautilus*, 8: 44. Not *Helix polita* Pulteney, 1797, or of Müller, 1774.

Polygyra tridentata discoidea Pilsbry, 1904, *Nautilus*, 17: 142.--Daniels, 1904, *Nautilus*, 18: 92.

Polygyra tridentata frisoni F. C. Baker, 1933, *Nautilus*, 47: 58.

In Cincinnati specimens of the form *polita* Wetherby (a homonym; now to be called *perpolita*) the shell (Fig. 474 r) is larger and more widely umbilicate than *T. tridentata juxtidentens*, the umbilicus contained 6 times in the diameter. In apical view the last whorl is wider than in *T. t. juxtidentens*. It has a more glossy surface and finer, weaker striation; in typical *polita* the striae are often partly effaced, especially on the base, but in some other Cincinnati lots they are evenly developed though weak. Some minute papillae can usually be seen around the umbilicus. The tint varies from dilute cream color to a very dilute ecru-olive (albinistic). The aperture, as Wetherby said, is like that of *T. t. juxtidentens*. The parietal tooth varies from short to rather long, nearly reaching the columellar insertion. Its peripheral end points towards the upper lip tooth, or a little above it. The lip teeth vary from quite small to rather strong, as shown in the figures.

Height 9.5 mm., diameter 19.5 mm.; 5 $\frac{3}{4}$ whorls. Cincinnati.

Height 7.9 mm., diameter 16.5 mm. Cincinnati.

OHIO: Shingle and waste of the limestone cliffs about Cincinnati (Wetherby), Type locality; old quarries overlooking the river (G. W. Harper); Eden Park (B. Walker). Columbus (J. H. Redfield).

INDIANA: Charlestown, Clark Co. (L. E. Daniels). Type of *discoidea*, 11076 A. N. S. P. Cannelton, Perry Co. (Daniels). Knox Co. (C. LeRoy Wheeler). Mt. Vernon, Posey Co.; "at all of these places the variety occurs on the immediate banks of the

¹ *P. t. juxtidentens* has been reported from "northern and western New England" by Archer, but the tridentate helices I have seen from that area appear referable to *tridentata*. His record "eastern Iowa and eastern Missouri", as well as those of F. C. Baker, 1906, from LaSalle Co., Illinois, are doubtless the form of *tridentata* which Baker called *frisoni*.

Ohio river, but when you go back into the country you get the typical *tridentata*", (Daniels). New Harmony (Bland).

ILLINOIS: South end of Fountain Bluff, Jackson Co., type locality of *frisoni* Bkr., Type Z34983 University of Illinois; paratype 161146 A.N.S.P. "Replaces *discoidea* in the Ohio valley in Illinois, and extends up the Mississippi valley as far north as Randolph Co." (F. C. Baker). Around Elizabethtown, Hardin Co.; Bay City, Pope Co.; 1 mi. south of Chester, Randolph Co. (Baker and Foster).

MISSOURI: St. Louis Co. at Fern Glen (L. Hubricht) and Meramec Highlands (G. H. Clapp).

The name *T. t. discoidea* is used here for a series of three named forms of the rocky bluffs of the northern banks of the Ohio between Cincinnati and the Mississippi. Their localities are given above in separate paragraphs. It is nearly 80 miles from *perpolita* at Cincinnati to the first known colony of *discoidea* at Charlestown, Indiana.¹ From the last colony of *discoidea* in Posey County, Indiana, to the first *frisoni* in Hardin County, Illinois, is about 40 miles. It would be interesting to collect along this reach of the Ohio River. Does each named race keep within its own state? Do they occur also on the south bank in Kentucky? It is hoped that some conchologist of the middle west will find answers to these questions.

The three minor races differ as follows, the apertures being practically alike in all, though in all the teeth vary.

The form *perpolita*, described above, is large with low, fine striation, which frequently tends to be partially effaced.

The form *discoidea* Pilsbry (Fig. 474 s) is as large as *perpolita*, 9 x 18.5 mm. to 10.5 x 21 mm. in the type lot, down to 16.5 mm., diameter in some from Posey Co. The fine, close striae are sharp and distinct, and the minute papillation rather copious, often visible weakly on the upper surface also. Color cinnamon-buff. Otherwise like *perpolita*.

The form *frisoni* F. C. Baker (Fig. 474 o, p, q) has the color and sculpture of *discoidea*, but it is in the average smaller, though the sizes intergrade; diameter 14 to 17 mm., the type 7.7 x 15.5 mm. Typically the umbilicus is a little smaller, contained $6\frac{1}{4}$ and $6\frac{1}{2}$ times in diameter in two of the paratypes, $5\frac{1}{2}$ times in one of a lot from near Elizabethtown.

In a lot from Meramec Highlands, St. Louis County, Missouri (Fig. 474 q) the striation is very fine and low and the surface very glossy, much as in Cincinnati *perpolita*. The upper lip tooth is usually bifid, or buttressed on its upper side. Diameter 13.7 to 15 mm., or in another lot up to 16.7 mm., as large as some Cincinnati *perpolita*. It is abundant in St. Louis, Franklin and Jefferson Counties, Missouri, according to Hubricht.

It does not appear that the forms described as *polita* (*perpolita*), *discoidea* and *frisoni* are really separable, and part of these names appear superfluous. As *polita* is a homonym, the race as a whole will be called *T. tridentata discoidea*.

¹Dr. G. H. Clapp informed me that the shells from Lawrenceburg and Aurora, Dearborn Co., Indiana, are closer to the Cincinnati form.

Triodopsis tridentata complanata (Pilsbry)

Fig. 474 t.

Polygyra tridentata complanata Pilsbry, 1898, *Nautilus*, 12: 22.—Archer, 1934, *Nautilus*, 48: 25, pl. 1, fig. 4.

The large, strongly depressed shell is openly umbilicate, the umbilicus contained about 4.4 times in diameter, glossy, with fine but weak striation, nearly effaced in places. There are some minute papillae around umbilicus and on the reverse of the lip and near it. The lip teeth, widely separated as in *tridentata*, are very small, usually mere traces. Parietal tooth of normal size.

Height 10.8 mm., diameter 23 mm.; 6 whorls. Type.

Height 10.8 mm., diameter 25.3 mm. Paratype.

KENTUCKY: Burnside, Pulaski County (J. H. Ferriss, L. E. Daniels), Type 71399 A.N.S.P. Casey County (Archer).

Except in the widely separated and weaker lip teeth it resembles *T. t. discoidea*. Archer mentioned a smaller form, diameter 17 mm., but otherwise quite typical, from Casey County, Kentucky.

Triodopsis platysayoides (Brooks)

Fig. 475.

Polygyra platysayoides S. T. Brooks, 1933, *Nautilus*, 46: 54, text-figs.—Pilsbry, 1933, *Nautilus*, 46: 103.

“The five whorls are flattened and only very slightly convex; base flattened and slightly inflated at the aperture. The shell is thin and translucent but is not fragile. The color is light horn with a yellowish area on the exterior surface of the peristome which exhibits a punctate appearance. This area of punctation extends back past the constriction of the peristome and over the first four or five oblique striae. The whorls striated obliquely, terminating in the wide, inverted cone-shaped umbilicus which exhibits all of the volutions to the apex. The first whorl smooth. The umbilicus seems slightly excentric due to the deflection of the body whorl at the aperture. The aperture is oblong-lunate. The lip is reflected, flat,



Fig. 475. *Triodopsis platysayoides*. (After Brooks.)

white, and quite heavy; the basal edge forming quite a straight line, thickened with a deposit of callus. The basal angle thickened and extending into the body whorl, visible in the umbilicus as a whitish band for the full length of the body whorl. On the parietal wall is a thick, obtusely pointed, tongue-shaped tooth, its apex directed tangentially out and away from the aperture; it is quite similar to the parietal tooth in *P. dentifera*. Greater diameter 22 mm.; lesser 18 mm.; height 8 mm.” (Brooks.)

WEST VIRGINIA: Cooper's Rock, Monongalia Co. (Graham Netting), Type 62.23750 Carnegie Museum.

A single specimen of this remarkable snail is now known. Apparently it is a *Triodopsis* in which degeneration of the lip teeth has gone further than in *T. tridentata complantata*, which seems to be the most nearly related form. As in the case of *T. tridentata edentilabris*, its status cannot be definitely fixed until a series is collected.

(*Platysayoides*, presumably means "like a flat *sayana*.")

***Triodopsis rugosa* Brooks & MacMillan**

Fig. 476 c.

Triodopsis tridentata rugosa Brooks & MacMillan, 1940, *Nautilus*, 53: 96, pl. 12, fig. 3.

"Shell somewhat depressed, costate, reddish-horn color, with a narrow umbilicus. Whorls $5\frac{1}{4}$, flattened above and rounded below, the body-whorl rounded. Suture impressed. Rib-striations prominent and continue undiminished into the umbilicus; interstitial striae few and faint; spiral striae weak, hardly discernible; a few granulations are visible on the upper whorls, becoming more numerous on the basal part of the shell. Striations on embryonic whorl and a quarter very weak; on next whorl and a half they become broken into short bars; and on remaining whorls they become gradu-

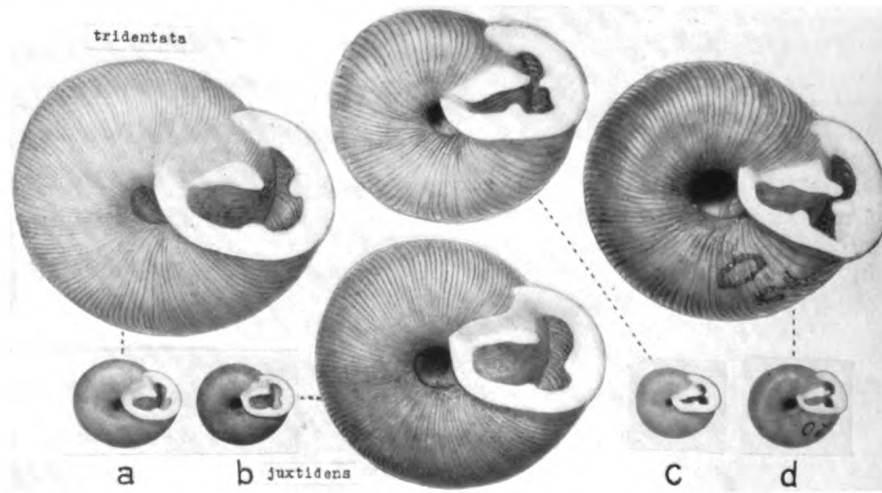


Fig. 476. a, *Triodopsis tridentata*, typical. b, *Triodopsis tridentata juxtidentens*, paratype. c, *Triodopsis rugosa*, paratype. d, *Triodopsis rugosa anteridon*, type. ($\times 3$ and actual size.)

ally larger until they are rib-like on the last two whorls. Aperture lunate, tridentate; peristome white, broad, thickened within; outer margin bearing a small, narrow, squarish tubercle which is bent slightly inward; basal lip bearing a marginal tubercle; parietal denticle tongue-shaped, entering slightly into the aperture, and separated from the umbilical margin of the peristome by a narrow channel. Umbilicus narrow, deep, the inner whorls hardly perceptible. Greater diameter 10.9, lesser diameter 9.2, height 5.6 mm." (Brooks & MacMillan.)

WEST VIRGINIA: "Damp ravine, Blair Mountain, 1 mile southwest of Blair, Logan County. Holotype: Carnegie Museum 62.32899, Section of Recent Invertebrates. Paratypes: U.S.N.M. 473963, A.N.S.P. 174909." Also found on cliffs and hillside, 2 miles southeast of Blair, Logan Co.; Sandstone bluffs and hillside, along Salmon Creek, Hughes Ferry Bridge, 3 miles south of Summersville, Nicholas Co.; Hill and ravine, along Cranberry River, Camp Woodbine, 7 miles north of Richwood, Nicholas Co.; woods along Muddlety Creek, near Summersville, Nicholas Co.; and Slagle, Logan Co. Found particularly in ravines and valleys that are narrow and damp." (Brooks & MacMillan.)

The essential feature of this species is the thickening of the outer lip which produces a sloping buttress below the outer lip tooth. The parietal tooth is strongly developed, as in *T. fallax* and *T. vannostrandi*, the structure otherwise being about as in *T. t. juxtidentis*.

Southward there is a more finely striate form or subspecies described below.

Triodopsis rugosa anteridon new subspecies

Figs. 474 m, 476 d, 477.

The shell is shaped about as in *T. hopetonensis*; between saccardo's umber and snuff brown in color, somewhat shining. The spire is moderately convex, whorls slowly increasing, the last rounded peripherally, descending a little in front, somewhat contracted behind outer and basal margins of the lip. There is a zone of short radial striae below the suture of the otherwise smooth first whorl. Last whorl regularly and evenly striate, copiously papillose around umbilicus, on reverse of lip and below suture, as in allied *Triodopsis*. The trilobed aperture is moderately dished, the lip reflected,



Fig. 477. *Triodopsis rugosa anteridon*, type and paratypes. (Actual size and $\times 2$.)

rather flat, strongly thickened within. Outer lip tooth is marginal, narrower than the basal, and has a strong sloping buttress on the lower side. Basal tooth is blunt, seated transversely on the lip-callus. The parietal tooth is slightly curved, high, with a very short, low, entering end, and it becomes abruptly lower in the short portion running towards the columella but not quite reaching it. The umbilicus is contained five times in the diameter.

Height 7.2 mm., diameter 13.8 mm.; $5\frac{1}{2}$ whorls. Type.

Height 6.6 mm., diameter 13 mm.

KENTUCKY: Pleasant Valley, Nicolas County (Dr. V. Sterki).

TENNESSEE: Valley Forge, Carter County (H. Burrington Baker, 1928), Type and paratypes 150304 A.N.S.P.

VIRGINIA: Draper Mt., south of Pulaski, Pulaski County (A. F. Archer).

The parietal tooth is shaped like that of *T. fallax*, *T. vannostrandii* and their allies. The buttress below the outer lip tooth is special to *T. rugosa* and this race. There is no trace of an internal callous ridge on the columella. Some *T. fraudulentata* from Carter County, Tennessee, have the parietal tooth curved as in *anteridon*, but the outer tooth is not buttressed below. *T. rugosa* of West Virginia is similar in having a slanting buttress below the outer lip tooth, but it is a smaller shell with coarser rib-striation and a smaller umbilicus.

The Virginian specimens are slightly smaller, diameter 10.7 to 12.6 mm.

Triodopsis fraudulentata (Pilsbry)

Fig. 478 a.

Polygyra tridentata fraudulentata Pilsbry, 1894, Proc. Acad. Nat. Sci. Phila., p. 20, pl. 1, fig. 6.

The shell is similar to *T. tridentata* but slightly less depressed, cinnamon-buff. The whorls are rather closely coiled, the last descending steeply in front, strongly contracted behind the spreading lip, with a distinct external impression at the position of the outer lip-tooth. The embryonic whorl has short radial lines below the suture (when not worn). Last whorl is regularly

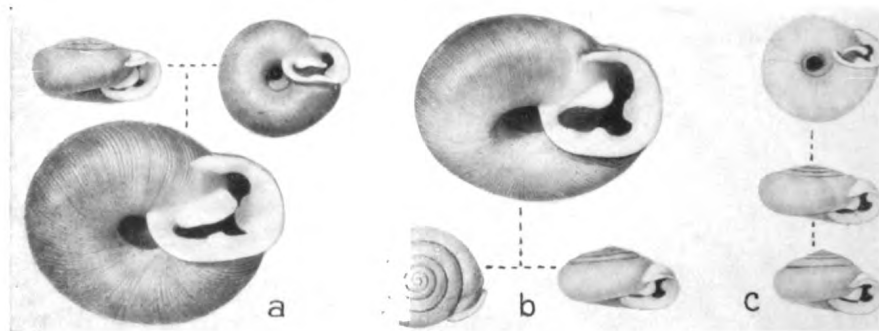


Fig. 478. a, *Triodopsis fraudulentata*, type and paratype. b, *T. fraudulentata vulgata*, type and paratype. c, *T. f. vulgata*, form of Woodville, Ala. (Actual size and $\times 2$.)

striate, with traces of spiral lines below the suture (or none), and densely, minutely papillose at umbilicus and below suture; aperture is distinctly dished, nearly closed by the large teeth. The lip is rather widely reflected in its outer and basal arcs, the basal margin straightened. Within the outer lip is a wide, receding tooth; a narrow tooth in the basal margin, and a high, nearly straight parietal tooth.

Height 9 mm., diameter 16.7 mm., 6 whorls. Type.

Height 7.7 mm., diameter 14.7 mm. Natural Bridge.

Height 8.4 mm., diameter 16 mm. Natural Bridge.

Height 7.8 mm., diameter 16.3 mm. Giles Co., Va.

WEST VIRGINIA: Morgan County opposite Hancock, Md. (Pilsbry); Type 64725 A.N.S.P.

VIRGINIA: Mowry Mill pike about 5 miles northeast of Staunton, fossil in marl (E. W. Berry). Natural Bridge, Rockbridge County (Pilsbry, J. B. Clark). Mountain Lake, Giles County, at about 4000 feet (P. P. Calvert). Fairfield (A. F. Archer).

Triodopsis fraudulenta was based upon a mountain form characterized by the development of a heavy, nearly straight ledge within the basal lip, upon which the basal tooth stands, and in oblique view this tooth is seen to pass down the inner side of the straight callous ledge. This basal lip structure is sometimes very similar to *T. fallax*, but the decidedly wider umbilicus and the straight parietal tooth of *fraudulenta*, as well as the greater size, at once differentiate them. The outer lip tooth is very broad and deeply receding. The parietal tooth is long and straight. It is a specialized local race of the widely spread *T. f. vulgata*.

It is known to occur only in the ranges along the Virginia and West Virginia boundary and a little farther east. Probably the specimens from Roan Mountain noticed by A. G. Wetherby (Journ. Cincinnati Soc. Nat. Hist., 16: 211) as *Triodopsis fallax* are *T. fraudulenta*, but I have not seen them.

(*Fraudulenta*, cheating, as it posed for many years as *T. fallax*.)

***Triodopsis fraudulenta vulgata* new subspecies**

Figs. 478 b, c.

Helix tridentata Say, in part, Binney, 1851, Terr. Moll., 3: 183, pl. 28, upper, middle and lower figs.

Helix fallax Say, W. G. Binney, 1869, L. & Fr. W. Sh. N. A., 1: 131, fig. 222; and of many other authors. Not *Helix fallax* Say.

Triodopsis fallax Say, W. G. Binney, 1878, Terr. Moll., 5: 309, pl. 28; pl. vii, fig. L, pl. xv, fig. B (teeth and genitalia).

Polygyra fraudulenta Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 117.—Sampson, Nautilus, 26: 91, 95; Trans. St. Louis Acad. Sci., 22: 89.—Sterki, Nautilus, 22: 52 (locomotion)—Walker, 1906, Ill. Cat. Moll. Mich., p. 462, fig. 7; Terr. Moll. Alabama, p. 22, figs. 25, 26.—F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 114.—Archer, 1934, Nautilus, 48: 49, pl. 1, fig. 6.—Goodrich, 1916, Ann. Carnegie Mus., 10: 530, 531.

The shell is cream buff to sea-foam yellow. It differs from *T. tridentata* and *T. tridentata juxtidentis* by having the upper lip-tooth wider than its fellow, and distinctly bent inward, and the peristome is more or less dished. Compared with *T. fraudulenta fraudulenta* the teeth of *T. f. vulgata* are not so large and the aperture is more open. The parietal tooth is straight or nearly so, and not so long as in *fraudulenta*, leaving much more space between it and the two lip teeth. The basal lip, while well thickened within, does not have the prominent straight callus of *fraudulenta*. The bay between the lip teeth is more symmetrical. The umbilicus is somewhat well-like beyond the enlargement at the last whorl, and wider than in *T. t. juxtidentis*, showing the first whorl plainly at the bottom.

Height 8.7 mm., diameter 15.7 mm. Type, Columbus, Ohio.

Height 10.4 mm., diameter 19.5 mm. Scott Co., Va.

Height 7.3 mm., diameter 13.5 mm. New Market, Va.

Height 10 mm., diameter 17.5 mm. Lawrenceburg, Ind.

ONTARIO: Middle Island and Middle Sister Island, in Lake Erie (Goodrich). Delhi and West Williams, Norfolk Co. (Oughton).

NEW YORK: Mohawk and Litchfield, Herkimer Co. (Jas. Lewis). Rochester, Monroe Co. (Walton). Canandaigua Lake (Mitchell). Buffalo and Ebenezer, Erie Co. (Letson).

PENNSYLVANIA: Warren, Warren Co. (Dr. J. Slack). Stoups Ferry, Allegheny Co. (G. H. Clapp). Waynesburg, Greene Co. (S. N. Rhoads).

MARYLAND: Jennings, Garrett Co. (W. Stone). Cumberland, Allegany Co. (Pilsbry). Bald Friar, Cecil Co. (Bayard Long).

DISTRICT OF COLUMBIA: Washington (E. Lehnert).

VIRGINIA: Harper's Ferry (Tryon). New Market, Shenandoah Co., and Luray, Page Co. (J. B. Clark). Near La Fayette, Roanoke Co. (Clench). Scott Co. (G. H. Clapp).

NORTH CAROLINA: Magnetic City and Roan Mt. (Wetherby). Eaglenest Mt., northwest of Waynesville, Haywood Co. (J. B. Clark). Welch Bald, Swain Co. (Ferriss). Wilmington (Pilsbry).

KENTUCKY: Near Monticello, Wayne Co. (B. P. Bales). Around Mammoth Cave (Rhoads).

TENNESSEE: Knoxville; near Dove, near Jasper, etc., Marion Co.; northern outliers of Roan Mt. and road to Cloudland, 4000-5000 ft.; sink holes 2 mi. west of Johnson City, Carter Co.; Limestone Cove and near Marbleton, Unicoi Co. (H. B. Baker). Monroe Co. (Annie M. Law). Samburg, Obion Co.; Richland Creek, Davison Co.; banks of Emory River, Harriman, Roane Co., and William's Island, 3 mi. west of Chattanooga (S. N. Rhoads).

ALABAMA: Cleburne, Cullman, DeKalb, Etowah, Franklin, Jackson, Lauderdale and Madison counties (Walker).

OHIO: Columbus (H. Moores); type 57148 A.N.S.P. Dover near Cleveland (J. A. Allen). "Over the state, common" (Sterki).

MICHIGAN: Saginaw-Grand valley and southeastern counties (Walker).

INDIANA: Henry Co. (E. Pleas). Danville and Vawter Park (Walker). Lawrenceburg (A. C. Billups). W. Lafayette, Tippecanoe Co. (A. F. Satterthwaite). Hillsides above Madison (Call).

ILLINOIS: Anna, Union Co. (A. D. Brown). Grand Tower, Jackson Co. (Woodruff). Pope and Hardin counties (Hinkley). Lermont, Cook Co. (Higley). La Salle Co. (Calkins). Johnson Co. (Baker).

MISSOURI: Fern Glen, St. Louis Co.; Allenville, Cape Girardeau Co.; Kimmswick, Jefferson Co. (Sampson).

The aperture is more dished than in *T. t. juxtidentis*, and there is an arcuate impression behind the peristome in the region back of the outer lip-tooth, lacking in *juxtidentis*.

T. f. vulgata has not been seen from eastern Pennsylvania, but probably it will be found in Lancaster and perhaps Chester Counties, as we have it from near the Pennsylvania line in Cecil County, Maryland. It occurs

throughout the state west of the Alleghenies. Farther south, in the Potomac valley, it comes as far east as Washington, D. C.

The range of this race in New York is evidently traceable to post-glacial immigration along the shore of Lake Erie, from the Ohio valley. The records appear to indicate its presence in a narrow belt from Niagara River to Herkimer County. The shells are rather small, diameter 13.7 to 15 mm., but otherwise similar to Ohio examples.

The general range is from western New York, Pennsylvania west of the Alleghenies and the Potomac valley, west to the Mississippi River counties of Missouri, and south through the Appalachian plateau to the northern part of Alabama.

Genitalia of a specimen from Wilmington, N. C. The rather short penis has a thick sheath and a rather small cavity with unequal longitudinal ribs. The terminal part of the vas deferens is rather thick, forming an incipient epiphallus. Near its end the penial retractor inserts. It is partially continuous with the retentor muscle. The talon is rather weakly nodulose. Length of penis $4 \pm$ mm., retractor 9 mm., vagina 3 mm., spermatheca 4 mm.

In northern Alabama there is a peculiar race in which the shell is often more depressed and the umbilicus wider, narrowing inward more gradually than in typical *vulgata*. The aperture is small. It resembles the smaller trans-Mississippian *T. neglecta* in shape and umbilicus, but differs by the straight parietal tooth, formed as usual in *vulgata*, while in *neglecta* this tooth is strongly curved. Specimens from Woodville are figured (Figs. 478 c)

Height 7.3 mm., diameter 16.2 mm., umbilicus 4.6 mm.

Height 8.4 mm., diameter 14.5 mm., umbilicus 3 mm.

This form was found by Miss Annie M. Law many years ago in Monroe County, Tennessee.

A single "bone" which I cannot refer to any known race was picked up on Shell bluff, Savannah River, Burke County, Georgia, by Dr. Francis Harper. The parietal tooth has sealed off. The lip teeth are spaced and shaped about as in *T. f. vulgata*, but the blunt upper one is not higher or wider than the basal, and is scarcely at all inflected. The umbilicus is very narrow, contained about 8 times in diameter (while in *T. f. vulgata* it is contained about $4\frac{1}{2}$ or at most 5 times). It is deeply constricted behind the lip, and the aperture is dished very little. Height 9 mm., diameter 16.8 mm.

(*Fraudulenta vulgata*, common cheat.)

Triodopsis neglecta (Pilsbry)

Fig. 479.

Triodopsis fallax Say, var. *minor*, Wetherby, 1881, Journ. Cincinnati Soc. Nat. Hist., 4: 333. Not *T. introferens* var. *minor* Tryon, 1867.

Triodopsis fallax, small variety, Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 189.

P.[olygyra] neglecta Pilsbry, 1899, Nautilus, 13: 40; 1903, Proc. Acad. Nat. Sci. Phila., p. 196; 1907, *ibid.* for 1906, p. 546, pl. 22, figs. 19-21.—Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 89.

The strongly depressed shell is openly umbilicate, the umbilicus contained about four times in the diameter; dilute eceru-olive often with a buff growth-rest streak; rather glossy. The spire is slightly convex, of closely coiled whorls, the last rounded peripherally, rather steeply descending to the aperture, strongly contracted behind outer and basal margins of the lip. Umbilicus is ample and shows the base of the first whorl plainly at the bottom. Embryonic $1\frac{1}{2}$ whorls with a band of short, fine radial striae below the suture. Last whorl is finely, regularly thread-striate. The aperture is a little dished, trilobed. Peristome white, rather widely reflected, thickened



Fig. 479. *Triodopsis neglecta*. a, Chadwick, Mo.; b, Eureka Springs, Ark. (Actual size and $\times 2$.)

within, its face somewhat convex; in the outer lip having a receding squarish tooth, and in the middle of basal lip a tubercular tooth. Parietal tooth is strongly curved, rather long, reaching to the columella.

Height 6.2 mm., diameter 12.5 mm.; $5\frac{1}{2}$ whorls. Type.

Height 5.4 mm., diameter 11.5 mm. Eureka Springs, Ark.

Height 5.9 mm., diameter 12 mm. Chadwick, Mo.

Height 4.5 mm., diameter 9.8 mm. Chadwick, Mo.

Height 6.7 mm., diameter 12.7 mm. Sulphur City, Ark.

MISSOURI: 5 mi. south of Fayetteville, Washington Co., and Walnut Shade, Taney Co. (Archer). Carthage, Jasper Co. and Cassville, Barry Co. (Sampson). Springfield, Greene Co. (Wetherby). Ozark (Archer) and Chadwick, Christian Co. (Ferriss and Pilsbry). Near Marble Cave, not far from Galena, Stone Co. (coll. A.N.S.P.). Seligman, Barry Co. (Ferriss).

KANSAS: Fort Scott, Bourbon Co. (F. A. Sampson). Erie, Neosho Co. (Ferriss).

ARKANSAS: Eureka Springs, Carroll Co. (Sampson); Type 76283 A.N.S.P. Rogers, Benton Co. (Ferriss and Pilsbry). Mammoth Spring, Fulton Co. (Ferriss). Sulphur City, Washington Co. (A. J. Brown). Rumley and Marshall, Searey Co. (Archer).

OKLAHOMA: Wyandotte, Ottawa Co. (Pilsbry and Ferriss).

Many specimens seen from all of the localities mentioned show it to be remarkably uniform. Whether *T. neglecta* will stand as a species or be reduced to the rank of a subspecies of *T. fraudulentata* remains to be seen when good collections from the intermediate region between its area and the Mississippi River can be examined.

The range of the species as now known is a relatively small area in the northern and northwestern outliers of the Ozark system, about 200 miles in extent east and west, and about 120 miles north and south.

Triodopsis fallax (Say)

Figs. 480 a-c.

Helix fallax Say, 1825, Journ. Acad. Nat. Sci. Phila., 5: 119 (vicinity of Philadelphia).

Polygyra fallax (Say), Pilsbry, 1894, Proc. Acad. Nat. Sci. Phila., p. 21.—Mazyck, 1913, Contrib. Charleston Mus., 2: 7.—Archer, 1934, Nautilus, 48: 50, pl. 1, fig. 7.

Helix introferens Bland, 1860, Ann. Lyc. Nat. Hist. N. Y., 7: 117, pl. 4, figs. 3, 4 (Gaston Co., N. C., Wheatley; Salem, N. C., Hartvig).

Triodopsis introferens Bld., W. G. Binney, 1878, Terr. Moll., 5: 310, fig. 204; pl. xvi, fig. c (teeth).

[*Triodopsis*] *introferens* var. *minor* Tryon, 1867, Amer. Journ. Conch., 3: 51.

The shell is narrowly umbilicate, the umbilicus contained about 9 times in the diameter, depressed, with dome shaped or conoidal spire; deep olive-buff (or dilute snuff brown). Whorls closely coiled, the last most convex above the middle, deeply constricted behind the peristome. First whorl smooth with a band of short radial striae below the suture. Later whorls with little gloss, closely thread-striate, with minute papillae around the umbilicus. The aperture is irregularly trilobed. The reflected peristome is white, thickened within, with a blunt, rather wide inwardly bent tooth in the outer margin, and a callous ledge surmounted by a transverse tubercle in the middle of the basal margin. Parietal tooth rather long and strongly arcuate or angularly curved. On the columellar axis there is a white ridge (sometimes rising to form a tubercle) formed by a continuation inward of the ledge upon the basal lip (Fig. 480 a).

"Greatest transverse diameter nine-twentieths of an inch." (Say.)

Height 8.2, diameter 12.4 mm. Manayunk, Penna.

Height 7.5 mm., diameter 11.8 mm.; 5½ whorls. Neotype.

PENNSYLVANIA: Ringing Rocks Park near Pottsville, Bradford Co. (J. B. Clark). Susquehanna, Susquehanna Co. (W. M. Gabb). Limestone knobs in field, Brumfieldville, Berks Co. (Pilsbry). Quarry north of Spring Mill, Montgomery Co. (A. P. Brown). Manayunk on the Schuylkill (R. Walton), neotype 75821 A.N.S.P. Montgomery Co. and Lancaster Co. (A. D. Brown). Near New Garden (Vanatta), and Oxford (A. D. Brown), Chester Co. Cemetery at 16th and Berks Sts., grounds of the Wagner Free Institute and elsewhere in Philadelphia (Tryon, Vanatta et al.). Near Green Village, Franklin Co. (H. G. Richards). Gettysburg, Adams Co. (Pilsbry). Folsome, Delaware Co. (Philip Nell).

NEW JERSEY: Camden Co. at Laurel Springs, Merchantville, and Garden Lake west of Clementon (Bayard Long). Atco (W. J. Fox). Gloucester Co. at Greenlock Terrace (Vanatta), and Tomlin (B. Long).

MARYLAND: Bald Friar, Cecil Co. (B. Long). Chestertown, Kent Co., and in a pine woods near Chestertown, Queen Anne Co. (Vanatta). Bull Point near Blackwater Bridge, Dorchester Co. (R. W. Jackson). Baltimore (W. H. Rush).

DISTRICT OF COLUMBIA: Washington (Lehnert).

VIRGINIA: Arlington Cemetery (Clark). Hills near Endless Caverns, New Market, Shenandoah Co., and Luray, Page Co. (J. B. Clark). Manasses, Prince William Co. (Archer). Charlottesville, Albemarle Co. (Clench and Archer). Lexington, Rockbridge Co. (M. McDonald).

NORTH CAROLINA: Vaughan, Warren Co. (Anna G. Brown). Cramertown, Gaston Co. (H. G. Richards). 3 mi. south of Holsburg, Davidson Co. (Archer). Tryon, Polk Co. (H. A. Green). Smith's Island and Pyke's farm, near Southport, Brunswick Co. (Pilsbry et al.).

SOUTH CAROLINA: Whitaker Mt., Blacksburg, Cherokee Co. (W. G. Mazyck). Columbia, Richland Co. (S. N. Rhoads). Aiken (Binney).

TENNESSEE: Citico, Monroe Co. (Wetherby). Lookout Mt. near Chattanooga (J. H. Ferriss). Holston valley (W. G. Binney).

GEORGIA: Fannin Co. (Binney).

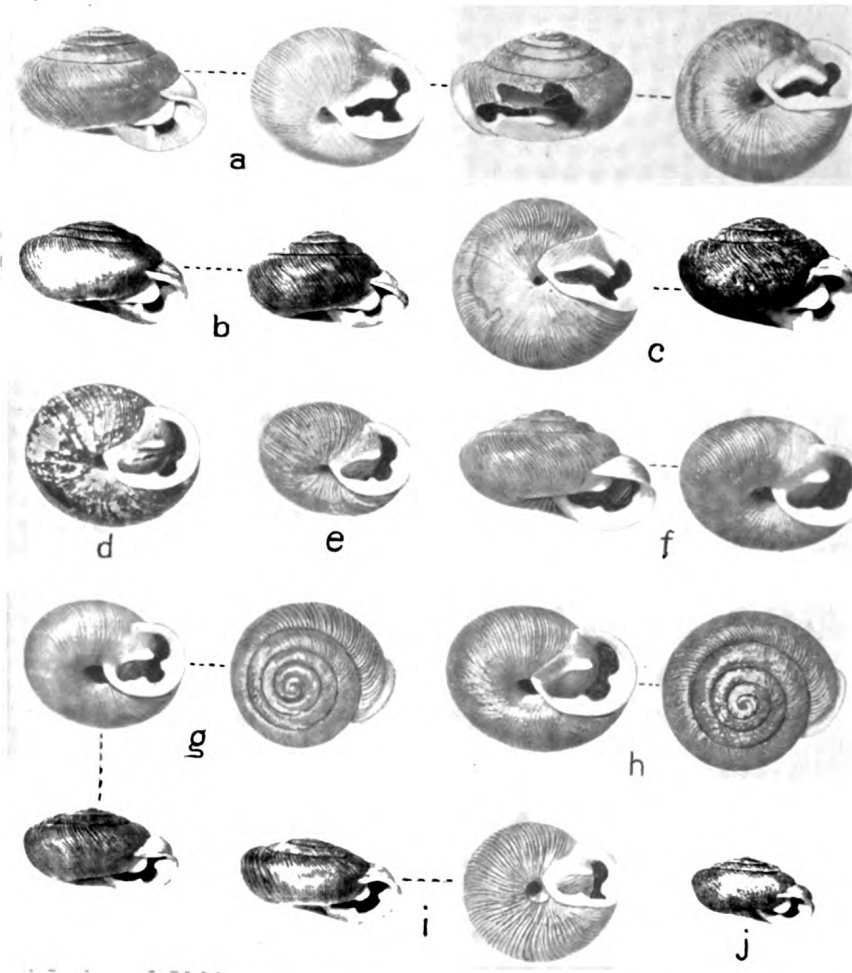


Fig. 480. a, *Triodopsis fallax*, Manayunk, Pa.; b, Chestertown, Md.; c, Southport, N. C. d, *T. hopetonensis chincoteaguensis*, Chincoteague I., Va.; e, Brighton, Va. f, *T. hopetonensis obsoleta*, Newbern, N. C. g, *T. hopetonensis*, Sullivan's I., S. C.; h, Wilmington, N. C. i, j, *T. hopetonensis* form *charlestonensis*, Charleston, S. C. (All $\times 2$)

The name *Helix* or *Triodopsis fallax* was long associated with the snails now known as *T. fraudulentata* and *T. f. vulgata*, but Tryon in 1867 (Amer. Journ. Conch., 3: 51) called attention to the fact that Say's description of *Helix fallax* applied to the shell then known as *H. introferens* Bland. This rectification was ignored by Binney, who rarely accepted correction except from Bland. *T. fallax* differs from *T. fraudulentata* by the smaller size, the shape of the basal lip and by possessing a callous tubercle on the axis within; there is a callous ridge from the basal tooth to the base of the columella within (shown in Fig. 480 a), but no such structure is found in *T. fraudulentata*.

Around Philadelphia the diameter varies from 11.7 to 12.5 mm.; in some places in neighboring counties it is larger, up to 13.5 mm. The largest seen are from Vaughan, N. C., 14.5 mm. diameter.¹ The smallest, diameter 9.9 mm., is from near Green Village, Franklin County, Pennsylvania.

The living animal, in Chestertown, Maryland specimens, is flesh colored, darkening on the back to purplish-black in some, fleshy gray in other examples, tentacles and eye-stalks of the same color. Sole pale flesh color. Mantle speckled with black as seen through the last whorl.

There are some perplexing shells in the coastal region of North Carolina. In a lot from Pyke's farm, 1½ miles inland from Southport, Brunswick County, the umbilicus is very small, and the internal tubercle wanting (Fig. 480 e). Somewhat similar shells from Winter Park, New Hanover County, and Elizabethtown, on the Cape Fear River, lack the internal tubercle, and have a small, pointed outer lip-tooth.

***Triodopsis hopetonensis* (Shuttleworth)**

Figs. 480 g, h.

Helix hopetonensis Shuttleworth, 1852, Mittheil. Naturforsch. Ges. in Bern, nr. 248, p. 198.

Helix tridentata, var., Binney, Boston Journ. Nat. Hist., 3: 382, pl. 18, fig. 2.

Helix tridentata var. *ephabus* Say, Ravenel, 1834, Catalogue, p. 9, name only.—Binney, 1859, Terr. Moll., 4: 71 (as *ephebus*).

Triodopsis hopetonensis Shuttl., W. G. Binney, 1878, Terr. Moll., 5: 311, fig. 205, pl. vii, fig. N and xv, fig. A (anatomy).—Johnson, Nautilus, 3: 138.

Polygyra hopetonensis Shuttl., Henderson, Nautilus, 21: 7.—W. G. Mazyck, 1913, Cat. Moll. South Carolina, Contrib. Charleston Mus., 2: 7.

Polygyra hopetonensis var. *charlestonensis* Mazyck, 1913, Contrib. Charleston Mus., p. 7, no. 102.

"The shell has a narrow and scarcely penetrating umbilicus, is depressed-globose, closely rib-striate; olivaceous horn colored, with a fat-like luster. Spire obtuse, convex; the 5½ whorls are somewhat convex, the last slightly descending in front, constricted at the aperture. The aperture is lunate, three-toothed: a moderate sized tongue-shaped parietal tooth, entering a little; the reflexed peristome, thickened with a thin white callus within, is provided with a small tooth, a little immersed, in the right margin,

¹ Archer (1934) mentioned specimens of 20 mm. diameter at Natural Bridge, Virginia, but evidently he had typical *T. fraudulentata*, which occurs there. If so, it is larger than any *fraudulentata* I have seen.

and a marginal basal tooth. Greater diameter 13, lesser 11, height 6 mm." (Shuttleworth.)

NORTH CAROLINA: Currituck Sound near Water Lily (W. Huber), and Church's Island (C. M. B. Cadwalader). Newbern (W. G. Mazyck). Beaufort (J. B. Henderson), Wilmington (Pilsbry, J. Baily) and Wrightsville, New Hanover Co. (Henderson).

SOUTH CAROLINA: Charleston, in St. Peter's churchyard (Clench, J. Baily). Sullivan's Island (W. G. Mazyck). Yemassee, Beaufort Co. (J. B. Henderson).

GEORGIA: Hopeton¹ (Shuttleworth), type locality. Augusta (Bland). Savannah (J. B. Clark). Altamaha Swamp and St. Simon's I. (A. D. Brown).

FLORIDA: St. Andrews (A. G. Wetherby). Larkin's bluff, Ochlochnee River, Leon Co. (C. W. Johnson). Ichatucknee River (Van Hyning). Cedar Keys (Hemphill). Imri, Hamilton Co. (E. B. Chope). Jacksonville (A. D. Brown). Mayport, Duval Co. (Mitchell). St. Augustine and Tallahassee (C. W. Johnson).

ALABAMA: Birmingham and Decatur (Archer).

A coastal plain species, often living at the edge of salt or brackish water. Frequently it occurs in abundance, and is a common urban snail in many coastal plain cities. In South Carolina Archer found it in pine woods.

"It differs from *H. fallax* by the narrower, scarcely penetrating umbilicus, darker color, the less thickened peristome with more widely separated teeth. It varies in size, specimens occurring down to little more than half." (Shuttleworth.)

With some resemblance to *T. tridentata* in miniature, this species is more closely related to the *fallax* group, like those forms, having a callus which buttresses the basal tooth on the columellar side. This is individually variable, being very low, practically vanishing in some individuals, strongly developed in others. The outer lip tooth is usually blunt but often conic. The parietal tooth is angularly bent, but the half which reaches towards the columella is very low and often hardly visible, the outer half of the tooth being moderately high and white. In *T. fallax* the curve of the tooth towards the columella is more strongly developed. The striation is strong, not so coarse as on the upper surface of *T. vannostrandii*, but it is equally developed above and below. The color is not far from tawny-olive, being distinctly browner than *T. fallax*.

There is a sinistral specimen in the collection of the Academy.

At Wilmington, North Carolina, the diameter ranges from 9.5 to 12.5 mm., 5 whorls. At Jacksonville, Florida, 11.5 to 13 mm., the largest with 5½ whorls.

A somewhat peculiar form of *hopetonensis* was found by Dr. A. F. Archer at Doak's Creek, Campbell County, Tennessee, 1100-1500 feet elevation, also in a waste lot behind a Gulf filling station on U. S. Highway

¹ "Hopeton" is the old name of a plantation on the south side of the Altamaha River, five miles above Darien, a little upstream from Santo Domingo State Park. J. Hamilton Couper, Esq., proprietor of Hopeton, supplied shells to Lea and others, and contributed the description of a new snail to Haldeman's Monograph, "*Amnicola tenuipes*, now known as *Littoridina tenuipes* (Couper).

11, south side of Chattanooga, Hamilton County, Tennessee. The upper margin of the lip flares forward, less upward than in typical *hopetonensis*. The teeth are well developed, the basal tooth buttressed on the columellar side. A Doak's Creek specimen measures: height 5.4 mm., diameter 10.1 mm. It varies in diameter from 9.2 to 11.7 mm. (Fig. 481).

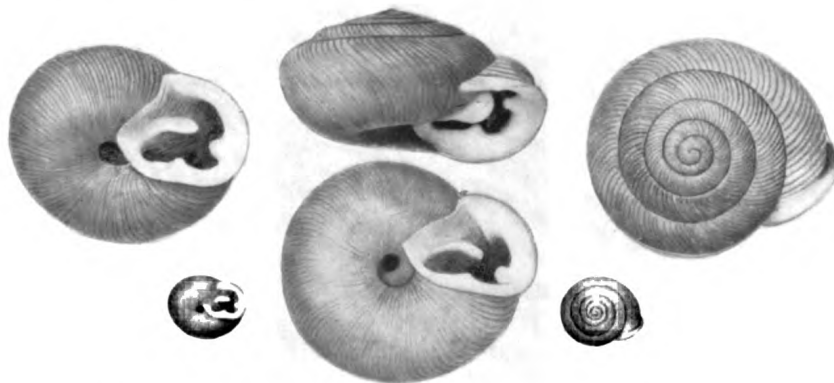


Fig. 481. *Triodopsis hopetonensis*, Doak's Creek, Campbell Co., Tenn. ($\times 3$ and actual size.)

These snails are abundant in dry places in a plant community characterized by red cedar, oaks, beech, tulip poplar and red bud, with undergrowth of *Opuntia*, grasses and ferns; limestone ledges are everywhere, and the ground is rocky.

It is surprising to find this Coastal Plain species cropping up sporadically in the very different faunal and ecologic setting of northern Alabama and especially of the valley of east Tennessee.

T. hopetonensis charlestonensis Mazyck (Figs. 480 i, j), "differs from the ordinary form of *hopetonensis* in being much more depressed, and only about two-thirds its diameter. The upper tooth of the peristome is proportionately broader and more like that of *P. vultuosa* in shape." (Mazyck). The parietal tooth is usually shorter than in *hopetonensis*.

Two specimens labelled co-types from Mr. Mazyck measure 4.8 x 8.5 mm. and 4.5 x 8 mm., both of 4 $\frac{3}{4}$ whorls. Type locality is Charleston, South Carolina. I can find no constant distinguishing characters except size. The shape of the upper tooth is quite inconstant in *hopetonensis*. It seems to be an ecologic "form" rather than a subspecies.

Triodopsis hopetonensis chincoteagensis new subspecies

Fig. 480 d.

Form and sculpture are as in *T. hopetonensis*, except that the umbilicus is very small, contained 9 $\frac{1}{2}$ times in the diameter, and the teeth are much reduced, the upper lip tooth small and submarginal.

- Height 6.7 mm., diameter 11.6 mm.
- VIRGINIA: Chincoteague Island, Accomac County (Wm. J. Fox); Type and paratypes 151482 A.N.S.P. Brighton, Northampton County (Paul Bartsch).

This race from peninsular Virginia, east of Chesapeake Bay, has the striation and shape of *hopetonensis*, but the very small umbilicus is like the form of *T. fallax* from near Southport, North Carolina. It is known by five specimens showing the teeth as figured. They were picked up in the woods where there had been a grass fire, and are in bad condition.

There is a smaller form with slightly larger teeth from Brighton, near Cape Charles, where it was taken by Dr. Bartsch under logs on a wooded beach at high tide line, together with *Melampus* (Fig. 481 e). It has the same very small umbilicus, and like the Chincoteague form it lacks the internal callous axial ridge of *T. fallax*.

Triodopsis hopetonensis obsoleta (Pilsbry)

Fig. 480 f.

Polygyra fallax obsoleta Pilsbry, 1894, Nautilus, 7: 140.

Polygyra hopetonensis obsoleta Pils., Henderson, 1907, Nautilus, 21: 7.—Archer, 1934, Nautilus, 48: 53.

Similar to *hopetonensis* except that the teeth are very much reduced, the outer lip tooth nearly or wholly obsolete. Umbilicus as in *hopetonensis*, contained about 6 times in diameter.

Height 7.8, diameter 13 mm. or smaller, down to 10.8 mm. diameter.

NORTH CAROLINA: Newbern, Type 57195 A.N.S.P. Wilmington (J. B. Henderson).

T. hopetonensis with normally developed teeth has also been taken at Newbern. I have not seen the Wilmington specimens.

Triodopsis soelneri (J. B. Henderson)

Fig. 482.

Polygyra soelneri John B. Henderson, 1907, Nautilus, 21: 13, pl. 3, figs. 1, 2.

"Shell globosely depressed; spire low conoid, periphery rounded; perforate, the opening half covered by columellar lip. Surface very glossy, closely, deeply and evenly ribbed throughout except on first $1\frac{1}{2}$ whorls which are smooth. Whorls $5\frac{1}{2}$, regularly increasing, the last falling abruptly and shortly in front, having a pale spot at the deflection. Narrowly and deeply contracted behind the lip. Aperture oblique and irregularly crescentic. Lip reflexed with a flange-like internal thickening which is widest basally and terminates short of the columellar end of the lip. A rather long curved white parietal tooth stands upon a hardly perceptible parietal film. Color mahogany, with a glossy satin-like sheen; lip purplish outwardly, the inner flange buff." (Henderson.)

· Height 7.2 mm., diameter 10.8 mm., $5\frac{1}{2}$ whorls. Type.

Height 7 mm., diameter 11 mm. Paratype.

Height 6.3 mm., diameter 10 mm. Paratype.

NORTH CAROLINA: Among cypress logs in a swampy region on the north shore of Lake Waccamaw, Columbus County (J. B. Henderson and G. W. H. Soelner). Type 94682 A.N.S.P.

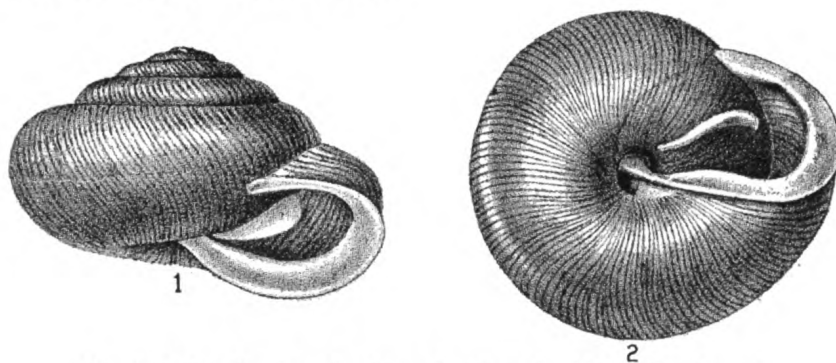


Fig. 482. *Triodopsis soelneri*, much enlarged. (After Henderson.)

The embryonic $1\frac{1}{2}$ whorls are nearly smooth, but well-preserved shells show very fine and short striae radiating below the suture, as in *T. hope-tonensis*. The striae of later whorls are narrower than their intervals, strong and even, glossy, with scarcely any traces of microscopic sculpture in the intervals. Within the umbilicus there are fine papillae as usual in *Triodopsis*, but too minute to be seen with a hand lens.

It is a somewhat isolated snail, as near to *Triodopsis hope-tonensis* as to any of the fully toothed species. This estimate of its affinities is confirmed by the structure of the penis, the fleshy body within the upper cavity being similar to that of *hope-tonensis* but much shorter. There is some superficial resemblance to *Mesodon christyi* (Bld.), as Henderson suggested, but that is a smaller, imperforate shell. The papillae within the umbilicus as well as the genitalia show that *soelneri* is not related to *Mesodon* or *Neohelix*.

Genitalia (Figs. 473: 5-5b), of one of the original lot, show a rather long penis, contracted near the middle, and rather suddenly contracting where it passes into the vas deferens. Inside walls of the rather capacious upper part is smooth with a mass of irregular fleshy bodies within the outer curve (Fig. 473: 5a). The anterior part is thick walled, with a small, five-ribbed cavity and a rather thin sheath (Fig. 473: 5b). The penial retractor inserts on the vas deferens near its base, and is partially continuous with the retentor muscle. The spermathecal duct is swollen.

The mantle over the lung is dark or light brown with long white spots and streaks.

***Triodopsis vannostrandi* (Bland)**

Figs. 483 a, b, c.

Helix Van Nostrandi Bland, 1875, Ann. Lyc. Nat. Hist. N. Y., 11: 200. — Binney, *ibid.*, p. 175, pl. 17, figs. 8, 12 (teeth and genitalia).

Triodopsis Van Nostrandi Bld., W. G. Binney, 1878, Terr. Moll., 5: 312, fig. 206, pl. vii, fig. 1 and pl. xv, fig. D (teeth and genitalia).

Polygyra vannostrandi (Bld.), Pilsbry, Nautilus, 11: 84. — Nylander, Nautilus, 34: 120.—Walker, 1928, Terr. Moll. Alabama, p. 23.—Archer, 1934, Nautilus, 48: 51, pl. 1, fig. 9.

Helix nostrandiae Crosse, 1876, Journ. de Conch., 24: 273, footnote 1 (emendation of *H. Van Nostrandii* Bld.).

“This species is in form and character of the aperture very nearly allied to *H. introferens*, but is more decidedly costate, more convex at the base, with smaller umbilicus, and without the internal tubercle. It connects *introferens* and *vultuosa* with, but is quite distinct from *fallax*. The measurements of a specimen with $6\frac{1}{2}$ whorls, are: diameter max. $12\frac{1}{2}$, min. 11, alt. 7 mill. Of a specimen with 6 whorls: diameter max. 10, min. 8, alt. 5 mill.” (Bland.)

Height 7.6 mm., diameter 12.4 mm., $6\frac{1}{2}$ whorls. One of original lot.

SOUTH CAROLINA: Aiken, Aiken Co. (Emma Van Nostrand, E. H. Schofield). Stateburg, Sumter Co. (Wm. G. Mazyck).

GEORGIA: Mimsville, Baker Co. (B. Walker).

ALABAMA: Elamville, Barbour Co. (B. Walker).

This snail differs from *T. fallax* and *T. hopetonensis* by the higher spire, the more closely coiled whorls and the higher last whorl, with the periphery situated higher, in some specimens bluntly angular in front. The surface slants inward below it. The striation is strong, especially on the upper surface. The two lip teeth are usually quite blunt, but the details of form

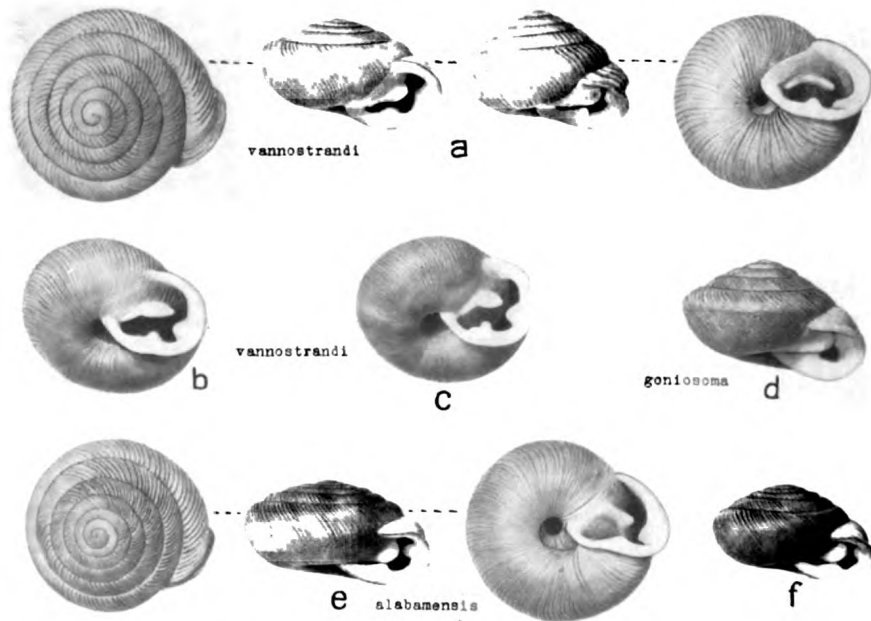


Fig. 483. a, b, *Triodopsis vannostrandi*, Aiken, S. C.; at b, one of the original lot; c, Stateburg, S. C. d, *Triodopsis vannostrandi goniosoma*, type. e, *Triodopsis vannostrandi alabamensis*, Calera, Ala.; f, type, Auburn, Ala. (All $\times 2$.)

vary. The upper one is bent inward. The parietal tooth is curved, as in *T. fallax*. Some short fine striae radiate from the suture in its first turn, but the initial whorl is mainly smooth. In a large lot from Aiken the extremes of size and degree of elevation are as follows:

Height 8.5 mm., diameter 13.7 mm., 6½ whorls; h/d 62.04.

Height 7 mm., diameter 11.5 mm.

Height 7.2 mm., diameter 12 mm.; 6 whorls; h/d 60.

Height 8.1 mm., diameter 10.8 mm.; 5½ whorls; h/d 75.

Shells from Baker County, Georgia, measure 10 to 11.6 mm. The species has been reported from Jacksonville, Florida.

Specimens from Stateburg, Sumter County, South Carolina (Fig. 483 c) differ by their very fine sculpture, the striae being much narrower, lower, and about half as widely spaced as in the Aiken form. Height 8, diameter 12 mm.; 6 whorls. Perhaps these form a recognizable subspecies, but I have seen only two examples.

There are shallow pits behind the peristome back of the two lip teeth, a low swelling between them, where in *hopetonensis* there is a simple, continuous groove behind the peristome.

There are some perplexing forms intermediate between *vannostrandi* and *fallax*, and the former may possibly be considered a subspecies, though as species go in *Triodopsis*, it seems to be fairly well marked.

In emending the specific name M. Crosse made it feminine. As it is not clear whether Bland named the shell for Henry D. Van Nostrand or for his daughter Emma, who discovered it, we leave the gender as it was originally written.

***Triodopsis vannostrandi goniosoma* (Pilsbry)**

Fig. 483 d.

Polygyra fallax goniosoma Pilsbry, 1912, *Nautilus*, 26: 80.—Archer, 1934, *Nautilus*, 48: 51, pl. 1, fig. 8.

The shell differs from *T. fallax* and *T. vannostrandi*; by being distinctly or strongly angular in front, the angle being situated high on the whorl. Sculpture of rib-striae stronger above the angle, the striae becoming smaller below it, and usually more numerous by intercalation of striae. Aperture as in *fallax*, the outer lip retreating, outer lip-tooth broad and deeply placed, basal tooth buttressed on the columella side, parietal tooth angularly bent. No internal callus node on the axis. Type and paratype measure:

Height 7.3 mm., diameter 12.5 mm.; 5½ whorls.

Height 7.8 mm., diameter 12.2 mm.

Height 6.3 mm., diameter 11 mm.

Height 6.3 mm., diameter 10.3 mm.; 5¼ whorls.

FLORIDA: Blountstown, Calhoun County, under oak logs in oak and pine woods (C. W. Johnson), Type 77948 A.N.S.P. Gainesville (T. Van Hyning) and Buzzard's Roost, 7 miles west, (J. B. Clark), Alachua County.

This race occurs at the lower limit of *T. vannostrandi*, from which it differs by the sharply angular periphery, a character of no great value.

(*Goniosoma*, angular body.)

***Triodopsis vannostrandi alabamensis* (Pilsbry)**

Figs. 483 e, f.

Polygyra alabamensis Pilsbry, 1902, *Nautilus*, 16: 30.

Polygyra vannostrandi alabamensis Pilsbry, 1912, *Nautilus*, 26: 80. — Walker, 1928, *Terr. Moll. Alabama*, p. 24, fig. 28. — Archer, 1934, *Nautilus*, 48: 52, pl. 1, fig. 10.

"Shell depressed, yellowish brown, glossy, finely rib-striate above and below; umbilicate. Spire low dome-shaped. Whorls about 6, *very closely coiled*, the last having the periphery situated high; a trifle deflexed in front. Aperture oblique, lunate; peristome white, narrowly reflexed, thickened within, the outer lip bearing a small, squarish tubercle, bent inward; basal lip bearing a marginal tubercle, abrupt on its outer, sloping or buttressed on its inner side. Parietal lamella short, erect, a trifle curved."

Height 6 mm., diameter 11½ mm.

ALABAMA: Auburn, Lee Co. (C. F. Baker); Type 82556 A.N.S.P. Elamville, Barbour Co.; Ten Island Shoals, Calhoun Co.; Langdale, Chambers Co.; 10 mi. southeast of Centre; 6 mi. west of Cave Spring, Ga.; Cherokee Co.; Butting Ram Shoals, Clanton, Duncan's Riffle, Chilton Co.; Pyriton, Clay Co.; Pinckhard, Dale Co.; Wetumpka, Elmore Co.; Black Creek Falls, Etowah Co.; Auburn, Lea Co.; Tuskegee, Macon Co.; Troy, Pike Co.; Roanoke, Wadley, Randolph Co.; Calera, Shelby Co.; Lock 3, Coosa River; Lock 4, Coosa River, Greensport, St. Clair Co.; Three Island Shoals, Ft. William Shoals, Talladega Co. (H. H. Smith).

The spire is lower than in *T. vannostrandi*, the umbilicus is a little wider and the whorls are more closely coiled; the outer lip tooth is less bent inward. Having now seen a great many of these shells, it must be admitted that while the types differ from *vannostrandi* rather obviously, in some lots the difference is not conspicuous. As Archer noted, "this variety practically replaces *P. vannostrandi* in Alabama. It is widely distributed in the eastern half of the state, in the Piedmont, lower Appalachian valley and eastern coastal plain."

***Triodopsis vultuosa* (Gould)**

Figs. 484 c, d.

Helix vultuosa Gould, 1848, *Proc. Boston Soc. Nat. Hist.*, 3: 39 (Corpus Christi and Galveston); in Binney, 1851, *Terr. Moll.*, 2: 189, pl. 40a, fig. 4. — Bland, 1861, *Ann. Lyc. Nat. Hist. N. Y.*, 7: 439, pl. 4, fig. 21. — Singley, 1893, *Geol. Surv. Texas*, 4th Ann. Rep., p. 305.

Triodopsis vultuosa Gld., W. G. Binney, 1878, *Terr. Moll.*, 5: 312, pl. 40a, fig. 4; 1883, *Bull. Mus. Comp. Zoöl.*, 11: 152, pl. 3, fig. J (teeth); 1885, *Man. Amer. L. Sh.*, p. 386, fig. 420. — Sampson, 1894, *Ann. Rep. Geol. Surv. Ark. for 1891*, 2: 189.

"Shell orbicular, depressed, about equally convex on both sides, rather solid, dark horn-color, delicately striated; spire a low dome, composed of about five and a half whorls, which are moderately convex, and separated by a well-defined suture, the exterior one somewhat angular at periphery. Beneath, well rounded, and perforated by a deep umbilicus, about one-fourth as broad as the base. Aperture rather large, lunate; lip moderately reflexed,

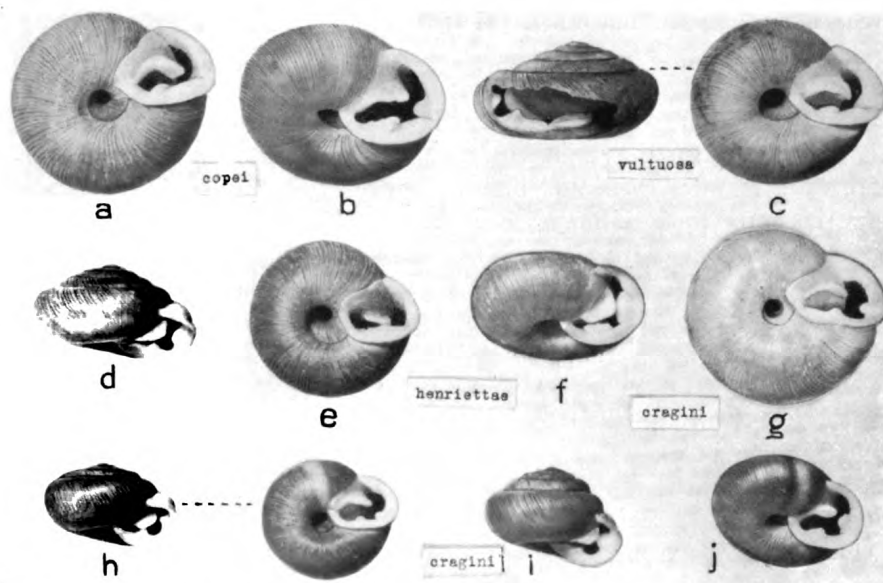


Fig. 484. a, b, *Triodopsis vultuosa copei*, 20 miles north of Beaumont, Tex.; at b, the type. c, *Triodopsis vultuosa*, Mt. Zion near Fairfield, Tex.; d, specimen from Gould. e, *Triodopsis vultuosa henriettae*, near Athens, Tex.; f, paratype. g, *Triodopsis cragini*, Fort Gibson, Okla.; h, Thayer, Kan.; i, Red River, southwestern Ark.; j, McAlester, Okla. (Fig. g $\times 3$, the rest $\times 2$.)

tortuous, white, having at the base a small tooth, and at the center a deep seated, more expanded, reflexed tooth. The columella bears a stout, elevated, arcuated, oblique lamella, joined to the lower extremity of the lip only. Diameter two-fifths of an inch, axis one-fifth of an inch." (Gould.)

Height 6.3 mm., diameter 10.6 mm. Specimen from Gould.

Height 6.8 mm., diameter 12.4 mm. Lee Co., Texas.

Diameter 9.5 to 12.3 mm. Mt. Zion, Freestone Co., Texas.

ARKANSAS: Rogers, Benton Co.; Washington, Crawford, Sebastian and Nevada counties (Sampson¹).

LOUISIANA: Near Lake Charles, Calcasieu Parish (Pilsbry).

TEXAS: Wood and Smith counties (Askew). Mt. Zion, 8 mi. east of Fairfield, Freestone Co. (G. H. Clapp). Anderson Co.; Wheelock, Robertson Co., and Lee Co. (Singley). Flatonia, Fayette Co. (H. A. Wenzel). Houston (Pilsbry). Macdona, Bexar Co. (Wenzel). Corpus Christi and Galveston (Bartlett), type localities.

With the general appearance of *T. fallax* and *T. vannostrandi*, this southwestern species differs by having the tooth in the outer lip more deeply immersed; it is rather wide. A callous ridge runs along the face of the

¹ Mr. Sampson mentions specimens from Sedalia and Boonville, Missouri, but some doubt attaches to both records. His Arkansas records probably include *P. cragini*, which he did not differentiate at that time. I have seen no *P. vultuosa* from Arkansas.

basal lip. This ridge is a constant feature of *vultuosa*, though varying in strength, and is not found in any of the related species. The basal tooth is obscurely doubled, or is buttressed on its columellar side.

The color is a light, very dilute ecru-olive to dilute cinnamon-buff. The minute papillation of the Triodopses is scarcely developed, but sometimes can be seen within the umbilicus. The lip is well expanded rather than reflected, somewhat thick and blunt, its reverse opaque buff. In a profile view the outer lip is either rather strongly concave in the middle, as in specimens from Gould, or it may be nearly straight, as in those from Lee County. The face of the basal lip always bears a flange in the region of the deep interdental bay, though it is usually not so prominent as in the following subspecies. The marginal basal tooth is high at its outer end. Its columellar end turns inward and runs as a strong, horizontal ridge about one-third of a turn on the columellar axis, seen on breaking the shell (Fig. 484 c, Freestone Co). This structure, present also in the varieties *copei* and *henriettae*, is like that of *T. fallax*, and is not found in *T. hopetonensis*, *vannostrandi* or *cragini*.

Louisiana specimens are small, diameter about 9.8 mm., with the umbilicus narrower than those of Texas.

(*Vultuosus*, frowning or grimacing.)

Triodopsis vultuosa copei (Wetherby)

Figs. 484 a, b.

Helix copei, or *H. vultuosa* var. *copei*, Wetherby, 1878, Amer. Nat., 12: 185, text-figs.—Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 305.

Triodopsis copei Wetherby, W. G. Binney, 1883, Suppl. to Terr. Moll., 5. Bull. Mus. Comp. Zoöl., 11: 152, pl. 1, fig. J; 1885; Man. Amer. Land Sh., p. 388, fig. 422.

The shell is chamois above, cream-buff below, with the sculpture and shape of *vultuosa*, but larger; teeth as in *vultuosa* but usually somewhat larger, the long basal tooth being marginal, the flange on the face of the basal lip stronger.

Height 7.7 mm., diameter 13.7 mm.; 5½ whorls. Type.

Height 7.2 mm., diameter 12.2 mm. Paratype.

Height 7.5 mm., diameter 14.5 mm. Angelina Co.

TEXAS: Under logs in pine woods 20 miles north of Beaumont (Wetherby). Type 82316 A.N.S.P. Crockett, Houston County (Ferriss). Angelina Co. (W. L. McDaniel). Also reported by J. A. Singley from Harris, Lee, Robertson, Anderson and Galveston Counties.

The size and lighter color are about all that differentiate this race from *vultuosa*; but the boundary is not very definite. It inhabits pine areas, while *vultuosa*, according to A. F. Archer, is prevalent in post oak savannas. Crockett specimens measure 12.8 to 13.5 mm. in diameter. I have selected as type the specimen figured by Wetherby.

(Named for Professor E. D. Cope.)

Triodopsis vultuosa henriettae (Mazyck)

Figs. 484 e, f.

Helix vultuosa Gld., Bland, 1861, Ann. Lyc. Nat. Hist. N. Y., 7: 439, pl. 4, fig. 21 (specimen from Pine Town, Cherokee Co., Texas).

Helix (Triodopsis) henriettae Mazyck, 1877, Proc. Acad. Nat. Sci. Phila., p. 297.

Triodopsis henriettae Mazyck, W. G. Binney, 1883, Suppl. Terr. Moll., 5, Bull. Mus. Comp. Zoöl., 11: 152, text-figs.; 1885, Man. Amer. Land Sh., p. 389, fig. 421.

"This species more nearly resembles *Helix vultuosa* Gld. than any other North American species, but differs from that shell in the shape and size of the umbilicus and in the form and armature of the aperture, which in *vultuosa* is lunate, almost circular, and in this species is rather V-shaped; in *vultuosa* the peristome, though moderately so, is decidedly reflexed, and its plane is almost entirely unbroken; in *henriettae* it is very much thickened, but scarcely at all reflexed, is very tortuous, and bears on its inner margin an obtuse denticle and a long lamelliform erect tooth, which are wanting in *vultuosa*; in *henriettae* the two internal teeth are so far within the aperture as to be seen only on looking into it, while in *vultuosa* they are plainly visible from the base of the side; in the latter the parietal tooth is arched upwards, and its outer margin is rounded—in *henriettae* it takes the opposite direction, and its margins form almost a right angle; the deep pits behind the peristome are wanting or obsolete in *vultuosa*. Diameter maj. $\frac{1}{2}$, min. $\frac{7}{16}$, alt. $\frac{1}{4}$ inch." (Mazyck.)

Height 6 mm., diameter 11.3 mm. Paratype.

TEXAS: Eastern Texas (Jacob Boll), Type in collection of Charleston Museum. Cedar Creek near Athens, Henderson County (Ferriss). Pine Town, Cherokee County (Bland).

The flange on the face of the basal lip is very strong. The basal tooth is immersed, as well as that in the outer lip; both being strongly developed, and marked behind the lip by distinct pits at periphery and on the base. The parietal tooth has a short but distinct branch from its end towards the upper termination of the lip. Of these characters, the immersion of the basal tooth is the essential feature.

Triodopsis cragini Call

Figs. 484 g-j.

Triodopsis cragini Call, 1886, Bull. Washburn College Lab. Nat. Hist., 1: 202, fig. 5. —W. G. Binney, 1890, 3rd Suppl., Bull. Mus. Comp. Zoöl., 19: 199, figs. (as synonym of *T. copei* Weth.).

Helix vultuosa var. *ragini* Call, Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 305 (Wood Co., Texas).

Polygyra cragini (Call), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 450; 1903, *ibid.*, p. 196. —Pilsbry & Ferriss, 1907, *ibid.* for 1906, p. 545.—Sampson, 1913, Trans. Acad. Sci. St. Louis, 22: 90 (as "*crageni*").

"Shell small, shining, deeply but narrowly umbilicated, depressed globose, vertical axis little less than one-half the major diameter; whorls five, convex, spire regularly increasing in size, body whorl rapidly enlarging, with numerous prominent sigmoid striae, which scarcely appear on the base of the body whorl, and are entirely wanting on apical whorl, body whorl well rounded, with tendency to subangulation at upper juncture of aperture only; epidermis reddish horn color, with well marked yellowish blotches which, however, mark the positions of former peristomes and are caused by

deposits of calcareous matter within; embryonic (apical) whorls smooth, obtuse; suture well impressed; aperture oblique, forming an angle of 45° with the plane passing through the vertical axis, slightly excavated on outer margin, lunate, approaching subquadrate, with a short, strong, straight, or scarcely curved parietal tooth; peristome reflected, white, thickened with a heavy deposit of callus. On the interior edge of the outer margin is a rather heavy white triangular tooth, which is somewhat excurved; in the basal region is another short heavy conical or somewhat transverse tooth, midway between the last and the point of juncture of peristome with parietal wall; columella with a rather heavy deposit of callus (the fulcrum) some distance within the aperture." (Call.)

"Alt. 4.6, maj. diameter 8.56, min. 8.22 mm.

"Alt. 4.31, maj. diam. 8.21, min. 7.4 mm.

"Alt. 4.72, maj. diameter, 8.49, min. 8 mm." (Call.)

KANSAS: Banks of Chetopa Creek, Neosho Co. (F. W. Cragin); Type 3123 M.C.Z. Thayer, Neosho Co. (Ferriss).

MISSOURI: Dade Co.; Split Log, MacDonald Co.; Mt. Vernon, Lawrence Co. (Sampson).

ARKANSAS: Mena, Polk Co.; Ultima Thule, Sevier Co.; Rocky Comfort, Little River Co. (Ferriss). North of Philadelphia, Clark Co. (Archer).

OKLAHOMA: Fort Gibson (E. W. Hubbard). Vinita, Craig Co.; South McAlester, Pittsburg Co. (Pilsbry and Ferriss). Antlers; Red Fork, Tulsa Co., and Choctaw, Oklahoma Co. (Ferriss).

LOUISIANA: Frierson, Nachitoches Parish (L. S. Frierson).

TEXAS: Wood Co. (J. A. Singley). De Kalb, Bowie Co. (Ferriss).

Cragin's triodopsis is closely related to *T. vultuosa*, of which Binney and Singley considered it a variety, perhaps with justice. It is smaller, and though the face of the basal lip of the aperture is convex, there is no distinct ridge or flange upon it such as is seen in *T. vultuosa*. The basal tooth in *T. cragini* varies from simply tubercular to more or less buttressed on the columellar side, but it is not saddle-shaped as is often the case in *vultuosa*, and its end towards the columella is not prolonged inward as a callous ridge upon the columellar axis. At most, there may be a weak callosity on the axis, never a ridge. Having examined over fifty shells in the Academy collection from all parts of the range of the species, and many in Ferriss' series, and opened many, I cannot find any internal callus which could be called a "fulcrum". Call did not open the shell, but merely looked in the aperture. I saw his specimens, and in fact, drew his figures.

The sculpture of apex and later whorls is about that of *T. vultuosa*. There is some minute papillation within the umbilicus. The color is from dilute snuff brown to cinnamon-buff. Specimens from near Thayer, Neosho County, Kansas, measure: height 5.3, diameter 8.6 mm. to 9 mm.¹ High

¹ The height as given by Call is less than my measurements, owing doubtless to a different method of measuring. As he worked it down to hundredths of a millimeter, he must have had a remarkably accurate method!

and low ones from near Texarkana, Arkansas are 5.3 x 8.4 to 6.3 x 9 mm. The largest seen, from McAlester, Oklahoma, is 9.8 mm. diameter; 5 whorls.

The only notable variation, aside from the small details already mentioned, is in a lot of four shells from Fort Gibson, Oklahoma, formerly referred to *T. hopetonensis*. The shell is very much depressed, 3.9 x 8.7 mm., 4½ whorls, and 3.6 x 7.6 mm. (Fig. 484 g). Further investigation in the field may show this to be recognizable as a race.

At South McAlester, Oklahoma, we found it under stones and wood on a stony hillside with very little shade. At Thayer, Kansas, Ferriss took it from crevices of the sandstone in a quarry.

Subgenus **XOLO TREMA** Rafinesque

Xolotrema Rafinesque, 1819, Journ. de Physique de Chimie, d'Hist. Nat., 88: 425, for *X. lunula* and *X. triodopsis*, undescribed.—Tryon, 1865, Amer. Journ. Conch., 1: 81; 1887, Man. Conch., 3: 113. Not *Xolotrema* Rafinesque, 1831.¹

Triodopses in which the inner margin of the basal lip has a long blade-like lamella, terminating at a notch where it joins the outer arc of the lip; the embryonic whorls are covered with close retractive radial striae (sub-obsolete in *T. fosteri*).

TYPE: *T. notata* (Desh.), here designated.

With the general structure of *Triodopsis*, this series differs by having a lamella along the inner edge of the basal lip, instead of a short tooth there.

¹ Rafinesque defined *Xolotrema* in 1819, without described species, as follows: "Xolotrema. Differing from the preceding [*Triodopsis*] by the want of an umbilicus (as in the genus *Helix*) or a little covered by the end of the lip. Aperture transversely linear, the lower tooth becoming a lamellar keel. Only two species, *X. lunula* and *X. triodopsis*." (translation). The selection of a genotype is thus subject to the provisions of Opinion 46 of the International Commission on Zoological Nomenclature. This Opinion provides that "In genera published without mention, by name, of any species, no species is available as genotype unless it can be recognized from the original generic publication" and "if . . . it is not evident from the original publication of the genus how many or what species are involved, the genus contains all of the species of the world which would come under the generic description as originally published." It is obvious that in the selection of a genotype the provisions of this Opinion are to be applied literally.

In republishing *Xolotrema* in 1831, Rafinesque ignored the specific names he had mentioned in 1819, but included *X. clausa*, which is inferred to be his Ms. species *Triodopsis clausa*, which was described in 1830 by Deshayes as *Helix clausa* Rafinesque, this being a synonym of *Helix inflecta* Say, 1821. If this inference be accepted, it is evident that Rafinesque changed the significance of *Xolotrema* in his 1831 paper, because *X. clausa* = *inflecta* certainly could not "be recognized from the original generic publication", as it has a basal tooth of entirely different shape, not "devenant une carène lamelleuse." Tryon, in 1865, identified *Xolotrema* as applicable to *Helix palliata* Say, *obstricta* Say and *appressa* Say (which at that time included *fosteri* F. C. Baker), but he did not designate a type. All of these species inhabit the region where Rafinesque worked.

In 1930, Pilsbry proposed "to ignore Herrmannsen's restriction to the undescribed *X. lunula* of uncertain identity, and to accept *X. clausa* Raf. 1831 = *H. inflecta* Say, as type of *Xolotrema*, on the ground that it was the first recognizable species." This was in effect ignoring Rafinesque's *Xolotrema* of 1819 and accepting his different *Xolotrema* of 1831, an obviously unlawful course. Following Tryon, *Xolotrema* Raf., 1819, is now restricted to *Helix palliata* Say (= *T. notata*) and its allies, which agree with the original definition, and *Xolotrema* Raf., 1831, is referred to the group of *Mesodon inflectus* (Say).

Typically it is characterized by the entirely striate embryonic whorls and rough later sculpture; but the species *caroliniensis* and *fosteri* approach the ordinary *Triodopses* in these particulars.

Key to Species of Xolotrema

- Surface with close-set papillae bearing stiff hairs; periphery obtusely angular in front only. *T. notata*
 Surface without such asperities.
 Periphery acutely carinate; surface with low, spaced rib-striae. *T. obstricta*
 Periphery rather sharply angular in front. *T. caroliniensis*
 Periphery rounded or indistinctly subangular; shell resembling *Mesodon appressus*; Illinois and westward. *T. fosteri*

***Triodopsis notata* (Deshayes)**

Figs. 485 a, b.

Helix palliata Say, 1821, Journ. Acad. Nat. Sci. Phila., 2: 152.—Binney, 1840, Boston Journ. Nat. Hist., 3: 353, pl. 7; 1851, Terr. Moll., 2: 136, pl. 14.—Leidy, Terr. Moll., 1: 253, pl. 7, fig. 8 (anatomy). Not *Helix palliata* Hartmann, 1807, Alpina, 2: 227.

Triodopsis palliata Say, W. G. Binney, 1878, Terr. Moll., 5: 302, pl. 14; pl. vii, fig. o (teeth).—Call, 1900, Indiana Dept. Geol. etc., 24th Ann. Rep., p. 385, fig. 6.

Helix notata "Fér.", Deshayes, 1830, Encyclopédie Méthodique, Hist. Nat. Vers., 2: 224.

Helix denotata Férussac, 1821, Tabl. Syst. Fam. Limaçons, p. 34, no. 102 (nude name; *Triodopsis scabra* Rafinesque cited as a synonym); Hist. Nat. Moll. Terr., pl. 49A, fig. 5.—Deshayes, 1838, in Lamarck, Hist. Nat. Anim. s. Vert., (2), 8: 115.

Polygyra palliata (Say), Pilsbry, 1894, Man. Conch., 9: 77.—Johnson, 1915, Fauna of New England, Mollusca, p. 197.—S. F. Price, Nautilus, 14: 75.—Billups, Nautilus, 16: 51.—Hinkley, Nautilus, 16: 34.—Hanna, Nautilus, 24: 24.—Johnson, Nautilus, 26: 59.—Pilsbry, 1903, Indiana Dept. Geol. etc., 26th Ann. Rep., p. 581, fig. 4 (transitions to *obstricta*).—Walker, 1906, Ill. Cat. Moll. Mich., p. 467; 1928, Terr. Moll. Alabama, p. 34.—F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 116.

The shell is imperforate (but locally varying to nearly covered umbilicate), depressed, with convex or low conoidal spire; tawny olive to snuff brown in color. The last whorl is obtusely angular in front, becoming rounded behind, descending very little to the aperture, scarcely contracted behind the lip. Embryonic shell closely sculptured with radial, slightly curved fine striae. Following whorls rather weakly, coarsely striate, and covered with fine wrinkles, the last whorl with close-set papillae bearing flattened triangular periostracal asperities, arranged in irregular retractive trends; the surface between them more or less covered with fine wrinkles, oblique or radiating from the papillae. The aperture is trilobed. Peristome white, broadly reflected in the outer and basal margins, its face flattened or concave. Outer lip bearing a strong conic or obtuse tooth at the inner edge, the basal margin of the lip thickened blade-like within, truncate at its junction with outer margin. Parietal wall bearing a very strong, long and curved tooth, which extends to the umbilical callus.

Height 13 mm., diameter 23.4 mm.; 5½ whorls. Lawrenceburg, Ind.

Height 12 mm., diameter 20.5 mm. Lawrenceburg, Ind.

Height 10.5 mm., diameter 19 mm. Mammoth Cave, Ky.

Height 13.7 mm., diameter 25.6 mm. Harlan Co., Ky.

Height 10 mm., diameter 18.3 mm. Tannersville, N. Y.

ONTARIO: Hamilton (R. Walton).

VERMONT: Mt. Ascutney, Winsor Co.; Orange Co. (Johnson).

MASSACHUSETTS: North Adams, Berkshire Co. (Bayard Long).

NEW YORK: Over all of the state except the Adirondacks and Long Island, in the following counties: Dutchess, Columbia, Ulster, Greene, Rennselaer, Albany, Washington, Otsego, Herkimer, Madison, Onondaga, Cayuga, Schuyler, Tompkins, Ontario, Yates, Livingston, Monroe, Alleghany, Orleans, Erie and Niagara.

NEW JERSEY: Alpine, Bergen Co. (S. N. Rhoads).

PENNSYLVANIA: Pittsburgh, Allegheny Co. (Rhoads); Swissvale (Stupakoff). Ellwood City, Beaver Co. (J. B. Clark). Bucks Co. (B. Long). Carrolltown, Cambria Co. (W. Stone). Kings Station (Rhoads). Round Island, Clinton Co. (Rhoads). Waynesburg, Greene Co. (Rhoads). Mt. Union, Huntington Co. (Rhoads). Near Indiana, Indiana Co. (Wehrle). Bradford, McKean Co. (W. E. Burnett); Port Allegany (Fowler). Abbott Twp., Potter Co. (S. Brown). Eaglesmere, Sullivan Co. (Pilsbry). West of Ligonier, Westmoreland Co. (Archer). York Furnace, York Co. (W. Stone).

MARYLAND: Cumberland, Allegany Co. (Pilsbry). Jennings, Garrett Co. (W. Stone).

OHIO: "Over the state" (Sterki).

MICHIGAN: Lansing, Ingham Co. (Miles). E. Saginaw, Saginaw Co. (Lathrop). Grand Rapids, Kent Co. (Currier). Berrien Co. (Baker). "Saginaw-Grand valley and southeast part of state" (Walker).

INDIANA: Lawrenceburg, Dearborn Co. (Billups). Brookville, Franklin Co., and Corydon, Harrison Co. (Call). Henry Co. (E. Pleas). Madison, Jefferson Co. (Call). Grand Chain, New Harmony, Posey Co. (L. E. Daniels).

ILLINOIS: Hamilton, Hancock Co. Johnson Co. Normal, McLean Co. Golconda, Pope Co. Dug Hill, Union Co. Wabash Co. White Co. (F. C. Baker).

ARKANSAS: St. Francis River, Cross Co. (A. W. Cline). Crittenden Co., opposite Memphis (Rhoads).

KENTUCKY: Brooklin Bridge, Butler Co. (C. R. Crosby). Mammoth Cave, Edmonson Co. (Rhoads). Pine Mt., Harlan Co. (W. Stone). Burnside, Pulaski Co. Warren and Barren counties (Price).

TENNESSEE: Outliers of Roan Mt., Carter Co. (H. B. Baker). Samburg, Obion Co., and Johnson City, Washington Co. (Rhoads). Limestone Cove, Unicoi Co., and Knoxville, Knox Co. (H. B. Baker). Mt. LeConte, Sevier Co. (Clench and Archer). Mouth Pond Creek, Loudon Co. (C. B. Moore). Cade's Cove, Blount Co. (Ferriss). Talassee Ford, Monroe Co. (Ferriss).

NORTH CAROLINA: Cranberry, Watauga Co. (H. B. Baker). Paintrock, Madison Co. (Walker). Mitchell Co. (Henry Skinner). Glen Cove, Unaka Mts. (Ferriss).

VIRGINIA: Great Falls, Fairfax Co. (Hanna, Pilsbry).

SOUTH CAROLINA: Calhoun Falls, Abbeville Co. (Billups).

ALABAMA: Boligee, Greene Co. (Hinkley). Stevenson, Jackson Co.; Florence, Lauderdale Co.; Huntsville, Madison Co.; Mobile, Mobile Co.; Tuscaloosa, Tuscaloosa Co. (Walker).

MISSISSIPPI: Near Anderson landing, Sharkey Co. (C. B. Moore). At Abbeville, Lafayette Co. (Hinkley).

The name given to this species by Say being a homonym, Férussac's *denotata* was substituted; but I cannot find that that name was validated by description or named figure prior to 1837, when Beck mentioned *H. denotata* Fér. as a synonym of *H. palliata* Say. *H. notata* Desh., 1830, appears to be the first published name to be defined; it was possibly an

error for *denotata*, or an emendation, since Deshayes attributed it to Férussac, and refers to his Tableau Systématique.

T. notata is very distinct from all others except *T. obstructa*. The surface is roughened by stiff periostracal asperities, more strongly developed than in any other helix of the region.

It is extremely variable. In many places, such as the Catskills, the umbilicus does not become completely covered, a narrow cleft remaining open. In shape it usually has the typical form described above, the periphery quite bluntly angular in front, becoming rounded in the last half turn; but in southern Indiana, Kentucky and Tennessee the angulation often becomes conspicuous, and continues nearly to the lip (Fig. 485 b, Pine Mt., Harlan Co., Ky.).

A series of 18 specimens submitted to me by Mr. L. E. Daniels collected by him in the flood-plain of the Wabash at Grand Chain, Posey County, Indiana, shows transitions from *notata* to *obstricta* (Figs. 486 a-c). A few of the specimens agree almost exactly with Say's type specimen of *palliata* [= *notata*], the periphery being moderately angular, the angle disappearing on the last third or fourth of the whorl; and the surface, besides having low,

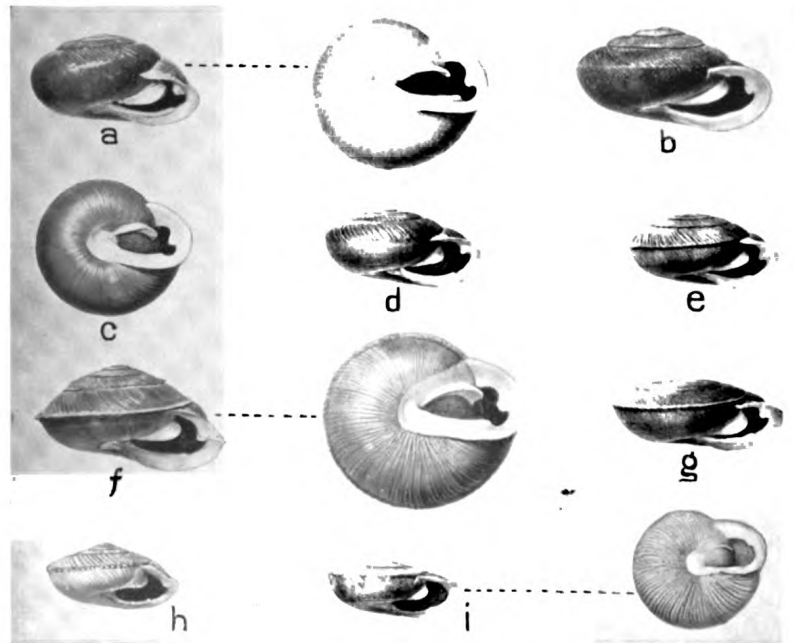


Fig. 485. *Triodopsis notata*: a, Lawrenceburg, Ind.; b, Pine Mt., Ky. c, *Triodopsis caroliniensis*. Poole's Island, Coosa River. d, topotype from Lea; e, Woodville, Ala. f, *Triodopsis obstructa*, Belleview, Tenn.; g, Harriman, Tenn. h, i, *Triodopsis obstructa occidentalis*, type (center) and paratypes.

coarse striae, bears numerous cuticular asperities, as though a loose cuticle had been pinched up into many little points, and more or less wrinkled in consequence between them. (See a, Fig. 486.)

Most of the shells are decidedly more acutely angular at the periphery than typical *palliata*, but have essentially the same sculpture (Fig. 486 b). A few of the specimens, Fig 486 c, have the peripheral keel acute, and reduced to an angle only on the latter part of the whorl, and there is a distinct tendency of the cuticle to pucker into spiral lines between the ribstriae; such ill-developed spirals being characteristic of *T. obstricta*. In some of these specimens the keel projects a little above the sutures, as usual in *T. obstricta*. They are similar to shells of the latter species found



Fig. 486. a, *Triodopsis notata*; b, intermediate specimen; and c, *T. obstricta*, Grand Chain, Indiana.

in the hills, about half a mile distant from the locality of the *notata-obstricta* series. No sharp line, however, can be drawn between the bluntly angular, the sharply angular and the strongly carinate shells; all intergradations occur, even in the small series.

As *obstricta* alone occurs in the adjacent hills, it seems likely that this is a hybrid *notata* × *obstricta* population.

Albino shells, between olive buff and pale olive gray, have been reported from Michigan and Ohio. Those seen are from Grand Rapids, collected by Currier.

There is great variation in the development of the periostracal asperities, and the wrinkles radiating from them. They are quite weak in some lots.

Genitalia of a specimen from Carrolltown, Pa., drawn in Figure 473: 6, the upper part not shown. The penis cavity has two sets of intersecting diagonal grooves, and a large ridge or pilaster. The upper section, (Fig. 473: 6 a), 1 mm. from the end, where the vas deferens enters by a small pore. The sheath is thin. The spermathecal duct has low longitudinal ribs within. Length of penis 8 mm., retractor 6 mm., vagina 4 mm., spermatheca 10.5 mm.; diameter shell 21 mm.

(*Notatus*, well marked.)

Triodopsis obstricta (Say)

Figs. 485 f, g.

Helix obstricta Say, 1821, Journ. Acad. Nat. Sci. Phila., 2: 154.

Triodopsis obstricta Say, W. G. Binney, 1878, Terr. Moll., 5: 303, pl. 15; pl. vii, fig. P (teeth); 1885, Man. Amer. L. Sh., p. 487, var. *planulata*, Tennessee, nude name. — Gratacap, Bull. Amer. Mus. Nat. Hist., 14: 379, with var. *planulata*, nude name.

Helix palliata var., Binney, 1851, Terr. Moll., 2: 137, pl. 15.

Polygyra obstricta (Say), Pilsbry, 1894, Man. Conch., 9: 77.—Hinkley, 1906, Nautilus, 20: 34.—Wheeler, Nautilus, 25: 124.—Walker, 1928, Terr. Moll. Alabama, p. 35, fig. 39.—Billups, 1903, Nautilus, 16: 127.—Hinkley, Nautilus, 20: 34.—Wetherby, 1911, Nautilus, 25: 60.—S. F. Price, Nautilus, 14: 75.

Carocolla helicoides Lea, 1834, Trans. Amer. Phil. Soc., 4: 109 [= 103], pl. 15, fig. 34a-c (near Nashville, Tenn.).

(?) *Mesodon labiatum* Rafinesque (in MS "Conchologia Ohioensis"), Binney and Bland, 1870, Ann. Lyc. Nat. Hist. N. Y., 9: 294, fig. 13.

"Shell depressed, with elevated lines forming grooves between them; epidermis pale brownish, naked; volutions five, depressed above, beneath rounded, with an acute projecting carina: umbilicus covered with a white callus, indented; mouth resembling that of *H. palliata*. Inhabits Ohio. Breadth nearly one inch. This species is very closely allied to *Helix palliata* [*T. notata*], but the epidermis is not covered with small elevations as in that shell, and the carina is very prominent and remarkable." (Say.)

One and a half embryonic whorls are finely striate, as in *T. notata*; following whorls with low, rather widely spaced rib striae, and minutely, closely wrinkled in the direction of growth lines, the wrinkles more or less broken into granules; often there are ill-defined superficial spiral lines on the upper surface of the last whorl. Where least worn, as above and below the keel, there are often some periostracal laminae or erect scales, sometimes scattered over the whole last whorl; but in other lots these are absent. The aperture is similar to that of *T. notata*. Beginning on the second whorl, the keel is visible above the suture; it continues strong to the end. The spire varies from very low to moderately high and dome-shaped. It is cinnamon colored.

Height 11.7 mm., diameter 23.8 mm.; 5½ whorls. Type.

Height 10.5 mm., diameter 21.3 mm. Sewanee, Tenn.

Height 14 mm., diameter 26.6 mm. Bellevue, Tenn.

Height 12 mm., diameter 25.1 mm. Bellevue, Tenn.

Height 14.3 mm., diameter 24.6 mm. Bellevue, Tenn.

[OHIO: Say, type (?) 11271 A.N.S.P.].

INDIANA: Grand Chain, Posey Co. (Daniels).

ILLINOIS: White Co. (Marsh).

KENTUCKY: Bowling Green, Warren Co. (Ferriss). Warren and Barren counties (S. F. Price).

TENNESSEE: Murfreesboro, Rutherford Co. (Wetherby). Sewanee, Franklin Co. (H. H. Smith). West Pikesville, Fraley Gap and Skillen Cove, Bledsoe Co. (H. B. Baker). Harriman, Roane Co. and Bellevue, Davison Co. (S. N. Rhoads).

SOUTH CAROLINA: Calhoun Falls, Abbeville Co. (?) (Billups).¹

ALABAMA: Near Bass (H. H. Smith). Woodville and Princeton, Jackson Co.; Florence, Lauderdale Co.; Gurley and Monte Sano, Madison Co.; Weduska Shoals, Talladega Co. (Walker).

MISSISSIPPI: Columbus, Lowndes Co. (Hinkley).

This striking species is typically very distinct, but there are forms almost connecting it with *notata* and *caroliniensis*, so that one is tempted to return to the view of A. Binney, that they are extremes of one polymorphic species.

¹ This lot probably is *T. caroliniensis*, as it seems remote from other localities for *obstricta*.

The locality "Ohio" given by Say has not been confirmed. That it occurs in that state appears doubtful. The specimen marked Ohio in the Academy collection, thought to be the type, looks like Kentucky or Tennessee *obstricta*.

Triodopsis obstricta occidentalis (Pilsbry & Ferriss) Figs. 485 h, i.

Polygyra obstricta Say, Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 186.
Polygyra obstricta occidentalis Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906, p. 543, pl. 22, figs. 30-32.

The imperforate shell is strongly carinate, slightly convex or nearly flat above, the base strongly convex. Surface sharply and rather finely rib-striate, minutely and closely granulose (not coarsely roughened as in *T. obstricta*). Teeth reduced, the parietal strong but short, not reaching to the umbilical callus; lip teeth very small or vestigial.

Height 7.3 mm., diameter 17 mm.; 4½ whorls.
Height 8.2 mm., diameter 17.8 mm.; 4¾ whorls.
Height 8.8 mm., diameter 17.3 mm.

ARKANSAS: Probably from near Benton, Saline County (Stuart Weller), Type and paratype 11269 A.N.S.P. Independence County (Sampson).

This isolated Ozarkian race appears distinct by the smaller size and much reduced teeth. It was described from dead shells, one of them retaining part of the olivaceous periostracum, which shows no scaly or laminar appendages. It is evidently what Sampson reported as *obstricta* from Independence County. His single specimen was 20.5 mm. diameter, "spire more flattened, superior tooth on peristome smaller, and decidedly more strongly striated" than Indiana and Tennessee *obstricta*. Unfortunately, Professor Weller did not label his shells in the field, so that the locality given from memory requires confirmation.

(*Occidentalis*, western.)

Triodopsis caroliniensis (Lea) Figs. 485 c, d, e.

Helix caroliniensis Lea, 1834, Trans. Amer. Phil. Soc., 4: 102, pl. 15, figs. 33a-c.
Triodopsis obstriata var. γ , Binney, 1878, Terr. Moll., 5: 304.
Polygyra obstricta caroliniensis (Lea), Pilsbry, 1892, Man. Conch., 8: 153, pl. 50, figs. 8-10; 1897, Nautilus, 11: 95.—Hinkley, Nautilus, 18: 54.—Wheeler, Nautilus, 25: 124; 1918, Nautilus, 31: 116.—Frierson, Nautilus, 14: 68.—Walker, 1928, Terr. Moll. Alabama, p. 36.

The imperforate shell is depressed, the height about half the diameter; between tawny-olive and cinnamon (or almost mikado brown) in color; the whorls weakly convex, the last sharply angular in front, the angle growing weaker on the last half turn, obsolete near the lip, where the periphery becomes rounded. The embryonic whorls have fine striation as in *obstricta* and *notata*. Last whorl is rib-striate, the striae passing over the base in the last half whorl, but in front of the aperture they are prominent on the peripheral angle, weaker below it. There is some weak, irregular minute wrinkling in intervals of the striae, but no periostracal asperities in the

specimens from Lea (but in certain lots some network of low granules or wrinkles is seen). Aperture as in *T. obstricta*.

“Diameter fourteen-twentieths, length seven-twentieths of an inch.”
(Lea.)

Height 10.4 mm., diameter 21 mm. S. C., from Lea.

Height 10.4 mm., diameter 19.2 mm. S. C., from Lea.

Height 11.7 mm., diameter 23.1 mm. Woodville, Ala.

SOUTH CAROLINA: Cheraw, Chesterfield Co. (Lea). Type 106735 U.S.N.M.

GEORGIA: Columbus, Muskogee Co. (A. D. Brown).

TENNESSEE: Near Jasper, Marion Co. (J. B. Clark). Dove (H. B. Baker).

ALABAMA: Blount Springs, Blount Co. Poole's Island; Gabriel; Slackland; Maple Grove, Cherokee Co. Langsdale, Chambers Co. Annison, Calhoun Co. Higgins Ferry and 3 mi. above Yellowleaf Creek, Chilton Co. Ft. Payne, Lookout Mt., DeKalb Co. Wetumpka, Elmore Co. Gadsden; Keener, Etowah Co. Burleson, Franklin Co. Stevenson, Princeton, Woodville, Limerock, Jackson Co. Squaw Shoals; Warrior, Jefferson Co. Florence, Lauderdale Co. Tuskegee, Macon Co. Huntsville, Monte Sano, Madison Co. Rumberts Ldg., Marengo Co. Mobile, Mobile Co. Red River, Montgomery Co. Wadley, Randolph Co. Whitney, Greensport, St. Clair Co. 3-mile Shoals; Ft. William; Horseblock Mt., Talladega Co. Tuscaloosa; Holt, Tuscaloosa Co. Forks of Warrior, junction of Lost and Wolf Creeks, Walker Co. (H. H. Smith in Walker, Wheeler, Sargent, Hinkley and C. B. Moore).

LOUISIANA: Grand Cane (Geo. Williamson), and Grand Raft of Red River (Frieron), De Soto Parish. Shreveport, Caddo Parish (A. D. Brown).

ARKANSAS: Kent, near Camden, Ouachita Co. (C. B. Moore). Southeastern corner of Clark Co. in heavy woods (Wheeler).

The description and Figure 485 d are from specimens received from Lea at the time he described the species. In some lots the intercostal intervals have more sculpture, and the periphery is keeled, a concavity below the keel; but it has not the clean-cut keel of *obstricta*; it is not margined above the angle, and the rib-striae are conspicuous where they pass obliquely over it. In some Woodville (Fig. 485 e) and other Alabama shells, those of Columbus, Georgia, and a lot from Prior Cove, near Jasper, Marion County, Tennessee, the keel extends to the lip and the surface is sometimes as much roughened as in *obstricta*, but without periostracal projections. This is Binney's var. β . Although some specimens certainly approach *obstricta*, I have not seen actual intergradation, and it may be wise temporarily to allow *caroliniensis* to stand as a species until intergradation is demonstrated.

T. caroliniensis is apparently a common snail in a belt from northeastern South Carolina through northern Georgia and Alabama and doubtless into Mississippi, though records are lacking. West of the Mississippi River it appears again in northwestern Louisiana and southern Arkansas, Ouachita and Clark Counties. In part of its range *T. notata* and *T. obstricta* also occur; but there may be local ecologic segregation of the trio,—a point which deserves investigation. Lea found the type lot under bark of an old log.

The genitalia of a specimen from Wetumpka, Alabama, do not differ materially from *T. notata*. Length of penis 7 mm., retractor 5 mm., vagina 3 mm., spermatheca and duct 11.5 mm.; diameter of shell 20.5 mm.

Triodopsis fosteri (F. C. Baker)

Fig. 487.

[*Helix appressa*] "var. a, Labrum with two projecting angles", Say, 1821, Journ. Acad. Nat. Sci. Phila., 2: 151.

Helix appressa and *Triodopsis appressa* Say, in part, of many authors.—Shimek, 1888, Bull. Lab. Nat. Hist. State Univ. Iowa, 1: 63 (Louisa Co., Ia.).

Polygyra appressa fosteri F. C. Baker, 1932, Nautilus, 46: 48.

"Shell differing from typical *appressa* in having the sculpture coarser and more rib-like, the parietal tooth somewhat heavier and often larger, and the outer lip with a distinct superior denticle, giving the aperture a form like that of *Polygyra paltata*. The periphery is also obscurely subangu-

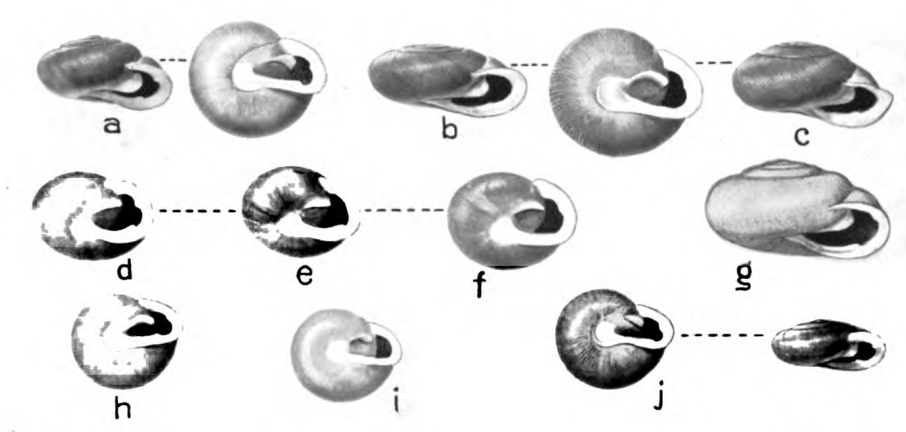


Fig. 487. *Triodopsis fosteri*: a, near Elizabethtown, Ill.; b, c, Hardy, Ark.; d, e, f, Burlington, N. J. g, *T. fosteri hubrichti*, paratype. h, *T. fosteri*, var., Afton, Ill.; i, *T. fosteri missouriensis*, Marion Co., Mo. j, type and paratype, Jefferson City, Mo. (All actual size.)

lated. Sculpture between the riblets like that of typical *appressa*. Greater diameter 16.5; lesser diameter 15.0; height 9.5 mm. Holotype." (Baker).

Paratypes measure: height 10, diameter 16.5 mm., and 8, 14 mm.

After the smooth tip the initial $1\frac{1}{2}$ whorls are covered with fine, close and regular, arcuate radial striae. Following whorls with rather coarse striae, on the last whorl about three in one mm., (above periphery near end of whorl). There is weak microscopic wrinkling in the direction of growth lines, cut by faint, extremely fine spiral lines, giving a granulose effect under the microscope, in some places. There are no scattered papillae on the base, such as *Mesodon appressus* has, and typically no impressed spaced spirals such as characterize *M. perigraptus*. There are no lines bearing papillae, as in *M. appressus* form *sculptior*.

INDIANA: Evansville (C. S. Hodgson).

ILLINOIS: "Along the Ohio from Shawneetown to Cairo, and on the Mississippi from Burlington, Iowa to Cairo, also in Calhoun Co., Ill." (F. C. Baker). Type locality, Hardin Co., 3 mi. northwest of Elizabethtown, in valley of Big Creek, under heavy blocks of limestone in gullies and hillsides, Type Z32079 University of Illinois Museum. Paratypes 157437 A.N.S.P. Dubois (Hinkley). Bluff north of Grand Tower, Jackson Co. (F. C. Baker). Joliet, Wills Co. (Ferriss). Alton, Madison Co. (John Ford).

IOWA: Keokuk (S. R. Roberts). Booneville, Dallas Co. (J. R. Henderson). Louisa Co. (H. F. Wickham).

MISSOURI: Bear Creek, Marion Co.; Farmington, St. François Co.; St. Genevieve, St. Genevieve Co.; and Allenville, Cape Girardeau Co. (Sampson). St. Louis, St. Charles, Franklin and Jefferson counties (L. Hubricht). Jefferson City, Cole Co. (O. A. Crandall). Booneville, Cooper Co. (J. H. Britts).

ARKANSAS: Helena, Phillips Co. (T. Bland). Hardy, Sharp Co. (Ferriss).

MISSISSIPPI: Vicksburg (C. W. Johnson).

LOUISIANA: Lake Ponchartrain (C. D. Orchard).

NEW JERSEY: Burlington and several miles down the Delaware River, imported.

The shell of this species is chiefly characterized by the absence of minute papillae such as *Mesodon appressus* possesses. Ordinarily no spiral engraved lines are to be seen, but in some places such as Joliet (117483 A.N.S.P.), such lines are rather distinctly developed. Almost always there is a tooth in the outer lip. It may be strongly developed, almost as in *T. notata*, or merely weakly indicated, and in exceptional individuals it is completely wanting.

The main distinction of the species is in the genitalia (Fig. 473: 7-7c), the penis being quite slender and enveloped in a thick, muscular sheath; its very long retractor muscle is inserted on the vas deferens; the stout, oblong spermatheca has a duct which is strongly swollen in its lower part, having a thick wall there. These characters all contrast with the structures found in *M. appressus* and *M. perigraptus*.

In paratypes seen, the diameter runs from 16 to 18 mm. Joliet specimens from 14.7 to 18.2 mm. The fine specimens collected by Sampson in Cape Girardeau County, Missouri, are large, up to 11.2 x 20.4 mm., with the upper lip tooth vestigial or wanting. Equally large examples, diameter 17.5 to 20.4 mm., are found at Hardy, Sharp County, Arkansas (Figs. 487 b-c). A specimen from Evansville, on the Ohio River, Indiana, measures 10.7 x 20 mm.

Sometime in the sixties, W. G. Binney planted specimens of *T. fosteri* sent by Robert Kennicott from Illinois, in his garden at 202 Union St., Burlington, New Jersey, recording them as *Triodopsis appressa* Say. They are now abundant in suitable places all over the town, and in 1909 I found them at least 8 miles down the river, at Plum Point, above Riverton, and in several intervening places along the Delaware River; also found at Torresdale, on the Pennsylvania side (1911). Many of the old living specimens

have lost most of their periostracum. Binney found a reversed specimen in his garden.

T. fosteri has several minor strains which do not seem sufficiently segregated for subspecific recognition. A small form with weak lip teeth, from Alton, Illinois, measures 14.2 to 15.6 mm., and in loess of the Mississippi bluff a mile above Alton, 14.5 to 17 mm. Similar small shells occur in Pike County, Illinois, at "Mt. Nebo"; all of these small shells have the upper lip tooth weak or hardly perceptible, and the microscopic sculpture distinct, but the parietal tooth is long, reaching to the axial callus.

Genitalia of specimen from near Stolle, St. Clair County, Missouri, (Figs. 473: 7-7c). The penis has a rather large cavity in the upper part (Figs. 7a, 7b), but in the forward part it is small with unequal longitudinal ribs (Fig. 7c), and a thick sheath. The vas deferens is somewhat enlarged a short distance from its anterior end, and the prostate gland continues into its upper part. Length of penis 5 mm., retractor 2.5 mm., vagina 3 mm., spermatheca 6 mm.; diameter of shell 15 mm. In specimens from Burlington, New Jersey, the measurements are: length of penis 5 to 6 mm., vagina 3 mm., spermatheca and duct 8 mm.

(*T. fosteri* was named for the late Thural Dale Foster. *Nautilus*, 52: 62.)

Triodopsis fosteri missouriensis new form. Small rather smooth Illinois and Missouri shells have hitherto been referred to *appressa*, and are apparently what Mr. Baker had in mind as *appressa* proper when differentiating *P. appressa fosteri*. In central Missouri, Cole and Cooper Counties, the shells are uniformly small. The parietal tooth is short and high, generally separated widely from the axial callus. The upper lip tooth is quite small, usually distinct, but sometimes disappearing. In other respects they are similar to the small shells of Madison and Pike Counties, Illinois, in having distinct sculpture of microscopic wrinkles cut by very delicate, close spiral lines, about 30 in one millimeter, the oblique striation weaker than in large *fosteri*. Specimens from Booneville, Cooper County measure 14.9 to 15.8 mm. in diameter; Jefferson City 7.2 x 14.3 mm., 4½ whorls, to 8.2 x 15.7 mm. (Figs. 487 j). In a similar lot from Bear Creek, Marion County, Missouri, the upper tooth is very weak or obsolete, (Fig. 487 i). Specimens similar to the above but up to 16.5 mm. diameter, are in the Carnegie Museum (no. 7707) from Booneville, Dallas County, Iowa. Thomas Say, it will be remembered, "also found it near Council Bluff."

***Triodopsis fosteri hubrichti* (F. C. Baker)**

Fig. 487 g.

Polygyra appressa hubrichti Baker, 1937, *Nautilus*, 51: 23.

"Shell differing from typical *appressa* in its much greater size, more elevated spire, rounded aperture, and general gibbous form. The parietal lamella is long, curved, end extends to the umbilical region as in the typical form. Basal tooth of peristome usually well developed, but the upper denticle of race *fosteri* rarely developed. Sculpture of fine lines of growth. Diameter 25.5; height 14.5; Ap. diam. 10.0; height 7.0 mm." (F. C. Baker.)

ILLINOIS: Valmeyer, Monroe County, in pink loess of Sangamon age (Leslie Hubricht). Type P6629 Museum of Natural History, University of Illinois; paratypes 168631 A.N.S.P. and A1562 collection of L. Hubricht.

MISSOURI: Loess of St. Louis County (Hubricht).

This race is distinguished only by its large size, which intergrades in a small number of specimens with *T. fosteri*.

"Typical *appressa* [= *T. fosteri missouriensis*] is rare in these deposits, only two specimens having been noted among fifty of the new race. In size *hubrichti* is the largest form of the *appressa* group. . . There is considerable variation in size among the 50 specimens of *hubrichti* from Valmeyer, about a dozen specimens ranging from 19 to 21 mm. in diameter." (Baker.)

Subgenus NEOHELIX Von Ihering

Neohelix H. von Ihering, 1892, Zeitsch. f. Wissensch. Zool., 54: 482.—Pilsbry, 1930, Proc. Acad. Nat. Sci. Phila., 82: 326, *Helix albolabris* Say designated type.

Capacious, depressed or depressed-globose, imperforate shells with rather large, lunate aperture, toothless or with a parietal tooth and sometimes a low, blunt prominence of the basal lip near the columella. Embryonic whorls are radially striate below the suture or practically smooth throughout. Later whorls striate, with minute spiral lines.

Genitalia (Fig. 488) as described for the genus; in addition, the penis has minutely wave-wrinkled or densely papillose inner walls and a single

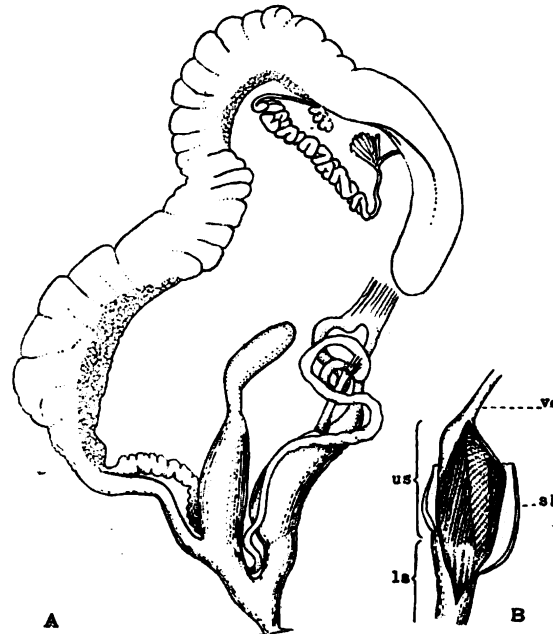


Fig. 488. *Triodopsis albolabris*, Sundale, Bucks Co., Pennsylvania; at B, the penis opened. ls and us, lower and upper sacs of penis; sh, sheath; vd, vas deferens.

strong pilaster in the upper cavity, numerous longitudinal ridges in the lower. The vas deferens is unusually long, disposed in loops or coils.

The shell in *Neohelix* has no superspecific character differentiating it from *Mesodon*, and the species have hitherto been referred to that group. On account of the divergence from *Triodopsis* in apertural formation, it might not be far amiss to rank *Neohelix* as a genus, but I have found no sufficient anatomical distinction.

Neohelix was proposed by Von Ihering as a genus "für die bisher zu *Helix* gestellten Subgenera: *Polygyra*, *Stenotrema*, *Triodopsis* und *Mesodon*." No type was mentioned. It was a blanket name, covering these groups in the same sense that *Polygyra* has been used in recent years. In 1930, I gave *Neohelix* definite significance by designating *Helix albolabris* Say as its type.

Some of the few species are among the commonest and most widely spread of the larger helices of the eastern United States.

Triodopsis albolabris (Say)

Fig. 489: 2-6, 8.

Helix albolabris Say, 1816, Nicholson's Encycl., 1st Amer. Edit., art. Conchology, sp. no. 1, pl. 1, fig. 1.—Binney, 1851, Terr. Moll., 2: 99, pl. 2.—Leidy, Terr. Moll., 1: 252, pl. 6 (anatomy).—Shuttleworth, 1878, Notitiae Malac., 2: 11 (text by Fischer), pl. 8, fig. 1, with var. *minor*, fig. 2.

Mesodon albolabris Say, Morse, Journ. Portland Soc. Nat. Hist., 1: 8.—W. G. Binney, 1878, Terr. Moll., 5: 317, pl. 2; pl. viii, fig. κ (teeth).

Polygyra albolabris Say, G. B. Simpson, 1901, Bull. N. Y. State Mus., no. 40, p. 243, pl. 1-14 (anatomy).—Wetherby, Nautilus, 9: 94 (sinistral).—Walker, 1906, Ill. Cat. Moll. Michigan, 1: 464; 1910, Proc. Acad. Nat. Sci. Phila., pp. 21-40 (variation in Michigan); 1928, Terr. Moll. Alabama, p. 30.—W. H. Krull, 1935, Pap. Mich. Acad. Sci., Arts and Letters, 20: 699 (eaten by frogs).

Polygyra albolabris goodrichi G. H. Clapp, 1916, Ann. Carnegie Mus., 10: 539, pl. 32, figs. 16-18.

Triodopsis albolabris Say, Beck, 1837, Index Moll., p. 22.

Mesodon albolabris var. *dentata* Tryon, 1867, Amer. Journ. Conch., 3: 39, pl. 7, fig. 6.

Polygyra albolabris var. *minor* Sterki, 1900, 8th Ann. Rep. Ohio State Acad. Sci., p. 31 (New Philadelphia, O.).

Helix albolabris var. *maritima* Pilsbry, 1890, Proc. Acad. Nat. Sci. Phila., p. 283, 3 figs. (shell, genitalia and teeth); 1892, Nautilus 5: 142.—Walker, 1906, Ill. Cat. Moll. Michigan, pt. 1, p. 465, fig. 13.—Cockerell, 1918, Nautilus, 31: 108 (Ram Island). Not *Helix* *maritima* Draparnaud, 1805.

Polygyra albolabris traversensis Leach. Pilsbry, Man. Conch., 9: 76, name only.—Walker, 1906, Ill. Cat. Moll. Mich., 1: 465, as synonym of *maritima*; 1910, Proc. Acad. Nat. Sci. Phila., p. 27.

[?] *Helix rufa* De Kay, 1844, Zool. New York, pt. V, Mollusca, p. 44, pl. 3, fig. 30 a, b (Rockland and Orange counties, N. Y.). Cf. *Helix thyroides* var. *rufa*, E. Michener, 1866, Amer. Journ. Conch., 2: 53. Not *Helix rufa* Draparnaud, 1805.

Polygyra redii J. B. Henderson, 1927, Index to The Nautilus, pp. 341, 358.¹

¹ "Redii" was a nickname used in the field for the roseate *T. albolabris* of Cade's Cove, Tennessee (Ferriss, Nautilus 12: 98). It is not a Latin word, was not intended for a scientific name, and was not printed in italics or used in combination with a generic name by Ferriss. The compiler of the Nautilus Index had small excuse for in effect basing a new binomial term on Ferriss' little pleasantry.

The depressed-globose shell is imperforate, rather solid, typically cream-buff to chamois colored (but often cinnamon-buff, becoming darker above to a russet apex). Surface nearly matt. Embryonic shell with a band of fine striae radiating below the suture, elsewhere smooth. Later whorls with sculpture of fine oblique striae and minute, crowded, incised spiral lines. The wide white peristome is flatly reflected, the columellar margin straightened or slightly convex within, with a shallow notch near the insertion.

Height 16 mm., diameter 25.5 mm., 5½ whorls. Philadelphia.

Height 17.5 mm., diameter 28 mm., 5½ whorls. Philadelphia.

Height 18.7 mm., diameter 31 mm., 5¾ whorls. Philadelphia.

QUEBEC: Levis (Abbe Provancher). Hull, Ottawa Co. (G. E. Fairbairn).

ONTARIO: Ottawa (Latchford) west to Mackay Lake, Algoma District (G. E. Fairbairn) and south to Lakes Ontario and Erie; seen from the following counties and districts also: Elgin, Essex, Halton, Huron, Kent, Knox, Norfolk, Peel, Ontario, Russell, Simcoe District, Welland, Wellington, Wentworth and York.

UNITED STATES: From Aroostook County, Maine, south to Georgia and west to the states bordering on the Mississippi River; absent on the Gulf coastal plain.

We did not find *albolabris* high on the mountains in the southern Appalachians, and in this region it probably does not ascend over 2500 feet, if so high as that, being confined to the coves.

This snail is usually more abundant and somewhat more solid on limestone terrains, but not larger than on acid soils. Thus a lot from the Wissahickon gneiss, Philadelphia, measures 23.5 to 31 mm. in diameter, some of them dentate. In the Tannersville valley, Catskill Mountains, New York, a sandstone region where shells are scarce, the diameter runs from 30.5 to 33.1 mm. A lot from the limestone foothills of Martin's Mt., Cumberland County, Maryland, 23 to 26.2 mm. in diameter. There is pronounced dwarfing, however, on extremely sandy soils, as in the form *traversensis* (*maritima*).

In Quebec, Ontario, New England, New York and Pennsylvania, also Maryland and most of Virginia, the shells do not vary significantly from the typical form of southeastern Pennsylvania (Figs. 489: 3). In Ohio, Michigan, Indiana and Illinois, they are often somewhat larger, up to 35 mm. in diameter (Joliet, Ill.), but small shells occur locally, down to 23 mm. (Starved Rock, Ill.). Bryant Walker, 1910, has studied a large Michigan series. He concludes that 24.5 mm. diameter is the dividing point between the minor forms known as *traversensis* or *maritima* and *albolabris* proper. The smaller shells occurring among the latter are individual and not racial diminutives.

A form with the lip very broad (nearly or quite 4 mm.), occurs in Lee County, Virginia, the diameter from 32 to 39 mm. (Fig. 489: 4, 5); some specimens from Craig County, West Virginia at 4000 feet, and Natural Bridge, Virginia, and Breathitt County, Kentucky, are similar.

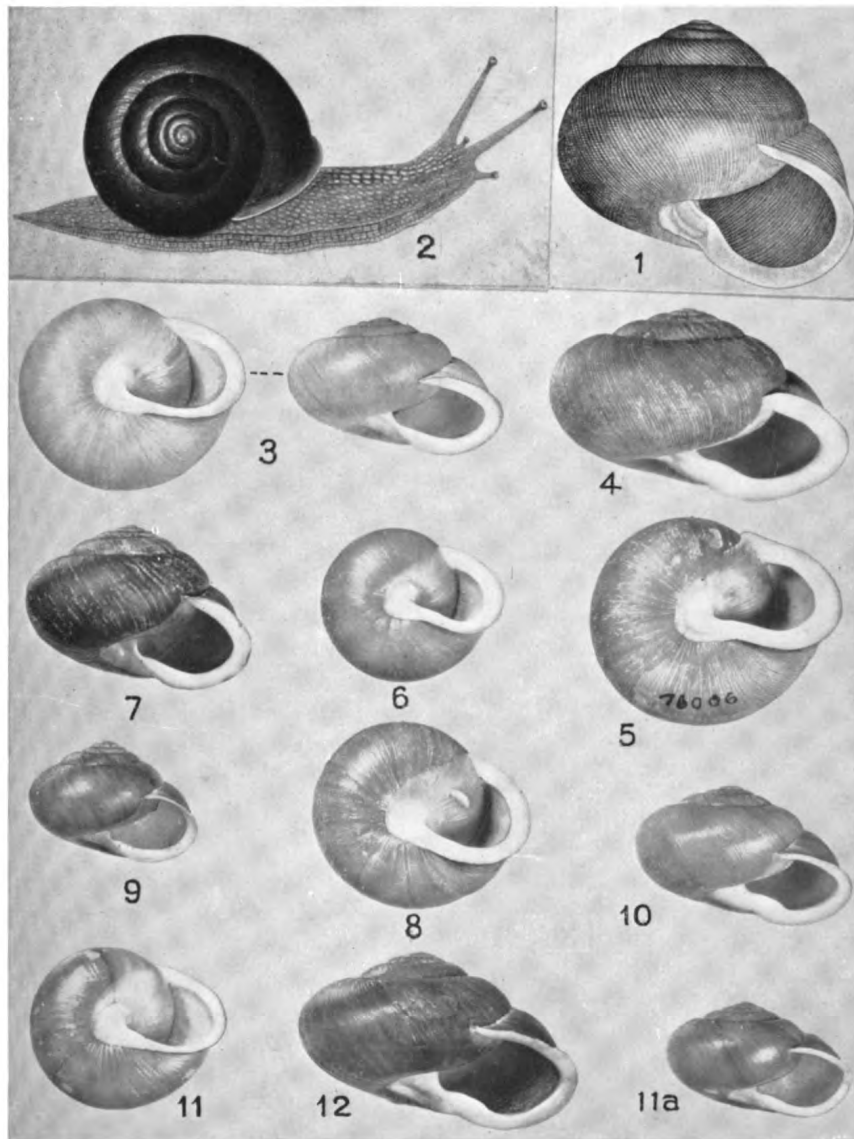


Fig. 489. 1, *Triodopsis albolabris major*, after Binney. 2, *Triodopsis albolabris*, after Binney; 3, *T. albolabris*, neotype, Philadelphia; 4, 5, Lee Co., Va.; 6, Foul Rift, N. J. 7, *T. albolabris goodrichi*, paratype. 8, *T. albolabris* mut. *dentata*, Summit Co., O. 9, *T. albolabris traversensis (maritima)*, Cape May, N. J. 10, *T. albolabris alleni*, Magazine Mt., Ark.; 11, 11 a, Hardy, Ark. 12, *T. albolabris fuscolabris*, type, Woodville, Ala. (Fig. 2 photographed abnormally dark.)

In Kentucky, very thin, light shells were collected at Pine Mountain, Harlan County by Witmer Stone, and Quicksand, Breathitt County by W. D. Funkhouser. By the texture and dilute ecru-olive color they resemble *Mesodon andrewsae intermedius*, but the form is somewhat more depressed, as in *T. albolabris*. Further investigation and dissection of these forms is desirable.

In east Tennessee large, solid specimens of 32 to 36 mm. have sometimes been taken for *T. albolabris major*. In Cade's Cove, east of Knoxville, the shells often have beautiful texture, the microscopic sculpture being sharply developed. Many of them when collected, blush with a lovely rose tint above, the base pale yellow, but this fades to cinnamon-buff in a few years. The shells of northern Alabama also are frequently large for the species. The typical cream-buff to chamois color is replaced by cinnamon-brown or even almost walnut brown in some North Carolina localities.

I have seen typical *T. albolabris* from west of the Mississippi only from Winfield, Henry County in southeastern Iowa. Owing to the frequent cutting of "ox-bows" by the Mississippi, and the consequent transfer of islands from one side of the stream to the other, the river is no bar to the distribution of snails inhabiting lowland forests.

The h/d varies individually. In Philadelphia a lot of 28 from near mouth of the Wissahickon have indices varying from 60 to 74.38, the average 67.29. In a lot from Carroltown, Columbia County, Pennsylvania, from about 60 to 75. A strongly depressed shell from Henry Valley, Perry County, Pennsylvania, only 55.5, others in the same lot up to h/d 62, all dentate. Walker (1910) found an average h/d index of 66 in a Cincinnati lot of 152. In the Michigan series from many localities the average index was 67, the extremes 59 and 75.

Helix rufa De Kay was a young shell of rufous color which had not formed the lip; whether *albolabris* or *thyroidus* is uncertain in the absence of the type, and of little importance if known.

Mut. dentata Tryon (Fig. 489: 8), has a small obliquely set tooth on the parietal wall. Such individuals occur among the toothless ones in most places where *T. albolabris* is found. Tryon's type, no. 11199 A.N.S.P., is labelled Ohio.

Several sinistral specimens have been reported.

Measurements of the genitalia drawn in Figure 488 follow: Length of penis 12 mm.; retractor muscle 3 mm.; vas deferens 56 mm.; spermatheca and duct 15 mm.; diameter of shell 29.5 mm.

Form *traversensis* "Leach" Walker (*maritima* Pilsbry, not Draparnaud), (Fig. 489: 9, Cape May, New Jersey). The shell is much smaller than *albolabris*, thinner, pale olive buff, the early whorls sometimes ruddy;

minute sculpture well developed; base sometimes swollen back of the lip, near the axis. Lip more narrowly reflected. Vas deferens shorter, its lower portion not kinked or thrown into folds as it is in *albolabris*.

Height 15 mm., diameter 22 mm. Cape May, New Jersey.

Height 12 mm., diameter 21 mm. Huntington, L. I., New York.

Height 16.4 mm., diameter 24 mm.; $5\frac{1}{2}$ whorls. Sea Cliff, L. I., New York.

MAINE: Brown Cow Island, Casco Bay.

MASSACHUSETTS: Ram Island.

NEW YORK: Sea Cliff, Huntington, and Orient, L. I.; Staten Island.

NEW JERSEY: Somer's Point, S. Atlantic City, Ventnor, Longport, Ocean City, Sea Isle City, Townsend's Inlet, Avalon, Peermont, Stone Harbor, Anglesea; Cape May, Type of *maritima* 101724 A.N.S.P.

VIRGINIA: Old Point Comfort.

NORTH CAROLINA: Fairfield.

MICHIGAN: Traverse City (M. L. Leach, Bryant Walker), at Douglas Lake, Cheboygan Co. (H. B. Baker), and Keweenaw Co. (Goodrich).

This form seems to be the result of the conditions of growth in thickets growing among sand dunes and on the higher spots in salt marshes. The Atlantic coastal form is almost identical with shells from the similarly sandy region in northwestern Michigan, known as var. *traversensis* Leach. It is not likely that the Atlantic coast and Michigan stocks are directly related, but rather that they are derived independently from the normal *P. albolabris* in each of the isolated colonies.

At Cape May the back and tentacles are dark, livid brown, fading to fawn color on the sides of the foot and the tail. The color varies individually; in some the fawn shade predominating, in others the darker hue. The mantle under the shell has rather small and very irregular black spots. The color is darker than is usual in *T. albolabris*.

Var. *minor* Sterki seems to be a similar form from Ohio. It was described as "a small, thin-shelled form found at New Philadelphia on the bank along the river." The name is preoccupied.

Triodopsis albolabris form *goodrichi* Clapp (Fig. 489:7) was thus described: "Shell elevated, heavy, dark chestnut-color, having a reddish cast when alive, lip brownish in immature shells and flesh-colored in adults. Whorls five and one-half. Compared with the average *albolabris* of the region the lip is narrower and less flattened, and the aperture is slightly more rounded and less oblique. One shell collected by Dr. Walker is dentate, and one in my collection very faintly so." (Clapp.)

Height 22 mm., diameter 30 mm.; h/d index 73.33. Largest.

Height 17 mm., diameter 25.5 mm.; h/d index 66.67. Smallest.

Height 22.5 mm., diameter 28.5 mm.; h/d index 78.95. Highest.

Height 16 mm., diameter 26 mm.; h/d index 61.53. Lowest.

Height 21 mm., diameter 29 mm.; 6 whorls. Paratype figured.

ONTARIO: Middle Sister Island, Lake Erie (Clapp, Walker & Goodrich), Type 7465 Clapp Collection, Carnegie Museum. Also on North Harbor Island.

"The color is so distinct and the shells so much more elevated than normal, that I consider it worthy of varietal rank and take pleasure in associating with it the name of Calvin Goodrich, of Toledo, Ohio, who has done much good work on the molluscan fauna of that most interesting island region." (Clapp.)

The color varies from cinnamon to tawny on different parts of the same shell. It is a feebly differentiated but rather conspicuous local race, of especial interest as showing how racial divergence may rapidly begin in a small, isolated colony.

Triodopsis albolabris alleni ('Wetherby' Sampson) Fig. 489: 10, 11, 11 a.

Mesodon albolabris and var. *minor* Wetherby, 1881, Journ. Cincinnati Soc. Nat. Hist. 4: 332 (Eureka Springs, Ark.). Not *Helix albolabris* var. *minor* Shuttleworth.

Mesodon albolabris Say, Sampson, 1885, Bull. Sedalia Nat. Hist. Soc., no. 1, p. 19 (Sedalia, Mo.).—Call. Bull. Washburn Coll. Lab. Nat. Hist., 1: 55 (Topeka; Silver Lake, Shawnee Co.; Labette Co., Kans.).

Mesodon albolabris Say, var. *alleni* Wetherby, Sampson, 1883, Kansas City Rev. Sci., 6: 24; 1887, Amer. Nat., p. 84; 1893, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 189, 190 (first description); 1913, Trans. Acad. Sci. St. Louis, 22: 91.

Polygyra albolabris alleni Weth., Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 451; 1903, *ibid.*, p. 197; 1907, *ibid.*, p. 552.—Hanna, Nautilus, 23: 82.

The cream colored shell differs from *T. albolabris* by being more depressed and more glossy, and the sculpture is weaker; the lip is narrower, its face rounded rather than flat, with a weaker, less angular rib within; the low baso-columellar "tooth" is often more pronounced.

Height 16.3 mm., diameter 25.4 mm. Eureka Springs, Ark.

Height 17.2 mm., diameter 28.5 mm. Sedalia, Mo.

Height 19.2 mm., diameter 31.5 mm. Jefferson Co., Ark.

Height 13.2 mm., diameter 20.7 mm. Kansas City, Mo.

Height 16.3 mm., diameter 26.5 mm. Des Moines, Ia.

Height 18.7 mm., diameter 30.4 mm. Mena, Ark.

MINNESOTA: Albert Lea, Freeborn Co.

IOWA: Des Moines. Sawyer Station, Lee Co. Winfield, Henry Co.

MISSOURI: St. Louis. Sedalia, Pettis Co. Kansas City. Providence. Seligman and Monet, Barry Co. Chadwick, Christian Co. Recorded by Sampson also from Jefferson City, Cole Co. McAllister Springs, Saline Co. Camden Co. Morgan Co. Warsaw, Benton Co. Columbia, Boone Co. Barry Co. Scott Co. Madison Co. Shepard Mt. Iron Co. Cape Girardeau, Cape Girardeau Co. Galena, Stone Co. River Bluffs, Moniteau Co. Birmingham, Clay Co. Bethany, Harrison Co. St. Charles Co.

KANSAS: Quenemo, Osage Co. Shawnee Co. Douglas Co.

OKLAHOMA: Fort Gibson, Muskogee Co. Tushkahoma and Stanley, Pushmataha Co. Wyandotte, Ottawa Co. Sugarloaf Mt., Leflore Co.

ARKANSAS: Rogers, Benton Co. Eureka Springs, Carroll Co. Mammoth Spring, Fulton Co. Arkansas R. 30 mi. south of Pine Bluff, Jefferson Co. Blue Mt. Station

and Magazine Mt., Logan Co. Helena, Phillips Co. Mena, Polk Co. Carrion Crow Mt., Pope Co. Little Rock, Pulaski Co. Potean Mts. south of Gwynn, Sebastian Co. Hardy, Sharp Co. Sulphur City, Washington Co. Sampson recorded it also from Benton, Crawford, Garland, White, Johnson, Nevada, and Independence counties.

ILLINOIS: Mississippi bluffs at Warsaw, Hancock Co. (F. C. Baker).

TENNESSEE: Chattanooga (S. N. Rhoads).

This widespread race of *T. albolabris* varies in size and color almost as much as the eastern form of the species, but in a broad view is distinguishable from the latter by its more depressed figure and glossy surface. The color varies to honey yellow in some lots. Some Arkansas lots vary notably in size: at Sulphur City from 17.6 to 29.7 mm. in diameter, and at Mena from 18.7 to 30.4 mm. Sampson reported a specimen of 32 mm. from Scott County.

Two large specimens from the north side of Magazine Mountain show a parietal tooth. We do not remember seeing this tooth developed in this trans-Mississippian race of *albolabris* elsewhere.

The largest specimens were taken on steep, damp and rocky northern slopes, without reference to elevation. At Wyandotte specimens of 25 to 30 mm. live at an elevation of about 900 feet above the sea on the steep, rocky bluff facing the river. At Magazine Mountain the series of large shells, 27 to 31 mm. diameter, came from the edges of the talus, just under the great sandstone cliff along the northern side of the plateau summit, at an elevation of about 2700 feet; while at an equal elevation on the dry south side, with the same sort of rock and abundant cover, the shells were small, 25 mm. in diameter, and at the base of the mountain still smaller, 24.5 mm. At Chadwick, where the country rock is limestone, the individuals are small, 22 to 25 mm., but it is a rather high, dry country.

Specimens of *T. a. alleni* from Albert Lea, Minnesota, the most northern point from which I have seen the variety, those from Winfield, Henry County, in southeastern, and Des Moines in central Iowa, are pale cream or whitish, small, averaging 23 mm. in diameter; 70 per cent of those seen measuring from 22 to 24 mm., the extreme of size being 21 and 26 mm., these extremes represented by very few specimens. This contrasts strongly with the conditions in western Arkansas, southwestern Missouri and Oklahoma, where in many localities there is a very much wider variation in absolute size. Thus, in a series of 18 shells from Seligman, Barry County, southwestern Missouri, the variation is from 20½ to 30½ mm.; the smallest being smaller than the extreme of the Des Moines lot of 50 shells, while about 70 per cent of the shells are larger than the largest from Des Moines.

A small form of *albolabris* has been recorded from Daingerfield, Morris County, Texas, collected by Mr. W. L. McDaniel (J. A. Singley, Contrib. to Nat. Hist. of Texas, Mollusca, p. 305; Fourth Ann. Rep. Geol. Surv. of

Texas, 1892). If these are *alleni* it is the southern limit known. Mr. Singley reports that a colony of *T. albolabris* from North Carolina has been established by Mr. Askew at Tyler, Smith County, Texas.

About 1885 I "planted" about a quart of living *T. a. alleni* from Des Moines, Iowa, on the island of Rock Island, in the Mississippi River opposite Davenport, Iowa, where the species did not exist before. It does not occur in the vicinity of Davenport, nor around Iowa City, Iowa, or Rock Island, Illinois. The fate of this colony has not been reported.

(Named for C. C. Allen, 1862-1934. *Nautilus* 48: 31.)

***Triodopsis albolabris fuscolabris* (Pilsbry)**

Fig. 489: 12.

Polygyra albolabris fuscolabris Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 200.—Walker, 1928, Terr. Moll. Alabama, p. 31.—H. H. Smith, 1916, *Nautilus*, 30: 24 (distribution, color. status).

Polygyra fuscolabris Pils., H. E. Wheeler, 1916, *Nautilus*, 25: 123 (Monte Sano).

Similar to *T. a. alleni* in its depressed last whorl, brilliant gloss and fine striation. Ochraceous buff colored. The aperture is strongly oblique, about 40° with the axis. The outer lip is less flattened than in *albolabris*, not so wide, and typically pale pinkish-buff¹ (though white in some lots). The baso-columellar lip has a wide, low "tooth" (strongly or weakly developed).

Height 22.7 mm., diameter 36.3 mm.; 5½ whorls. Type.

Height 23 mm., diameter 38.3 mm. Paratype.

Diameter 31.8 to 35 mm. Monte Sano.

ALABAMA: Woodville (H. E. Sargent), Type 66304 A.N.S.P. Princeton, 12 mi. northwest of Stevenson (Walker); and Keel Mt., Paint Rock (Clench and Archer), Jackson Co. Monte Sano, Huntsville (Clench and Archer), Madison Co. (Also reported by Walker from Anniston, Calhoun Co.; Dugger Mt., Cleburne Co.; Wetumpka, Elmore Co.; Little Bear Creek, Nauvoo, Franklin Co.; all doubtful records).

TENNESSEE: Rocky Falls, Pea ridge, 6 mi. south of Fayetteville, Lincoln Co. H. H. Smith).

H. E. Wheeler and H. H. Smith are disposed to treat this as specifically distinct from *albolabris*. They found no intergradation where both occur in Alabama. Mr. Wheeler writes of it as follows: "The racial validity of this species impresses the collector more than it would the student within doors. It is a shell of the mountains, choosing the crevices of large rocks and cave entrances preferably, though sometimes found under logs. It is not easy to bridge the gap between this and *albolabris* by a series collected in the same locality. The pink lip, however, is not a constant character, being nearly as often white as pink. But its larger size, splendid symmetry and richer color readily endorse it for specific rank."

This beautiful snail inhabits the Cumberland Plateau and its outliers in northern Alabama, a calcareous region, but according to Walker, who recorded H. H. Smith's collections, also occurs as far south as Wetumpka. The Tennessee specimens came from near the Alabama line.

¹"Tinted fleshy brown" I called it when describing fresh specimens. They fade in the cabinet.

It differs from *T. albolabris alleni* mainly in size, color and greater solidity. The areas of the two would seem well separated were it not that I have a shell of 28.3 mm. in diameter from near Decherd, Franklin County, southern central Tennessee, from A. G. Wetherby, which I cannot distinguish from trans-Mississippian *alleni*.

I noted no difference from *albolabris* in the genitalia.
(*Fuscolabris*, brown-lipped.)

Triodopsis albolabris major (Binney)

Fig. 489: 1.

Helix major Binney, 1837, Boston Journ. Nat. Hist., 1: 473, pl. 12; 1851, Terr. Moll., 2: 96, pl. 1.—W. G. Binney, 1876, Proc. Acad. Nat. Sci. Phila., p. 189, pl. 6, fig. 1 (genitalia).—Bland, 1858, Ann. Lyc. Nat. Hist. N. Y., 6: 359, as var. of *albolabris*.

Mesodon major Binn., W. G. Binney, 1878, Terr. Moll., 5: 316, pl. 1, pl. viii, fig. c (teeth); Third Suppl., Bull. Mus. Comp. Zoöl., 19: 190, pl. 1, figs. 2, 3 (teeth).—Gratacap, 1901, Bull. Amer. Mus. Nat. Hist., 14: 383.

Polygyra albolabris major (Binn.), Archer, 1932, Nautilus, 46: 40.—Walker, 1928, Terr. Moll. Alabama, p. 32, fig. 36.—H. H. Smith, Nautilus, 30: 24.

“Compared with *H. albolabris*: It is much more globose, of a coarser and more solid texture, and the striae of increase are much more raised and prominent, so much so, indeed, as to leave distinct grooves between them. The revolving striae, so distinct on that shell, are either wanting or very indistinct. The aperture is smaller in proportion to the size of the shell, less flattened towards the plane of the base, and more rounded. The pillar lip and umbilicus are in many instances covered with a smooth and shining, semi-transparent, testaceous callus. The margin of the lip is thickened, the lip itself is narrower, less abruptly reflected, and not so much flattened, and there is often a tooth-like process on the inner and upper side of the margin near the umbilicus. The color of the epidermis is generally much darker.” (Binney, 1851.)

Greatest diameter $1\frac{1}{2}$ inches (Binney, 1837); $1\frac{3}{4}$ inches. (Binney, 1851.)

Height 31 mm., diameter 43 mm. Georgia.

Height 32 mm., diameter 39.5 mm. Georgia (Terr. Moll., pl. 1).

GEORGIA: Burke, Decatur, Early, Fulton, Monroe, Pulaski and Thomas counties.

ALABAMA: Barbour, Cherokee, Crenshaw, Jackson, Talladega, Chambers, Conecuh, Elmore and Marion counties (Walker).

Coastal North Carolina, to coastal South Carolina (Santee Swamp), coastal and central Georgia, northern Florida and eastern Alabama (Archer).

The narrower peristome of *major* is mentioned by Archer as diagnostic. The other characters he adduces, “axial striae crowded, and fold-like spiral lines almost absent or completely obsolete”, do not seem significant; the spirals are often as well developed as in *albolabris*. A wide low columellar “tooth” is often developed, but none have the parietal tooth occasionally present in *albolabris*.

North Carolina specimens seen are rather hard to differentiate from large *albolabris*. In South Carolina, I have seen *major* from Abbeville, Sassafras Mt., Pickens County and Eutaw Springs, St. Johns, Berkeley

County; all 31 to 35 mm. diameter. Those from Santee Swamp are typical *major*, solid, buckthorn brown, measuring 28.5 x 39 mm., and 33 x 39 mm. In Florida it must be confined to the Georgia border; I know no definite locality.

Occasionally very high specimens are found, one measured having h/d index 81. The usual proportions do not differ from *albolabris*.

According to W. G. Binney the teeth and genitalia of *major* are the same as in *albolabris*. Binney (Bull. Mus. Comp. Zoöl., 19: 192) stated that "the original specimen of *major* of the Terrestrial Mollusks was included in the collection given by Mr. J. S. Phillips to the Philadelphia Academy." It is no. 11212, from Georgia, credited on the label to Dr. Binney. Binney's figure is reproduced in our Figure 489: 1. This specimen measures 32 x 39.5 mm. Another on the tray with it 33 x 45.3 mm.

The present location of the specimen figured as *H. major* in the Boston Journal is unknown. W. G. Binney (*l. c.*, p. 191) appears to think it a large *albolabris*. It measured 40 mm. in diameter according to the figures, one inch and a half (about 37.5 mm.) according to the description. As Dr. Binney's account was based upon several specimens from "Georgia, Alabama and Florida", that figured in the Boston Journal is not necessarily the type, and it appears permissible to choose as type the Georgia specimen he figured subsequently, preserving the traditional identification.

Dr. Binney referred to *Helix albolabris* var. *maxima* Férussac, pl. 43, fig. 4 and pl. 44 (should be 44A) fig. 7. These figures are what is regarded as true *major*; but evidently Férussac meant "*H. albolabris*, largest variety," and was not using *maxima* as a name, in the Explicatio Tabulorum, 1822.

Triodopsis dentifera (Binney)

Fig. 490.

Helix dentifera Binney, 1837, Boston Journ. Nat. Hist., 1: 494, pl. 21; 1851, Terr. Moll., 2: 134, pl. 12.—Morse, 1867, Amer. Nat., 1: 99, figs. 6, 7; 1861, Journ. Portland Soc. Nat. Hist., 1: 9.—Hanham, 1896, Nautilus, 10: 99.—Latchford, 1890, Ottawa Nat., 4: 57; 1892, *ibid.*, 6: 118.

Mesodon dentifera Binn., W. G. Binney, 1878, Terr. Moll., 5: 328, pl. 12; pl. viii, fig. J (teeth).

Mesodon dentiferus Binney, var. *major* Ancy, 1887, Conchol. Exch., 1: 55 (diam. 28 mm.; North Carolina).

Polygyra dentifera (Binn.), Banks, Nautilus, 5: 139.—Johnson, 1915, Fauna of New England, 13, Mollusca, p. 196; Nautilus, 21: 106.—Nylander, Nautilus, 13: 103.—J. B. Henderson, 1907, Nautilus, 20: 97.—Witmer Stone, 1912, Nautilus, 25: 113.

The shell is imperforate, depressed, thin, ecru-olive. The embryonic 1½ whorls have radial striae below the suture, short at first, but later extending half across the whorl. Subsequent whorls are not glossy, finely striate, with very minute wrinkles parallel to the striae, cut by spiral lines. The last whorl is rounded at periphery, descending slightly in front, and is contracted behind the lip. The white peristome is rather broadly, flatly reflected, thickened at the inner edge. Parietal callus transparent, bearing a short, obliquely set tooth.



Fig. 490. *Triodopsis dentifera*: a, Cazenovia, N. Y.; b, Oliverea, N. Y.; c, Banners Elk, N. C.

Height 12.3 mm., diameter 21.5 mm.; 5 whorls. Vt.; from A. Binney.

Height 16.5 mm., diameter 28.4 mm.; 5½ whorls. Jennings, Md.

Height 11.4 mm., diameter 20 mm. to 12.4, 23 mm. Chittenango Falls, New York.

Diameter 19.9 to 24 mm. Quebec.

QUEBEC: Lac aux Sables (Dr. Wm. Hughes); Casselman; Montreal to Isle d'Orleans, Quebec, and south to Knowlton (Latchford).

ONTARIO: Ottawa (Latchford).

MAINE: Caribou, Woodland (Nylander). Capens, Moosehead Lake; Bethel (Johnson).

NEW HAMPSHIRE: Fitzwilliam (Johnson).

VERMONT: Eastern slope of Green Mountains, type locality, and Strafford (A. Binney); Mt. Ascutney (Johnson).

MASSACHUSETTS: Chester; North Adams.

NEW YORK: Whiteface Mt. at about 2000 ft., Essex Co. (Pilsbry). Buffalo (Lewis); Springville (Letson), Erie Co. Ossian, Livingston Co. (S. Smith). Cayuga Lake region, Tompkins Co. (Banks). Cazenovia and Chittenango Falls, Madison Co. (Henderson). Oneida Co. (Binney). Litchfield (Lewis). Winfield (Beecher), Herkimer Co. Delaware Co. (Amer. Mus.). Near Hartford, Washington Co. (Jewett). Tannerville valley (Pilsbry); near Kaaterskill Junction, and summits of Plateau and Hunter mountains (E. A. Mearns), Greene Co. Near Summit (Bicknell); Oliverea (J. Bequaert), Ulster Co.

PENNSYLVANIA: Bradford (W. E. Burnett); Port Allegheny (H. W. Fowler), McKean Co. Near Raymonds, Potter Co. (Fowler). Round Island, Clinton Co. (W. Stone). Shady Nook (W. Stone); Ganoga Lake (S. Brown); Eaglesmere (Pilsbry), Sullivan Co. Crane Swamp and Bellasylva, Wyoming Co. (Stone). Pocono Manor, Monroe Co. (J. L. Baily). Allegheny Co. (Stupakoff). Indiana, Indiana Co. (R. W. Wehrle). Cresson (W. G. Binney); Carrolltown (Stone), Cambria Co. Laurel Ridge, Somerset-Fayette Co. Henry Valley, Perry Co. (W. L. Abbott).

MARYLAND: Jennings, Garrett Co. (W. Stone); near Bittinger (J. B. Clark), Garrett Co.

WEST VIRGINIA: Wirt Co. (Wm. J. Fox).

VIRGINIA: Mountain Lake, Giles Co., about 4000 ft. (P. P. Calvert).

SOUTH CAROLINA: Banners Elk, Watauga Co. (Mrs. Geo. Andrews).¹

¹ *Helix dentifera* was reported from Ohio by A. Binney, but Sterki (1907) had not seen it in that state, and the old Cincinnati record was discredited by Harper and Wetherby in their Catalogue of 1876. R. E. C. Stearns, 1893, reported it from Washington, Mississippi (Proc. U. S. N. Mus. 16: 749), but Dr. Paul Bartsch informs me that this specimen, no. 125602 U.S.N.M., is a low-spined example of *Mesodon thyroides bucculenta* (Gould).

A Canadian Zone and Alleghenian species, thinner and much more depressed than *T. albolabris*. In shape it is like *T. multilineata*, but differs by the constant presence of a parietal tooth, the usually flatter and wider lip, and the very minute wrinkling of the surface, as well as by the sculpture of the first whorl.

In the north, *T. dentifera* often lives at low levels, though everywhere it prefers broken or mountainous country. At Quebec, Justice Latchford and Mr. Hanham found it plentiful on the cliff of Orleans Island having northern exposure, among rank vegetation where there is moist shaly rock among the dead leaves. Around Cayuga Lake it lives in "very dark, cold, wet swamps" according to Nathan Banks. In the Adirondacks and Catskills it occurred in moderately humid places with leafy cover and on evidently acid soils.

Binney gave the diameter as "about three-quarters of an inch." The usual size in Canada, New England, New York and Pennsylvania is 20 to 24 mm., but larger shells occur in a few places, Dr. Clapp possessing one of 30.5 mm. from Ossian, New York. In southern Pennsylvania, West Virginia and North Carolina, the diameter is often up to 27 mm.

In the specimen of *dentifera* drawn (Fig. 491, Jennings, Md.) the penis is large owing to its very thick sheath, which extends nearly to the apex. The cavity is finely granose-ribbed longitudinally and its upper half is nearly filled by a large rounded pilaster. Below the sheath the small cavity

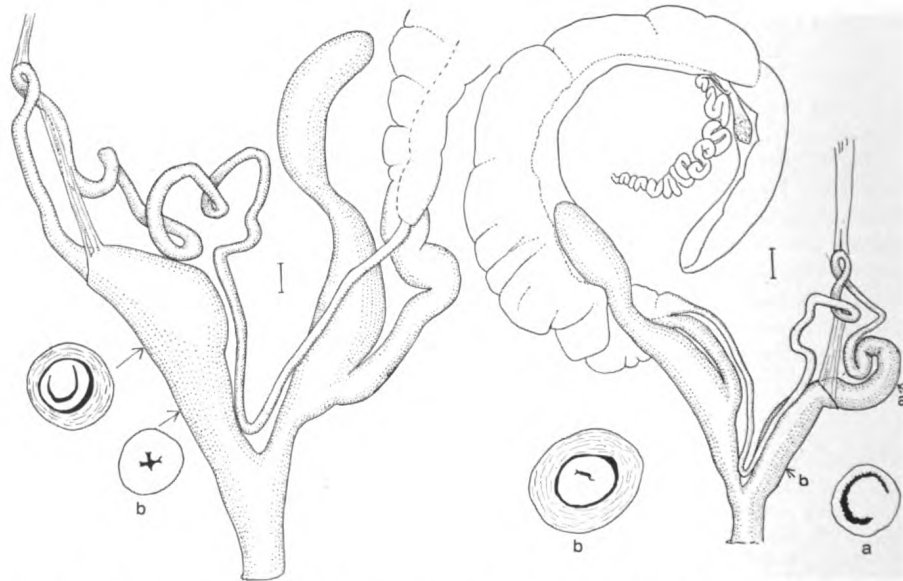


Fig. 491. *Triodopsis dentifera* Garrett Co., Md.; at *b* section of penis below sheath.

Fig. 492. *Triodopsis divesta*, Grand Cane, La. (Scale lines = 1 mm.)

has four longitudinal folds, as in the section at Figure 491b, and the walls are thick. Vas deferens is quite long, as usual in *Neohelix*, the retractor inserted on it, and not obviously connected with the retentor muscle. The oblong spermatheca has a strongly swollen duct, its thick walls being strongly folded longitudinally. Length, in mm., of penis 10, retractor 10, spermatheca 13, vagina 4; diameter of shell 27 mm.

***Triodopsis multilineata* (Say)**

Fig. 493.

Helix multilineata Say, 1821, Journ. Acad. Nat. Sci. Phila., 2: 150 (Illinois and Missouri).—Binney, 1851, Terr. Moll., 2: 103, pl. 3.—Leidy, Terr. Moll., 1: 254, pl. 8, figs. 1-6 (anatomy).—Binney, 1858, Proc. Acad. Nat. Sci. Phila., p. 203, with var. *albina* and var. *rufa*, *unicolor*. (Nude names).—Coues, 1871, Proc. Acad. Nat. Sci. Phila., p. 147.

Mesodon multilineata Say, W. G. Binney, 1878, Terr. Moll., 5: 320, pl. 3, pl. viii, fig. 1 (teeth).—Wetherby, Nautilus, 9: 94 (sinistral).

Polygyra multilineata Say, Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 93.—Walker, 1906, Ill. Cat. Moll. Mich., p. 466; Nautilus, 20: 81.—F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 116.—E. D. Crabb, 1928, Nautilus, 42: 35 (eating *Succinea*).—Chadwick, Nautilus, 19: 58.

Helix multilineata var. *alba* Witter, 1878, Quart. Journ. Conch., 1: 384. (Nude name).—Walker, 1906, Ill. Cat. Moll. Mich., p. 467.

Helix multilineata var. *rubra* Witter, 1878, Quart. Journ. Conch., 1: 384 (Muscatine, Iowa). Not *Helix rubra* Nardo, 1847.

Mesodon multilineata var. *alba* and var. *unicolor* Currier, 1868, Shell-bearing Moll. Michigan, p. 5. (Nude names).

Polygyra multilineata altonensis F. C. Baker, 1920, Nautilus, 34: 65; 1931, Journ. Paleontology, 5: 273. Cf. Shimek, Nautilus, 49: 124.

The shell is imperforate, depressed-globose, rather thin, ivory yellow or olive-buff, with few or many lines and bands of hazel to russet (or often of uniform colonial buff or hazel color). Surface rather glossy, the first 1½ whorls smooth, the rest with fine sculpture of oblique striae, rather weak

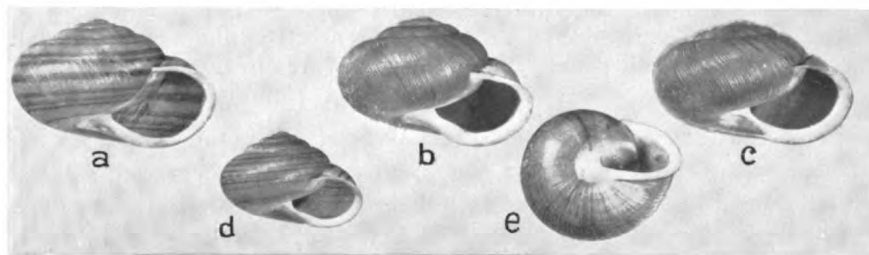


Fig. 493. *Triodopsis multilineata*: a, Iowa City, Iowa; b, Fort Madison, Iowa; c, Michigan. d, *T. multilineata* f. *algonquianensis*, topotype. e, *T. multilineata* f. *chadwicki*, type.

spiral engraved lines in their intervals. The spire is moderately elevated, h/d index usually 60 to 70. Peristome white or pink tinted, rather narrow with rounded face. Parietal callus typically plain (but often with a low, oblique tooth).

Height 18.5 mm., diameter 30 mm.; 5¾ whorls. Grand Rapids, Mich.

Height 14.3 mm., diameter 22 mm.; 5½ whorls. Grand Rapids, Mich.

Height 17.8 mm., diameter 25 mm. Fort Madison, Ia.

Height 14 mm., diameter 21 mm. Council Bluffs, Ia.

OHIO: "Over the state" (Sterki); Put-in-Bay Island.

MICHIGAN: North to Benzie and Osceola counties, and Menominee Co., in the Upper Peninsula (Walker).

WISCONSIN: Milwaukee (Chadwick).

INDIANA: South to the Ohio River.

ILLINOIS: South to the Ohio River.

MINNESOTA: West to Hennepin and Goodhue counties.

IOWA.

NEBRASKA: Eastern (Shimek). Omaha and Bellevue (Walker).

KANSAS: Wyandotte.

MISSOURI: Booneville, Cooper Co., on the Missouri R. (Sampson).

ARKANSAS: Helena (Shimek).

MISSISSIPPI: Vicksburg (Call).

In the loess, generally distributed from Indiana to Topeka, Kansas.

The thin texture and profuse or few hazel lines on a cream or slightly olive tinted ground are characteristic. In occasional shells some microscopic wrinkling in the direction of growth lines is visible, but usually it is almost smooth. While quite variable in marking and size, there are no definite races, though several ecologic forms have been named. A low parietal tooth is developed as an occasional individual mutation throughout the range of the species. Wetherby recorded a sinistral specimen.

Color mutations.—*Mut. rubra* Witter (Fig. 493 c). Dark bands are coalescent, producing a uniform hazel to mikado brown color. It occurs with the banded shells everywhere, but is locally abundant, as at Grand Rapids, Michigan. This is evidently "var. rufa, unicolor," of Binney, undescribed.

Mut. alba Walker (Fig. 493 b). "Unicolored, pale horn color [olive-buff] without bands." Occurs sporadically among banded shells. Why it was called *alba* is a mystery. This is apparently the undescribed var. *alba* Witter and var. *albina* Binney, first defined by Walker.

W. G. Binney, quoting Dr. Kirtland, writes: "Wet marshes are its principal resort, where, during summer, it may be seen climbing about on weeds and blades of grass, apparently endeavoring to avoid the water collected together beneath it. At the approach of winter it retreats to the tops of the carex-bogs, where several dozen may be found collected together in a torpid state, with the mouths of their shells closed with an epiphragm. They usually form a shallow excavation on the bog, concealed beneath the tufts of dead grass. The numbers collected in these retreats are sometimes agglutinated into one mass."

Near Iowa City *T. multilineata* occurred abundantly on weedy, willow covered islands which were submerged annually by the spring freshets.

Coues' record from the beach at Shakleford, Ft. Macon, near Beaufort, Carteret County, North Carolina, is enigmatic, since no other shell could well be mistaken for *multilineata*.

Form *altonensis* (F. C. Baker). "Shell differing from typical *multilineata* in being larger, the whorls more gibbous, the spire more depressed, and the sutures between the later whorls more deeply impressed; the last whorl begins to rapidly descend on the previous whorl until the upper part of the outer lip rests against the periphery, instead of above this point, as in *multilineata*; the deflection of the upper part of the whorl toward the aperture is also more abrupt, and forms a distinct shoulder at this point; the reflected lip is much heavier as is also the umbilical callus; the spiral color bands and lines are apparently much less numerous than in typical *multilineata*." (Baker.) Type and paratype measure 19.5 x 32 mm. and 15.5 x 28 mm.

It is from the lower ten feet of pink loess, plant No. 2 Mississippi Lime and Materials Co., Alton, Madison County, Illinois. Also reported by Hubricht from Monroe County, Illinois. Shimek found specimens from 25.5 to 29 mm. in diameter at the type locality and at another place in Alton, Illinois, and 24.5 to 32 mm. in loess at Helena, Arkansas. His measurements of recent *multilineata* include specimens 19 x 29 and 12 x 20.5 mm., Knox County, Indiana, 19 x 28.5 and 13 x 18 mm. from Muscatine, Iowa, from a series of 276. Witter gives 17 x 30 mm. for a Muscatine shell. These large shells, occurring sporadically in loess and recent faunas at widely separated places, are apparently ecologic forms, not true subspecies.

Triodopsis multilineata form *algonquinensis* Nason

Fig. 491 d.

Polygyra multilineata algonquinensis Nason, 1906, Nautilus, 19: 141.—Shimek, 1936, Nautilus, 49: 120.—F. C. Baker, 1922, Nautilus, 36: 21.

Polygyra multilineata wanlessi F. C. Baker, 1928, Nautilus, 41: 132; 1931, Journ. Paleont., 5: 273.

The shell is small, thin, varying from colonial buff to cinnamon brown, either uniform, or the lighter ones usually with cinnamon brown spiral lines and bands. Peristome narrow, white or pinkish.

Height 12.7 mm., diameter 18.2 mm. Lectotype.

ILLINOIS: Algonquin, McHenry Co. (Wm. A. Nason). Cotypes in collections of University of Michigan, Chicago Academy of Sciences, A. F. Gray and Academy of Natural Sciences of Philadelphia; Lectotype figured is 91193 A.N.S.P. Fulton Co., west of Havana, in Peorian loess (H. R. Wanless). Type of *wanlessi* P2358 Mus. Univ. Ill.

INDIANA: Loess of New Harmony (F. C. Baker).

WISCONSIN: Lake Winnebago region (F. C. Baker).

IOWA: Loess at Iowa City, Mason City and Council Bluffs (Shimek).

NEBRASKA: (Shimek).

Measurements by Dr. Nason of 228 of the 284 specimens collected follow: 14.5 mm., 2 specimens; 17 mm., 32; 17.5 mm., 24; 18 mm., 72; 18.5 mm., 41; 19 mm., 54; 21 mm., 3. "No larger specimens than those mentioned were found in the region, although the ground was well explored for many years. The specimens were all found in crevices and hollows about the roots of a clump of willows, growing in a marshy and boggy place." (Nason.)

I am wholly disposed to believe this snail an ecologic form, as Shimek held, and not properly a subspecies. The loess form, *wanlessi*, seems quite identical with the living *algonquinensis*.

The color variation of *algonquinensis* is the same as in large *multilineata*. Shimek has given measurements and other data on recent and fossil specimens, the latter from Fulton, Cass and Henderson counties, Illinois, St. Joseph, Missouri, Iowa City and Council Bluffs, Iowa, and eastern Nebraska. His collections show that living *algonquinensis* "seems to extend chiefly through the prairie region from northern Illinois and southern Wisconsin through northern Iowa and southern Minnesota to eastern Nebraska, in which it usually inhabits the thickets or groves which border the margins of prairie swamps—less frequently entering similar emerging places within the swamp itself. In the portion bordering the Mississippi and Missouri Rivers, however, this form grades into the larger type."

Polygyra multilineata wanlessi was thus described: "Shell differing from recent *multilineata* in being smaller, the body whorl somewhat gibbous, of greater diameter as compared with height, the aperture somewhat narrower, and the base flattened and indented about the umbilical region, which may be narrowly perforate or completely closed. It may be distinguished from variety *algonquinensis* Nason, by its usually larger size, more gibbous whorls, especially the body whorl, and the deeper indentation of the umbilical region. There are faint indications of color lines or stripes on a few specimens, but the majority were probably unicolorous as are some specimens of *multilineata* at the present time. Adults are usually imperforate but immature shells appear to be always umbilicated. Height 13.5, diameter 21.5 mm. Holotype. Height 11.1, diameter 18.5 mm. Paratype." (Baker.)

Shimek has discussed this form, which he believes indistinguishable from *algonquinensis*. Having series of both, I agree with his view. The fossil condition of *wanlessi* is about all that constantly separates them.

Triodopsis multilineata form *chadwicki* (Ferriss)

Fig. 493 e.

Polygyra multilineata chadwicki Ferriss, 1907, Nautilus, 21: 37.—Hanna, 1909, 23: 82.

The shell is uniform, deep colonial buff or cinnamon to clay color (rarely with faint darker spiral lines). Peristome narrower than in *multilineata* and rounded; parietal callus with a low tooth about 3 mm. long.

Height 13.5 mm., diameter 20.5 mm. Sometimes larger, diameter 25 mm.; or smaller, 18.3 mm., at Falls City, Nebraska.

KANSAS: Banks of the Kaw River, Lawrence (W. C. Chadwick); Type and paratypes 94052 A.N.S.P.

NEBRASKA: Falls City (F. V. Hayden).

The parietal tooth is absent in some apparently full grown shells. It is a weakly characterized race, or more likely an ecologic form, on the

extreme western border of the *multilineata* range. On an island in the Kaw River at Lawrence, the shells are similarly unicolored and indistinctly dentate, 22 to 25 mm. in diameter. Walker's Nebraska records belong here. At Omaha he found the diameter 20 to 20 $\frac{2}{3}$ mm; at Bellevue, 16 $\frac{2}{3}$ mm.

Triodopsis divesta (Gould)

Fig. 494.

Helix abjecta Gould, 1848, Proc. Boston Soc. Nat. Hist., 3: 40; 1851, Terr. Moll., 2: 122, pl. 13a, fig. 2. Not *Helix abjecta* Lowe, 1831.

Helix dejecta Gould, 1851, in Binney, Terr. Moll., 2: 91. Nude name. Not *Helix dejecta* Petit, 1842.

Helix divesta Gould, 1851, Terr. Moll., 2: [358], and Terr. Moll., 3: 27. Substitute for *H. abjecta* Gld.

Mesodon divesta Gld., W. G. Binney, 1878, Terr. Moll., 5: 319, pl. 13a, fig. 2; pl. xi, fig. j; pl. xvi, fig. v (anatomy).—Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 190.

Polygyra divesta (Gld.), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 200.—Pilsbry & Ferriss, 1907, *ibid.* for 1906, p. 551.—Sampson, 1913, Trans. Acad. Sci. St. Louis, 22: 92.

The shell is imperforate, depressed, rather thin, cream color, usually with a brownish or whitish growth-rest streak. Spire low, convex to low-conoidal. The initial 1 $\frac{1}{2}$ whorls are smooth with a zone of fine striae radiating from suture, at first quite short, but lengthening on the second whorl. The last whorl scarcely descends in front and is contracted behind the outer and basal margins of the lip. Surface dull, with regular sculpture of fine, strong striae, about as wide as their intervals, and under the microscope

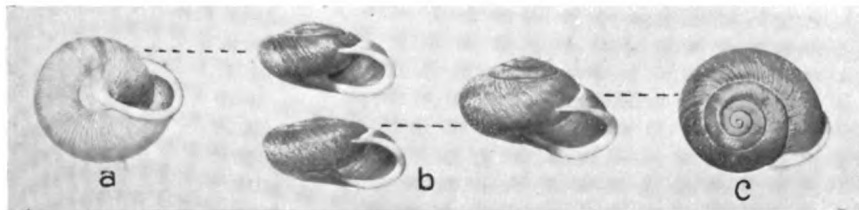


Fig. 494. *Triodopsis divesta*: a, Hot Springs, Ark.; b, c, Magazine Mountain, Ark.

showing traces of spiral impressed lines, varying from rather distinct to very weak. In places, especially near the umbilical callus, excessively minute spirals decussated by radial scratches are visible in well preserved examples. The broadly lunate aperture has a white lip, rather narrowly reflected throughout, thickened within, the sloping baso-columellar margin straightened or slightly in-bent. Parietal callus thin, toothless.¹

Height 9.6 mm., diameter 17.4 mm.; 4 $\frac{3}{4}$ whorls. Spec. from Gould.

Height 10.9 mm., diameter 19 mm. Spec. from Gould.

Height 13.8 mm., diameter 21 mm., 5 whorls. Magazine Mt.

Height 9.7 mm., diameter 18.9 mm., 4 $\frac{1}{2}$ whorls. Magazine Mt.

Height 11.2 mm., diameter 18.2 mm. Chadwick, Mo.

Height 8.4 mm., diameter 13.7 mm. Chadwick, Mo.

¹ In a large specimen from Magazine mountain there is a minute but distinct parietal tooth.

MISSOURI: Seligman, Barry Co. (Ferriss). St. Joseph, Buchanan Co., Pleistocene, and Camden Co. (Sampson). Chadwick, Christian Co. (Ferriss and Pilsbry). Dade Co. (Sampson). Springfield, Greene Co. (Ferriss). Jasper Co. (Sampson). Mt. Vernon, Lawrence Co. (Walker). Cedar Gap, Wright Co. (Ferriss).

KANSAS: Fort Scott, Bourbon Co. (Sampson, M. J. Becker).

ARKANSAS: Rogers, Benton Co., Blue Mountain Station and Magazine Mt., Logan Co. (Pilsbry and Ferriss). Eureka Springs, Carroll Co.; Conway, Crawford, Franklin and Sebastian counties (Sampson). Carrion Crow Mt., Pope Co.; Petit Jean, Yell Co.; Hot Springs, Garland Co. (Ferriss). Mablevale, Pulaski Co. (C. W. Johnson). 5 mi. southeast of Maumelle, Pulaski Co. (L. Hubricht). Sulphur City, Washington Co. (A. J. Brown). Washita Springs, Montgomery Co. (Gould), Type locality.

OKLAHOMA: Fort Gibson, Muskogee Co. (E. W. Hubbard, C. T. Simpson).

LOUISIANA: Grand Cane, DeSoto Parish (Geo. Williamson).¹

This species is smaller than *Mesodon roemeri*, with much coarser, thread-like striae, duller surface, and the lip is expanded or reflected to its upper insertion. It resembles *M. indianorum* Pilsbry more closely, but that species is glossier, more finely striate, and has nearly one whorl more in shells of equal diameter. Except in color and the greater development of apical sculpture it is much like *T. multilineata*.

Throughout its range the species is very uniform in character, the diameter ordinarily being from 17 to 21 mm. At Chadwick, Missouri, where nearly all land snails are dwarfed, the shells are remarkably small, a series of 23 measuring as follows:

Number of specimens	1	3	6	3	4	4	1	1
Diameter in mm.	13.6	14.5	15	15.5	16	16.5	17	18

Genitalia (Figs. 492, Grand Cane, La.). The penis has a thick sheath. The walls of its cavity are coarsely tessellated, and in the upper part it contains a large pilaster (Fig. 492 a). The cavity becomes small anteriorly (Fig. 492 b). The retractor is seated rather far out on the vas deferens, which is long, as in *T. albolabris*. Duct of the spermatheca is moderately swollen. The oblong talon is weakly tubercular. Length of penis 8 mm., vagina 3.5 mm., spermatheca 9 mm. The genitalia are similar to those of *T. dentifera*, but the penis is relatively longer and less swollen.

The mantle over the lung is sparsely spotted with gray.

Subgenus CRYPTOMASTIX Pilsbry

Cryptomastix Pilsbry, 1939, Land Moll. N. Amer.,² I, pt. 1, p. xvii.

Cryptomastix is characterized anatomically by: first, the presence of an epiphallus (Fig. 496 d, epi.) well differentiated from the vas deferens (Fig. 496 d, v.d.) by its greater diameter, terminating in a vestigial flagellum represented by a very short branch of the cavity at the junction of epi-

¹ *T. divesta* has been reported from Bowling Green, Kentucky, by Miss S. F. Price (Nautilus, 14: 75), but I have not seen specimens from there and doubt the identification. It has been recorded by W. G. Binney from "Vernon Co., Miss.," but there is no county of that name in the State. No reliable record of its occurrence east of the Mississippi River exists.

² Acad. Nat. Sci. Phila., Monographs 3.

phallus and vas deferens, as in the section (Fig. 496 D, fl.); secondly, by the internal structure of the penis, which has contiguous twin pilasters in the part above the sheath, the epiphallus opening between their upper ends (Fig. 496, a, b', D). There are also other longitudinal ridges, smaller, but varying in size in different races, as shown in the same figures. The posterior end of the penis is rather large and obtuse, not tapering as in *Triodopsis*. The structure is otherwise about as in typical *Triodopsis*, the epiphallus being connected by a penial retentor muscle, sometimes very slender, to the upper edge of the sheath, and the duct of the spermatheca is more or less swollen.

TYPE: *Triodopsis mullani olneyae* (Pilsbry).

(Κρυπτός, μάλιστα, hidden flagellum.)

In shell form and apertural characters the species of *Cryptomastix* imitate those of eastern divisions of the genus, some being like typical *Triodopsis*, others like *Xolotrema* and *Neohelix*; causing Binney to divide them between *Triodopsis* and *Mesodon*. As a whole they differ from the eastern species by the wrinkle-like rather than thread-like striae. All are hirsute in the early neanic stage, but in most the hairs disappear in the adult.

Although *Cryptomastix* has several rather important differential structures, it has been thought best to recognize its affinity to the eastern *Triodopses* by the subgeneric relation, rather than to treat it as generically distinct. As in *Allogona*, the western and eastern herds are widely separated.

The embryonic shell, of about $1\frac{1}{2}$ whorls, has fine, somewhat irregular striae radiating from the suture, towards their ends broken into oblong granules. There is considerable variation in the degree to which the striae break into granules in different lots of the same race, or even among individuals of one lot. The sculpture may extend nearly across the whorl, as is usual in *T. devia*, or, especially in the more delicately sculptured races, only about half way. There is always the usual smooth area near the tip, and a wide or narrow smooth band below the sculptured part. At about the middle of the second whorl the sculpture changes and delicate hairs appear, somewhat irregularly standing in oblique trends. These hairs are found only in fresh young shells. They are lost in the adult stage (except in *T. mullani tuckeri* and *T. germana*), but in most if not all races they are represented in some examples by spaced papillae or "hair-scars" in oblique trends, visible under the microscope in a proper light on the base in front of the aperture. Many fresh adult individuals show none.

Distribution.—Montana west of the continental divide, Idaho, northern Oregon, Washington, and the adjacent part of British Columbia. The range of this group (Fig. 495) is nearly coincident with that of *Allogona* subgenus *Dysmedoma*.

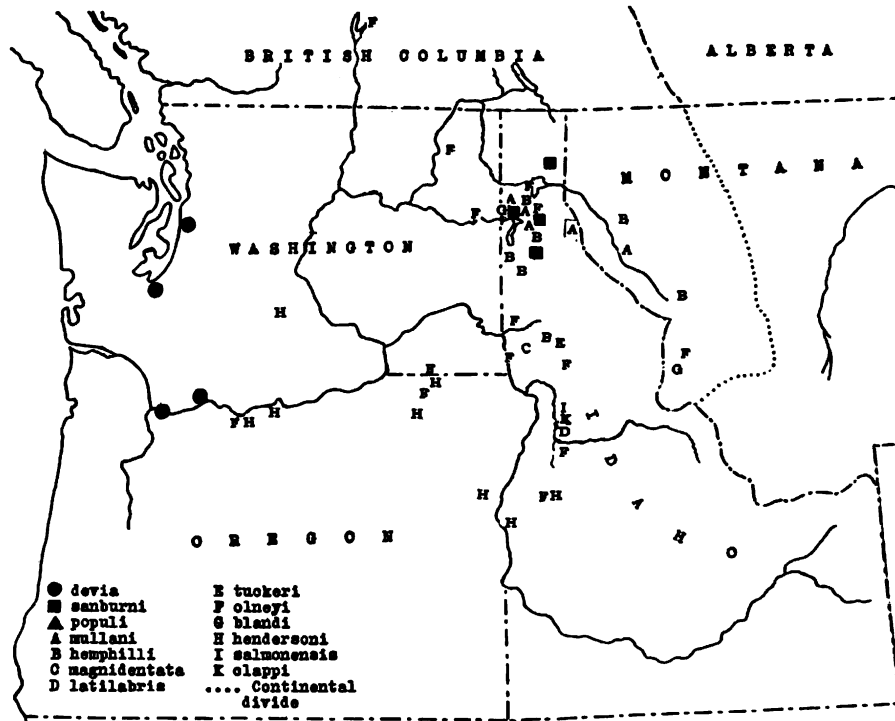


Fig. 495. Distribution of *Cryptomastix*. (Vancouver I. record for *T. devia* inadvertently omitted.)

The species live in humid places, under logs and stones, in Idaho often in slides of schistose or granitic rock.

Throughout the northern half of Idaho and the adjacent parts of Washington, Oregon and Montana, where humidity and shelter favor, some form of *Triodopsis mullani* appears to be found almost everywhere. The size of shell and the degree of development of hairs or hair-scars, and of the apertural teeth, are quite noticeably variable in single colonies, and they vary locally so much that a number of supposed species and numerous subspecies have been defined. Having before me a series of Hemphill's shells, and hundreds from many places collected by Dr. H. Burrington Baker, it appears that intergradation is extensive. The races of *T. mullani* now recognized by name represent the high lights of the picture; the intergrades between these races are likely to be lost sight of in the shadows. However, where extreme forms are so unlike, it may be useful to have names for the more prominent aspects of variation. It should occasion no surprise if some distinctions now made are traced with difficulty in other lots, or if

further races of an equal degree of validity are turned up by new collections. Large areas of that country have not been explored for snails.

T. devia, *sanburni* and *mullani* appear as well differentiated species; but the rest may all prove to be races and intergrades of the *mullani* stock.

Anatomy.—There has been no extensive study of the anatomy, but those examined are much alike. As only a few of the many forms have been dissected it seems convenient to assemble notes on their anatomy here.

T. devia, from bluffs north of Seattle (Fig. 496 A). The penis is long, with two contiguous ribs in the upper part of the cavity, shown in section at a'. The sheath is thick. Penial retractor muscle is quite slender, (omitted in the figure).

T. mullani hendersoni, small form, (Fig. 496 B), specimen from Steven's ranch, near mouth of east fork of Weiser River, Adams County, Idaho, no. 170767. The epiphallus is inserted laterally on the summit of the penis and is united with the retractor muscle. The cavity of penis has two strong contiguous fleshy pilasters which continue down to the sheath, with other short ridges near the apex only. Anterior part of penis very narrow, enclosed in a loose sheath (lower section).

T. mullani magnidentata, (Fig. 496 E), paratype, no. 171243. The twin pilasters are enlarged at the summit of the penis cavity, and there are also four small ridges in the upper part. The branch of the cavity of epiphallus representing a flagellum is extremely short, but I found it in one section. The kidney is 8 mm. long, pericardium 2.7 mm.

T. mullani olneyae, (Fig. 496 c, d), north end of Newman Lake, Spokane County, Washington, no. 11499. The twin pilasters of the penis are drawn in Figure 496 d. There are also numerous small longitudinal ridges. The retractor muscle is very weakly developed. The cavity of epiphallus branches at the end, forming a vestigial flagellum shown in section at fl. in the same figure.

Measurements in mm. follow:

	<i>devia</i>	<i>hendersoni</i>	<i>magnidentata</i>	<i>olneyae</i>
Museum no.	158336	170767	171243	11499
Penis	12.0	6.0	7.0	6.0
Epiphallus	14.5	9.0	5.0	...
Penial retractor	3.0	2.5	...	2.0
Vagina	5.0	3.0	2.0	3.0
Spermatheca	13.0	9.0	6.5	9.0
Diameter of shell	21.5	12.8	11.5	13.0

TRIODOPSIS MULLANI GROUP

Triodopsis devia (Gould)

Fig. 497.

Helix devia Gould, 1846, Proc. Boston Soc. Nat. Hist., 2: 165; 1852, U. S. Expl. Exped., Moll. and Shells, 12: 69, pl. 5, figs. 74-74b.

Mesodon devia Gld., W. G. Binney, 1878, Terr. Moll., 5: 337, fig. 220.—G. W. Taylor, 1891, Nautilus, 5: 92.

Odotropis devia Gld., J. G. Cooper, 1868, Amer. Journ. Conch., 4: 230; 1873, Proc. Cal. Acad. Sci., 4: 153.

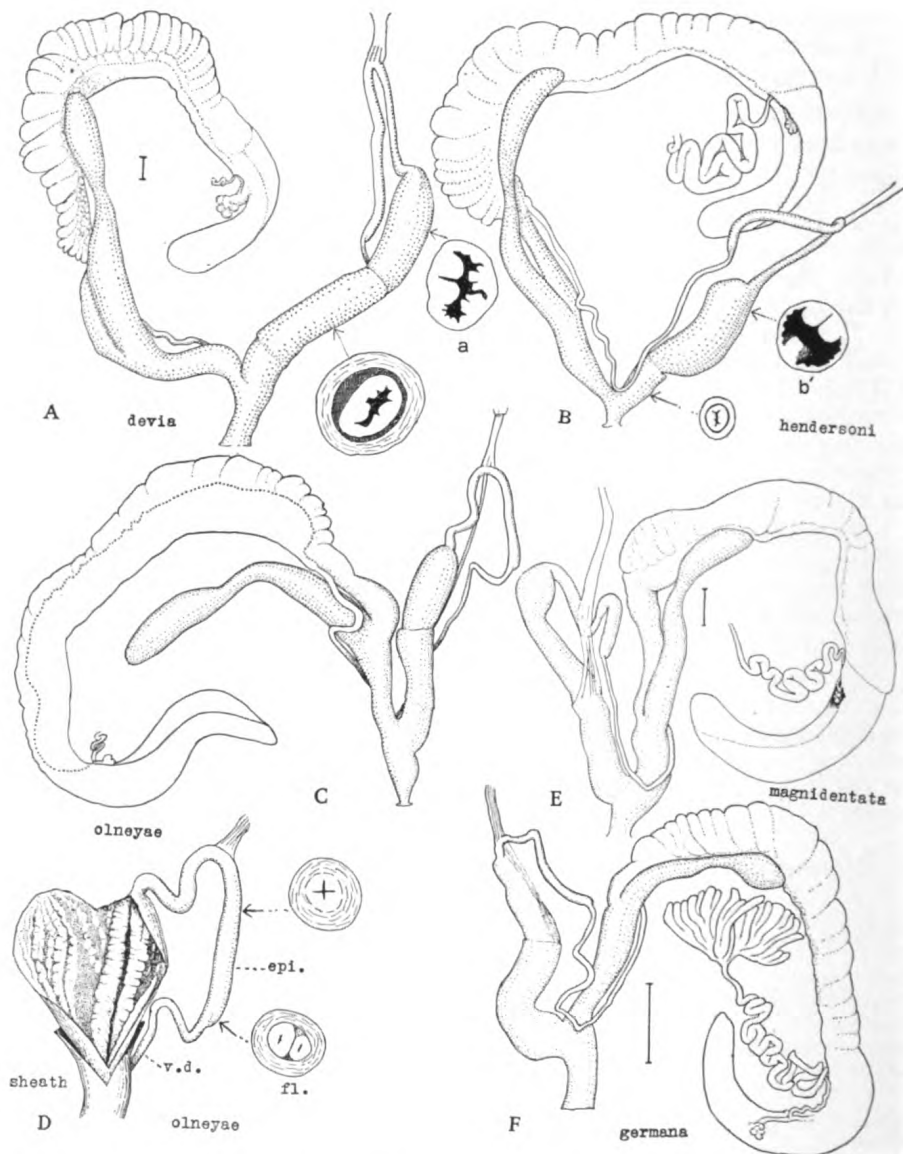


Fig. 496. A, *Triodopsis devia*, with two sections of penis. B, *Triodopsis mullani hendersoni* and sections of penis. C, D, *Triodopsis mullani olneyae*, with sections of the epiphallus (epi.), flagellum (fl.), and upper part of penis opened. E, *Triodopsis mullani magnidentata*. F, *Triodopsis germana*.

Polygyra devia Gld., Dall, 1905, Harriman Alaska Exped., 13: 24.—Henderson, 1929, Univ. Colo. Studies, 17: 80, fig. 36.

Helix baskervillei Pfeiffer, 1850, Proc. Zool. Soc. London for 1849, p. 130; Monogr. Hel. Viv., 3: 230.—Reeve, 1852, Conch. Icon., pl. 117, fig. 684.

“Shell solid, depressed globose, of a pale yellowish horn-color, rather finely marked with lines of growth. Whorls six, convex, separated by a well-defined suture, and forming a rounded spire. Beneath, slightly convex, and perforated by a moderate sized umbilicus, which appears to have an obtuse channel revolving on the whorls within it. Periphery rounded.

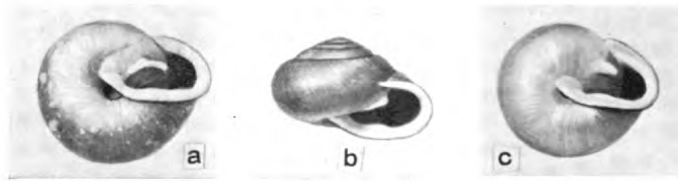


Fig. 497. *Triodopsis devia*: a, Carson, Wash.; b, Hayden Island, Ore.; c, Seattle, Wash.

Aperture transverse, obliquely lunate; lip white, rather broadly reflexed, horizontal at base, and abruptly turning up to form a short columella, where it dilates and partly surrounds the umbilicus. Near the upper angle, and on the penultimate whorl, is a white trigonal tooth. Diameter four-fifths of an inch; axis nine-twentieths of an inch.” (Gould.)

Height 14 mm., diameter 21.5 mm. Hayden Island.

Height 15.3 mm., diameter 22 mm. Seattle.

Height 13.4 mm., diameter 21.2 mm. Seattle.

Height 15.6 mm., diameter 23.2 mm. Freeport, Washington.

Height 12.5 mm., diameter 20 mm. Oregon.

VANCOUVER ISLAND: (Lieut. Baskerville; G. W. Taylor).

WASHINGTON: Puget Sound, type locality (Drayton). Bluffs north of Seattle (H. B. Baker). Carson (J. G. Malone). Freeport (Hemphill). Nisqually flats (S. N. Rhoads).

OREGON: Hayden Island, opp. Vancouver, Wash. (J. G. Malone).

After the smooth tip the embryonic whorls have irregular, low, radial wrinkle-striae, more or less interrupted into short granules, or anastomosing. One or two neanic whorls show regularly spaced papillae or hair-scars in the best-preserved shells. The later whorls have low, coarse, irregular striae and shallow spiral lines, and over all a close wavy, microscopic lineolation roughly parallel to growth lines or more strongly retractive. This lineolation varies from distinct, in some lots, to mere traces here and there in othes. The color is saccardo's umber to snuff brown, the reverse of the white or slightly tinted lip being yellow. The surface is either somewhat glossy or semimatt. There is usually a very low, blunt prominence within the basal lip, hardly developed enough to be called a tooth. The h/d index runs from 60 to 70.

This is a form of the humid region, inhabited also by typical *Allogona townsendiana*. Dr. Baker found them at bases of east-facing slopes along the lake north of Seattle, near damp places with maples and sword ferns.

Triodopsis sanburni W. G. Binney

Fig. 498.

Triodopsis sanburni W. G. Binney, 1886, 2d Supplement, Bull. Mus. Comp. Zoöl., 13: 37, pl. 1, fig. 9, shell, pl. 3, fig. 3, teeth; 1890, 3rd Suppl. Bull. Mus. Comp. Zoöl., 19: 215, text-figure.

Polygyra sanburni (W. G. B.), Henderson, 1924, Univ. Colo. Studies, 13: 106, fig. 22.

The shell is narrowly umbilicate, thin, somewhat translucent olive-buff, or in some lots more opaque with a faint brownish tint; depressed, with convex or low dome-shaped spire and well rounded periphery. The whorls are closely coiled, the last descending in front and strongly contracted behind the lip. The surface is rather glossy when unworn. The first whorl is



Fig. 498. *Triodopsis sanburni*. At left the type, Kingston, Idaho; following figure a paratype; middle and right figures, Old Mission. (Apical view actual size, the rest $\times 2$.)

radially striate, the striae not extending quite across the whorl, later whorls with weak striation, very faint spiral lines at the base and no hair-scars. The aperture is three-lobed. The white peristome is widely reflected, the edge more or less recurved. Outer margin with a squarish tooth, separated by a deep sinus of about its own width from a bluntly conic basal tooth, passing into a callus on the inner margin towards columella. The parietal tooth is rather long and high.

Height 7.8 mm., diameter 11.5 mm.; 6 whorls. Type.

Height 6.7 mm., diameter 12.2 mm. Old Mission.

Height 6.4 mm., diameter 11.7 mm.; $5\frac{1}{2}$ whorls. Old Mission.

Height 5.7 mm., diameter 10.0 mm.; $5\frac{1}{4}$ whorls. Hope.

IDAHO: Kingston, Shoshone County (J. Rand Sanburn, H. Hemphill), Type 11119 A.N.S.P. Old Mission (Hemphill), and Coeur d'Alene (H. E. Dore); Kootenai County; Hope, Bonner County (Mary P. Olney).

With much the general shape and narrow umbilicus of *T. mullani*, this species differs by the more closely coiled whorls, the much larger and higher parietal tooth, the stronger upper lip tooth and the pale color. There is considerable variation in height of the spire, as is usual in the group. It appears to be quite distinct from all forms of the polymorphic *T. mullani* by the narrow whorls. It is also more narrowly localized.

Binney described this shell as "sparsely hirsute", with the remark that "no hairs were found on the scars which surely bore them." In his second reference he figured it as closely hairy, without remark. Having before me the specimen he gave the Academy as "type figured" and many others, partly in fine, unworn condition, I conclude that what he took for hair scars are minute corroded dots, probably not examined by him under the microscope. I find no hairs and no regularly arranged points, such as appear in many forms of *T. mullani*.

Triodopsis mullani (Bland & Cooper)

Fig. 499 a, b, c, d, e.

Helix mullani Bland & Cooper, 1861, Ann. Lyc. Nat. Hist. N. Y., 7: 363, 448, pl. 4, figs. 16, 17.—Binney & Bland, 1869, L. & Fr. W. Sh. N. A., 1: 130, fig. 221.

Triodopsis mullani Bland, Cooper, Tryon, 1867, Amer. Journ. Conch., 3: 53, pl. 9, fig. 15.—W. G. Binney, 1886, 2nd Suppl., Bull. Mus. Comp., Zool., 13: 2, pl. 1, fig. 11.

Polygyra devia mullani (Bld. & Coop.) Henderson, Univ. Colo. Studies, 13: 105, fig. 19.

Polygyra mullani mullani (Bld. & Coop.), Henderson, 1929, Univ. Colo. Studies, 17: 83; 1936, 23: 96.

"Shell with umbilicus partially covered, globose-depressed, dark horn colored, irregularly striated, having a thin epidermis with microscopic spiral lines, and tubercles (the latter with hairs?); beneath the epidermis shining; spire short; whorls $5\frac{1}{2}$ to 6, convex, the last gibbous above, scarcely descending, the base rather smooth, much constricted at the aperture, aperture subtriangular, oblique, with a short white linguiform parietal tooth; peristome white, or reddish horn colored, thickened, expanded, and roundly reflected, with two teeth on the margin of the callus, the lower one lamelliform, the other small, often obsolete, the columellar margin partially covering the middling sized pervious umbilicus." (Bland & Cooper.)

"Diameter maj. $13\frac{1}{2}$, min. 11. Alt. 7 mill." (Bland & Cooper.)

Height 7.9 mm., diameter 13.1 mm.; $5\frac{1}{2}$ whorls. Coeur d'Alene Mts.

Height 8.7 mm., diameter 14.1 mm. Old Mission.

Height 8 mm., diameter 14.7 mm. Old Mission.

IDAHO: Near Coeur d'Alene Mission, Coeur d'Alene Mountains, type locality (J. G. Cooper, H. Hemphill), paratype 1901 A.N.S.P. West side of Bitter Root Mountains, under logs and in dry pine woods (Cooper). St. Joseph River, Kootenai Co. (Binney Coll.). 2 mi. east of Rathdrum (Henderson). Trail between Dorsey and Twin Lakes, 4900 ft., and Coeur d'Alene River above Larson, 3500-3700 ft. Shoshone Co. (H. B. Baker).

MONTANA: 16 mi. east of St. Regis (Henderson).

In specimens received from Cooper, part of his original collection, (Fig. 499 a), Coeur d'Alene Mts., the umbilicus is nearly covered, in others from Old Mission, about half covered. The fine, wrinkle-like striae vary in strength, and some lots (Old Mission) show the microscopic wrinkling of the periostracum as distinctly as in *T. devia*, while in others it may be weak or barely discernable. In some examples a few weak spiral lines appear on the base. In front of the aperture a few widely spaced "hair-

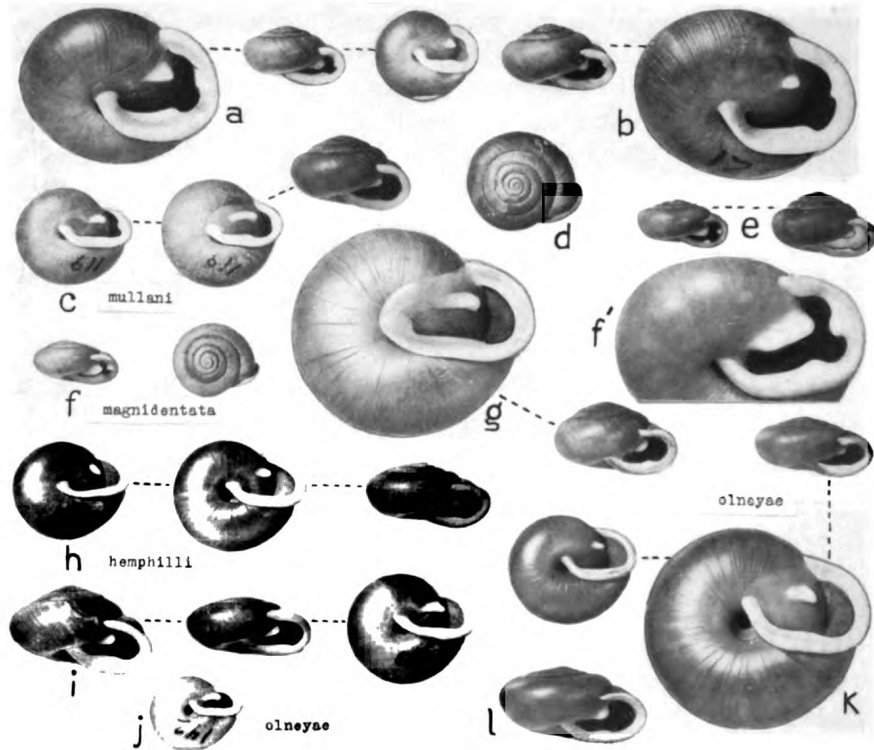


Fig. 499. a, *Triodopsis mullani*, cotype; b, above Larson; c, Willow Creek; d, Old Mission; e, Twin Lakes. f, f', *T. m. magnidentata*. g, *T. m. hemphilli*, Old Mission; h, St. Joe River above Avery. i, *T. m. olneyae*, Rabbit Creek; j, south of Stites; k, Spokane, type and paratype; l, the Dalles. (Figures a, b, g, f', k, about $\times 2$, the rest actual size.)

sears" in oblique series are visible under the microscope, but I believe that they never bear hairs. The edge of the lip is rolled well back. The parietal tooth is short, somewhat triangular. The basal "tooth" is rather a long ridge or lamina on the inner margin of the lip, typically truncate at its outer end, but often quite weakly so. It is much like the basal lip of *Xolotrema*. The tooth in the upper lip is moderately developed, typically, but in large lots from Shoshone County, recorded above, it varies by minute stages from distinct to absent, the latter being "*hemphilli*". In fact, *mullani* and *hemphilli* seem to be merely the end forms in a continuous series, found in the same colonies, not really different races.

The original description of *mullani* was framed to include specimens with the outer lip tooth obsolete (*hemphilli*) as well as the typical form with a small tooth. The localities for distinctly three-toothed *mullani* are in

Kootenai and northern Shoshone Counties, Idaho, and over the range into Montana.

Dr. H. B. Baker found two forms at rock slides and springs around Twin Lakes, east fork of Willow Creek, northeast of Stevens Peak, Shoshone County, at 5400-5600 feet, a subalpine locality on schistose rock, in fully developed larch-pine-hemlock forest. On most specimens (Fig. 499 c) the umbilicus is almost covered, and there is an unusually wide space between the small upper and lower lip teeth, or the small upper tooth may be absent; height 8.6 mm., diameter 13.6. The other form has a moderately open umbilicus, less than half covered. Both lip teeth are well developed and nearer together, as usual in *mullani*; height 6.2 mm., diameter 11.6 mm., being more depressed.

(*Triodopsis mullani* was named in memory of Captain Mullan, U. S. A., who in 1853-4 built a road over the Bitter Root and the Rocky Mountains, from the forests of Lake Coeur d'Alene in the Columbia River system to the plains of the upper Missouri River.)

Triodopsis mullani hemphilli W. G. Binney

Fig. 499 g, h.

Triodopsis hemphilli W. G. Binney, 1886, 2nd Suppl., Bull. Mus. Comp. Zool., 13: 38, pl. 1, fig. 17.

Polygyra mullani hemphilli (W. G. B.), Henderson, 1924, Univ. Colo. Studies, 13: 104, fig. 20; 1929, 17: 82; 1936, 23: 97.

Helix binominata Tryon, 1887, Man Conch., 3: 146, pl. 38, figs. 98, 99. (Substitute name for *Triodopsis hemphilli* W. G. B.).

"Shell imperforate,¹ globosely depressed, coarse, slightly wrinkled, russet-colored, sparsely hirsute; whorls five and a half, convex, the last globose, slightly descending; aperture very oblique, lunate, with a short, narrow, slightly curving parietal tooth; peristome white, broad, thickened, revolute, usually quite concealing the umbilicus, bearing on its basal margin an elongated, lamellar toothlike process. Greater diameter, 17 mm.; lesser, 14 mm.; height 7 mm." (W. G. Binney.)

Height 9.7 mm., diameter 16.5 mm.; 5½ whorls. Type.

Height 8 mm., diameter 12.8 mm.; 5¾ whorls. Fernan Lake.

IDAHO: Kootenai Co., around Fernan Lake, 2100-2200 ft., and Blue Creek valley, 7 mi. south of Coeur d'Alene; Cedar Creek valley near Summit; 2 mi. east of Harrison, 2100-2300 ft. (H. B. Baker). Coeur d'Alene (E. W. Roper). Cataldo, in schistose rock slides; north side Mt. Baldy (H. B. Baker). Around Old Mission (Hemphill, Baker). Benewah Co., north side Lake Chatcolet, and north-facing slopes below St. Joe, 2400-3400 ft., lava (H. B. Baker). Shoshone Co., Kingston (J. Rand Sanburn), Type 11106 A.N.S.P. St. Joe River around Avery. Clearwater Co., 11 mi. up Orofino Creek, 2500-3000 ft. (Baker). Idaho Co., 2 mi. up Wet Creek (H. B. Baker).

MONTANA: Saltese (Henderson). Thompson Falls, Sanders Co. (H. B. Baker). Lo Lo Creek, 11 mi. south of Missoula (Henderson).

¹ Binney's figured type is not quite imperforate, though in a basal view the umbilicus is wholly concealed. None of the eight other topotypes from him in our collection is absolutely imperforate, and in hundreds collected by Dr. H. B. Baker, wholly imperforate specimens are rare, though in many the crevice remaining is very narrow.

The shell varies from imperforate or narrowly rimate to partly covered umbilicate. The rather glossy surface has unequal wrinkle-like striae, and usually weakly developed, shallow, spiral lines. It is not in the least hairy. In several specimens of the original Kingston lot of *hemphilli*, from Binney and Hemphill, the "hair-scars" vary. In some examples a few widely spaced papillae in oblique series can be seen near the periphery in front of the aperture, but in others in equally good condition none can be made out. Among the other lots of *hemphilli*, such scars appear rather well developed and subregularly arranged in oblique series in some lots, and in other lots none were seen. There is great variation by individuals and by colonies in the microscopic crinkly-lineolate sculpture, from distinct to practically absent. The color is cinnamon-brown, dresden brown or buckthorn brown. The lip is strongly revolute, as in *mullani*; the basal margin having a low lamina along its inner edge, usually obliquely truncate at junction of basal margin with outer arc of the lip. Typically there is no trace of a tooth within the outer lip, but in any large lot specimens occur with a slight thickening there, or a small tooth. In any large lot the variation from *mullani* to *hemphilli* is really continuous. The size is rather variable. In a lot from gulches on St. Joe River around Avery, mainly burnt over, and on shistose and granite rock, the diameter runs from 14.3 to 17 mm. Around Fernan Lake, west of Coeur d'Alene the diameter is from 12.8 to 15 mm.

***Triodopsis mullani magnidentata* new subspecies**

Fig. 499 f, f'.

The shell is depressed, half-covered umbilicate; semi-matt, isabella color above, more of a dull citrine or buffy citrine at the somewhat glossy base. Spire low, convex. The whorls increase about as in *mullani*, more rapidly than in *sanburni*, the last being somewhat contracted behind the lip. The sculpture is that of *mullani*; some spaced hair-scars are visible on the base in front of the aperture. The aperture resembles that of *T. sanburni* by the large teeth which obstruct it more than in any other form of *mullani*. The peristome is reflected and recurved, buff, with white teeth. Outer lip-tooth blunt, nearly as wide as the deep sinus separating it from the broadly conic basal tooth. The parietal tooth is slightly curved, high and rather long.

Height 5.7 mm., diameter 10.8 mm.; 4 $\frac{3}{4}$ whorls.

IDAHO: Mission Creek, 7 or 8 miles above Jaques Spur, Nez Perce County, in limestone and lava rock slides (H. B. Baker). Type 171243 A.N.S.P.

This race is very similar to *T. sanburni* by its contracted aperture and very large teeth, especially the high parietal and the strong upper lip tooth. It differs by the strongly depressed shape and the fewer, less closely coiled whorls. The resemblance is owing to convergent evolution rather than to

direct relationship. It is a *mullani* with more strongly depressed shell and larger parietal and upper lip tooth.

(*Magnus, dentatus*, large, toothed.)

***Triodopsis mullani latilabris* new subspecies**

Fig. 500.

The shell is more depressed than *T. mullani*, about as in *T. m. olneyae*, with an open umbilicus like the latter. The lip is very broad, wider than in any other form of the species. The upper lip-tooth varies from distinct though small to a mere trace (or sometimes wanting). Parietal tooth triangular, well developed. Some regularly spaced points or "hair-scars" can be seen in front of the aperture in some examples, none in others.

Height 7.2 mm., diameter 14.3 mm.; others down to 11.4 mm. diameter.



Fig. 500. *Triodopsis mullani latilabris*. John Day Creek, four figs. at left; Section 35, two figs. at right.

IDAHO: Lower two or three miles of John Day Creek, Type 175777 a A.N.S.P.; one or two miles up its middle fork, and along the Salmon River adjacent. Also taken with the tridentate form of *clappi* in Section 35, Twp. 26 N., range 1 E., north of Lucile. Also on moss-covered slopes and rock slides on right bank of the South Fork Clearwater River, three or four miles below Harpster; all in Idaho County (H. B. Baker).

The specimens from near Harpster run up to 15.5 mm. diameter.

(*Latilabris*, wide lipped.)

***Triodopsis mullani tuckeri* (Pilsbry & Henderson)**

Fig. 501.

Polygyra mullani tuckeri Pilsbry & Henderson, 1930, *Nautilus*, 44, pl. 5, figs. 8, 9, 10; 1931, *Nautilus*, 44: 121.

"Shell depressed; color medium to dark brown; whorls $5\frac{1}{2}$, closely coiled, increasing gradually in size from apex to aperture; suture well impressed; umbilicus open, but partly covered by the reflected columella; aperture lunate; lip light-brown, expanded, rather thinly so at the periphery, widened toward the columella by slightly-developed lamellae above and below; type specimen exhibiting some irregular, microscopic, spiral striae on the surface, apparently due to slight wrinkles in the epidermis; surface sparsely covered with short, flattened, scale-like, curved hairs, smaller on the base, which are much better exhibited on a well-preserved, immature paratype, but show on all of the specimens examined. Some specimens have a small, triangular, white parietal tooth, others have none. Type non-dentate; greater diameter, not including reflection of lip, 13, lesser diameter 12, altitude 6.5 millimeters."

Height 6.9 mm., diameter 12.5 mm.; 5 whorls. Paratype.



Fig. 501. *Triodopsis mullani tuckeri*, drawn by Elberta L. Craig. (Enlarged; actual diameter 12.5 to 13 mm.)

IDAHO: On the Clearwater River near the junction of Fourth-of-July Creek (H. M. Tucker), Type 17001a University Colorado Museum; paratype 152334 A.N.S.P. Also Orofino, on the Clearwater River (Hemphill).

This form differs from all recognized races of *T. mullani* by the strongly developed hairs of the periostracum. In *T. mullani clappi* (Hemph.) there are extremely minute and much closer hairs in places, but all of the other subspecies have the surface smooth and more or less glossy, or showing only minute points in place of hairs.

In the lot from Orofino the hairs are much less developed than in the type lot, but more prominent than in any *T. m. hemphilli* seen.

Triodopsis mullani olneyae (Pilsbry)

Fig. 499 i, j, k, l.

Polygyra (*Triodopsis*) *mullani* var. *olneyae* Pilsbry, 1891, *Nautilus*, 5: 47, (Spokane, Wash.).

Polygyra mullani olneyae Pilsbry, 1928, *Proc. Acad. Nat. Sci. Phila.*, 80: 177-186.—Henderson, 1929, *Univ. Colo. Studies*, 17: 84, fig. 40.

The shell is more depressed than *T. m. hemphilli*, with a wider, less covered umbilicus; glossy buckthorn brown, smoothish; the radial striation of the embryonic shell extending only a short distance below the suture. Spiral lines are typically very weak or wanting on the last whorl; the microscopic crinkling of the surface only weakly developed. In some specimens of the original lot a few "hair-scars" can be seen in front of the aperture, but in most shells none are evident. The strongly revolute peristome has the basal margin widened by a lamina along its inner margin, but there is no tooth in the outer lip. Parietal tooth is small and short.

Height 8 mm., diameter 15 mm.; 5½ whorls. Type.

Height 9.5 mm., diameter 18.3 mm. Bowl and Pitcher (largest).

BRITISH COLUMBIA: Vernon (S. N. Rhoads).

WASHINGTON: Spokane (Mary P. Olney), Type 11112 A.N.S.P. East-facing lava slides at "Bowl and Pitcher", 5 mi. down Spokane River from Spokane, 1800 ft. (H. B. Baker). North end of Newman Lake, Spokane Co. (G. H. Clapp). 4 and 14 mi. north of Colville, Stevens Co. (Henderson). 5 mi. south and 15 mi. east of Walla Walla (Henderson).

OREGON: Valley of Pine Creek, 5-10 mi. above Weston, Umatilla Co. (H. B. Baker). The Dalles (Hemphill).

IDAHO: East side Selkirk Mts. between Sand Point and Coburn, Bonner Co. (Baker). 6½ mi. east of Coeur d'Alene (Henderson). 50 mi. south of Lewiston (R. W. Jackson); half a mile west of North Lapwai, on north-facing lava rock slides, at 800-900 ft., Nez Perce Co. (H. B. Baker). Idaho Co. in valleys of Elk and Lower Falls Creeks, 20 mi. south of Riggins, 2900-4000 ft., lava and white granite; 8-12 mi. up Squaw Creek, over 5 mi. west of Riggins, mainly on limestone outcrops, 2700-3500 ft.; valleys of Salmon and Little Salmon Rivers, and lower 2 mi. of Squaw Creek near Riggins, shistose and sandstone; 7-10 mi. up Race Creek (H. B. Baker). Near Meadows and New Meadows, Adams Co., on granite, 4000-4500 ft. (H. B. Baker).

MONTANA: South side Sawtooth Mt., Bitter Root range; near Ward; and Lost Horse Creek, near Charlos (L. E. Daniels).

In the original lot the shell is bright and somewhat translucent. A large lot from "Bowl and Pitcher" are buffy citrine and opaque. Two showing extremes of elevation and depression measure height 9.6 mm., diameter 16.2 mm., and 7.4, 16.7 mm. Specimens from the north end of Newman Lake, Spokane County, and those from 4 and 14 miles above Colville, Stevens County, are small, 11.3 to 13.4 mm. Similar shells were taken by Henderson around Walla Walla, and by H. B. Baker in Pine Creek Valley above Weston, Oregon. An albino, of a pale glass-green tint, was found in the lot from a bluff on the Bitter Root River north of Ward, Montana.

The single shell seen from Vernon, British Columbia, is unusually elevated, height 8.9, diameter 13.8 mm., but this is probably an individual peculiarity.

In Idaho the line between *olneyae* and *hemphilli* is practically wiped out, since specimens referable to both, or either, often occur in the same lots. Among the localities for *olneyae* only a few Idaho lots with umbilicus wider than normal for *hemphilli* are listed.

Around Stites, in northern Idaho County, Idaho, this race is abundant in mainly north-facing lava rock slides 1 to 4 miles up Rabbit Creek, 1500-2000 feet (Fig. 499 i). It is matt or semimatt having well developed microscopic sculpture and a few "hair-scars" in front of the aperture; cinnamon-brown to dresden brown. The parietal tooth and the callous ridge in the basal lip are well developed; no trace of an upper lip-tooth. The umbilicus is normal, but in a few examples narrow enough for *hemphilli*. Spire is usually more elevated than in *olneyae*, but variable.

Height 9.8 mm., diameter 16 mm.

Height 11.6 mm., diameter 18.5 mm. (Largest).

Height 8 mm., diameter 16 mm. (Most depressed).

In a large series from west-facing lava rock slides a mile south of Stites (Fig. 499 j) the diameter runs from 10.4 to 12.3 mm., the shells are small, rather thin, delicate and strongly depressed as in *clappi*, but the callus in the basal lip is about as in the larger *olneyae*, the parietal tooth is well developed and the umbilicus somewhat narrower than in *clappi*. At the

same locality but doubtless in a different ecologic setting, large specimens, diameter 16 to 16.6 mm., similar to the more depressed shells among those from Rabbit Creek were taken.

In Montana the shells from near Ward and Charlos have the form of *olneyae*, those from farther north, around Thompson Falls being *hemphilli*.

At The Dalles, Oregon, Hemphill collected a form (Fig. 499 1) having the shape, umbilicus and apertural characters of *olneyae*, except that the lip is not as strongly revolute as in the races of *mullani*, but merely a little turned back at the edge. It reaches a larger size than any *olneyae*, from height 10.9, diameter 19.9 mm. to diameter 16.3 mm.; $5\frac{1}{2}$ whorls. It was labelled *H. devia* Gld., by Hemphill, but the shell is much more depressed than that species, and it seems best to rank it as a form of *olneyae*. In the small series seen from The Dalles there is no intergradation with *hendersoni* or with *devia*.

***Triodopsis mullani hendersoni* (Pilsbry)**

Fig. 502: 2, 3, 4-6.

Polygyra mullani hendersoni Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 178, figs. 2-6.—Henderson, 1936, Univ. Colo. Studies, 23: 97; 1929, *ibid.*, 17: 83, fig. 39.

Helix (Mesodon) mullani Bland & Cooper, var. *oregonensis* Ancey, 1882, Le Naturaliste, 2: 29. Not *Helix oregonensis* Lea, 1839. Not *Polygyra devia oregonensis* Vanatta, 1914, Proc. Acad. Nat. Sci. Phila., 66: 368; nor of J. Henderson, 1924, Univ. Colo. Studies, 13: 106.

“The shell is thin, narrowly umbilicate, umbilicus contained $9\frac{1}{2}$ to 10 times in diameter, dilute snuff brown, somewhat transparent, glossy, with low but coarse wrinkles of growth and weakly impressed or subobsolete spiral lines. The last whorl descends very little in front and is rather

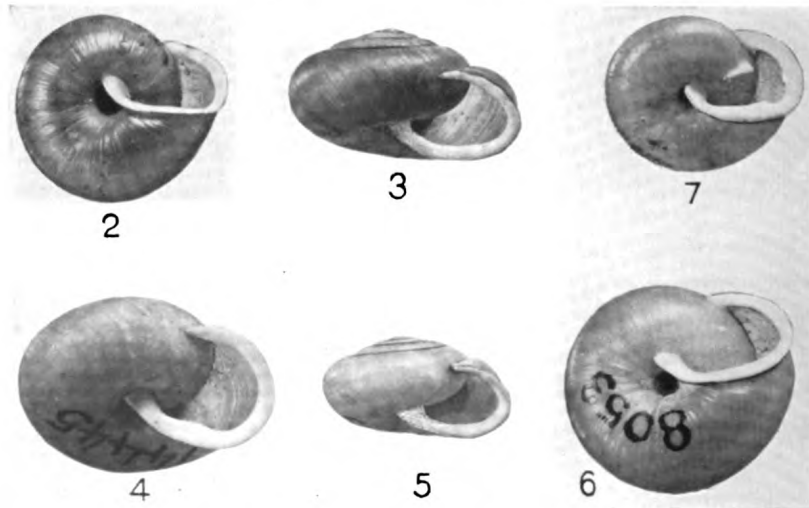


Fig. 502. 2, 3, *Triodopsis mullani hendersoni*. The Dalles, type and paratype; 4-6, paratypes in C. A. S. 7, *Polygyra mullani*, Orofino, Idaho. ($\times 2$.)

strongly contracted behind the outer and basal margins of the lip. The white peristome is *narrowly* reflected, very narrowly recurved at the edge and wholly toothless. The parietal callus is very thin, transparent, without a tooth."

Height 8.2, diameter 14.5 mm.; $5\frac{1}{3}$ whorls. Type.

Height 9.0, diameter 16.2 mm.; $5\frac{1}{2}$ whorls.

OREGON: The Dalles (Hemphill), Type 145479 A.N.S.P. Below Rufus (Henderson). Umatilla Co. in various places at and east of Milton and in the Walla Walla valley above Milton (Henderson, H. B. Baker); 6 or 8 mi. north of Pendleton (Henderson). Gulch above Portland cement plant, 6 mi. northwest of Huntington, Baker Co. (Junius Henderson).

WASHINGTON: 3 mi. north of Yakima, and near Walla Walla (Henderson).

IDAHO: Muddy bank of Snake River at Weiser, under willows (Henderson). Adams Co. near Starky Hot Springs, 3200 ft. (H. B. Baker), and Meadows (E. H. Ashmun).

"(*Helix*) *Mesodon devia* var. *oregonensis*" was one of Hemphill's collection names, sent out on printed labels. It was first published by Ancey, who did not accept the reference to *H. devia*; he referred it to "*Helix*" *mullani*. As the name *oregonensis* is not available, having already been used in *Helix*, I have named this form for Professor Junius Henderson.

To the original description, quoted above, it may be added that no hair-scars were seen on The Dalles examples, but among those from the Walla Walla region some were found showing scars on the last whorl in front of the aperture. In a lot from Weiser, Idaho, no hair scars could be found.

The typical form of *T. mullani hendersoni* from The Dallas is rather distinct by the entire absence of teeth and the narrow, even peristome. A little farther east, below Rufus, Oregon, Junius Henderson found specimens which differ only by possessing a very small parietal tooth (Fig. 504 a). Farther east, at Walla Walla as well as at and above Milton, Oregon, the same form occurs, nearly every specimen being provided with a parietal tooth, but a few adult shells have none. In the lots from Umatilla and Baker Counties, Oregon, there are frequently specimens with more or less of a callus within the basal lip, thus being transitional to *olneyae*. On the Snake River, Weiser, Idaho, the form and lip are typical, a parietal tooth either present or wanting, five out of eighteen shells showing a small or minute parietal tooth. In this area it becomes a nice question where to draw the line between *hendersoni* and *clappi*.

***Triodopsis mullani blandi* Hemphill**

Fig. 503 a.

Triodopsis mullani Bland, var. *blandi* Hemphill, 1892, in Binney's 4th Suppl., Bull. Mus. Comp. Zool., 22: 184 (not pl. 2, fig. 6).

Polygyra devia blandi Hemph., Vanatta, 1914, Proc. Acad. Nat. Sci. Phila., 66: 368.—Henderson, 1924, Univ. Colo. Studies, 13: 106.

Polygyra mullani blandi (Hemph.), Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 186.—Henderson, 1936, Univ. Colo. Studies, 23: 97.

The shell is slightly more depressed than *olneyae*, but with similar umbilicus contained 6.7 times in the diameter. Surface smoothish, with rather widely spaced minute papillae in oblique series on the base (but none visible in some individuals). The lip is rather narrow, revolute, with only

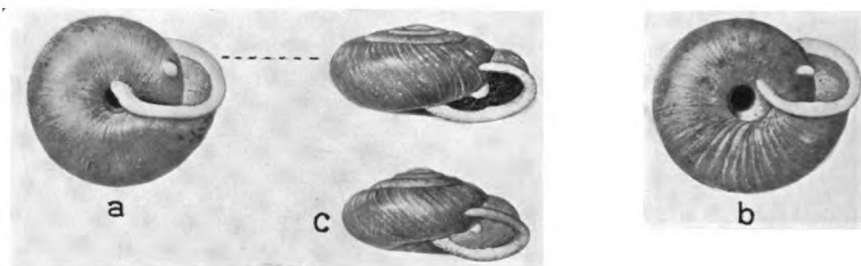


Fig. 503. a, *Triodopsis mullani blandi*, Post Falls. b, c, *T. mullani clappi*, Salmon River Mountains. ($\times 2$)

the weak trace of a callous ridge along inner margin of the basal lip. The basal margin curves gradually into the columellar, without the subangular appearance usual in *olneyae*. A small parietal tooth present. Topotypes from Hemphill measure:

Height 6.5 mm., diameter 13.5 mm. Post Falls.

Height 6.3 mm., diameter 13 mm. Post Falls.

IDAHO: Post Falls, Kootenai County (Hemphill), Type in C.A.S.; topotypes from Hemphill 62304 A.N.S.P.

MONTANA: Near Lake Como, Ravalli County (L. E. Daniels).

The shells from around Lake Como in the Bitter Root mountains, Ravalli County, Montana, are practically identical with *blandi*, having a similar narrow umbilicus in most specimens, but in some it is wider, approaching the condition in *clappi*. Diameter from 13 to 14 mm.

Triodopsis mullani clappi (Hemphill)

Fig. 503 b, c.

Helix devia var. *clappi* Hemphill, 1897, Nautilus, 11: 74.

Polygyra mullani clappi (Hemph.), Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 186.—Henderson, 1936, Univ. Colo. Studies, 23: 97.

The shell is similar to *T. m. blandi*, from which it "is separated by the basal deposit and larger umbilicus", according to Hemphill. In paratypes from him the umbilicus is contained $4\frac{1}{2}$ times in the diameter, thus decidedly larger than in *blandi*.

"Height 5 mm., diameter 15 mm., largest." (Hemphill.)

"Height 3 mm., diameter 11 mm., smallest." (Hemphill.)

Height 5.8 mm., diameter 13.7 mm.; $5\frac{1}{4}$ whorls. Paratype.

IDAHO: "Salmon River mountains" (Hemphill), Type in C.A.S., paratypes 71479 A.N.S.P. Lucile (H. B. Baker). White Bird, Lucile and Slate Creek (in Hemphill Collection, according to J. Henderson).

Specimens from Lucile vary from 11.2 to 14.2 mm. in diameter. In many of them the umbilicus is narrower than in Hemphill's shells. As usual, Hemphill gave no exact locality for his type, but it was probably from Lucile, here selected as type locality, or from somewhere between Lucile and White Bird, as he collected along that part of the Salmon River.

Form intermediate between *T. mullani clappi* and *T. harfordiana*, (Figs. 504, b, c, d). The shell is similar to *T. mullani clappi* (Hemph.) in shape, size and umbilicus, but there is a small tooth within the outer lip, varying from as well developed as in some *harfordiana* to barely perceptible, and the parietal tooth is usually larger than in *clappi*. Minute papillae in oblique, forwardly trending series are visible on the last whorl, under the microscope.

Height 6.5 mm., diameter 12 mm.; others from 10.3 to 13.3 mm. diameter.

IDAHO: East side of Salmon River north from Lucile, Idaho County, in Section 35, Twp. 26 N., range 1 E., at 1800-2100 feet, below bluish limestone ledges in a dry gulch (H. B. Baker). Also collected by Hemphill, who gave the locality Salmon River, Idaho. Similar specimens of about 11 mm. diameter were taken by Hemphill at Orofino, Clearwater County, Idaho.

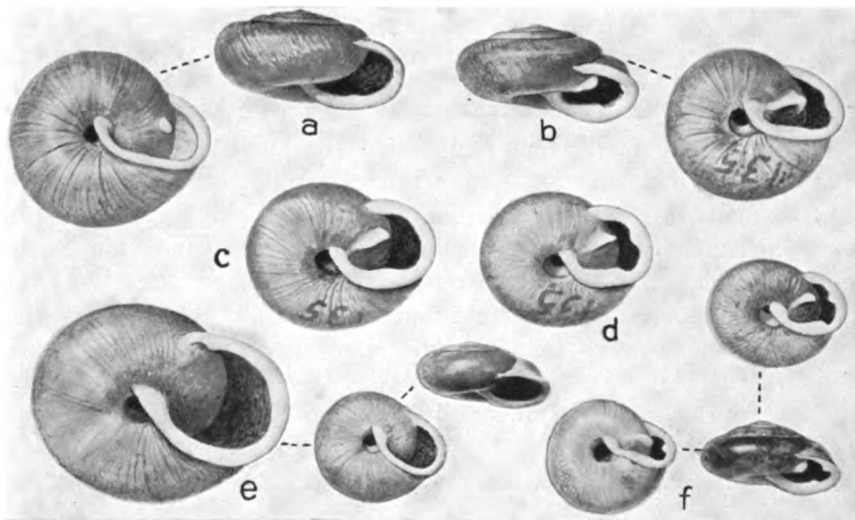


Fig. 504. a, *Triodopsis mullani hendersoni*, Stevens' ranch ($\times 2$). b, c, d, form intermediate between *clappi* and *harfordiana*, Idaho Co., Sect. 35, Twp. 26 N., ($\times 2$). e, *Triodopsis populi*, type ($\times 2$ and actual size). f, *Triodopsis harfordiana*, type and topotypes ($\times 2$).

Triodopsis harfordiana W. G. Binney

Fig. 504 f.

Triodopsis harfordiana J. G. Cooper, W. G. Binney. 1878, Terr. Moll., 5: 309, fig. 203, shell, pl. vii, fig. R, teeth. Not the description of the shell or the synonymy; 1886, 2d Suppl., Bull. Mus. Comp. Zool., 13: 37, pl. 1, figs. 6, 7. Not *Daedalochila harfordiana* J. G. Cooper, 1870.

- Mesodon devius* var. *mullani* W. G. Binney, 1885, Man. Amer. L. Sh., p. 119, fig. 88.
Helix salmonensis Tryon, Sept. 2, 1887, Man. Conch., 3: 147, pl. 38, fig. 96. 97.
 (Substitute for *T. harfordiana* W. G. B.).
Helix commutanda Ancey, Dec. 1887, Conchologist's Exchange, 2: 79. (Substitute
 for *T. harfordiana* W. G. B.).
Polygyra harfordiana (W. G. Binney), Hanna & Rixford, 1923, Proc. Cal. Acad.
 Sci., (4), 12: 48. (Nomenclature).
Polygyra (Triodopsis) salmonensis (Tryon), Pilsbry, 1924, Nautilus, 37: 134. (Nomen-
 clature).
Polygyra salmonensis (Tryon), J. Henderson, 1924, Univ. Colo. Studies, 13: 105,
 fig. 21. (Nomenclature).

The shell is small, thin, strongly depressed, umbilicate, the umbilicus contained nearly 6 times in diameter of shell; of a dull citrine or ecru-olive hue. Spire low, the periphery indistinctly subangular in front. Whorls rather slowly increasing, the last somewhat contracted behind the aperture, descending in front. The surface is somewhat glossy, the embryonic whorls irregularly striate radially below the suture, the striation extending scarcely half across the whorl. Later whorls have weak, somewhat uneven striation and some microscopic granulation between the striae; no hairs and no regularly spaced papillae. The aperture is strongly oblique, tridentate. Peristome white, reflected, the edge a little recurved; outer lip bearing a distinct but small tooth, basal lip with a wider tooth, prolonged and gently sloping on the side towards columella; parietal tooth rather short and oblique.

Height 4.8 mm., diameter 9 mm.; 4 $\frac{3}{4}$ whorls. Type.

Height 4.5 mm., diameter 8.7 mm.

IDAHO: Salmon River (Hemphill), Type 11116 A.N.S.P.

It is somewhat smaller than any *mullani* seen, with more open umbilicus, and I can find no hairs or regularly arranged papillae on the specimens seen, all of them from Hemphill, and one (my lower right Figure 504 f) from Binney marked "type fig'd." I believe that Binney's expression "sparsely hirsute" was inexact. His measurement of the height was evidently taken at the shell axis, not to the lower margin of the lip.

T. harfordiana has been allowed to stand as a species because I have not seen specimens fully connecting it with the tridentate form of *clappi*; but the difference is so small that fully intergrading shells are to be expected. Just where Hemphill found it on Salmon River is not known; probably somewhere north of Lucile. He was an outstanding collector, but weak on labelling his shells.

Nomenclature.—Binney's first notice of this species, 1878, under the name "*Triodopsis harfordiana* J. G. Cooper", was composite, the name, synonymic reference and first locality being referable to Cooper's Californian species "*Daedalochila*" *harfordiana*, while the figures of shell and teeth, description of teeth, and the second locality, belong to the Idaho snail under consideration, which Binney at first wrongly identified with Cooper's species. In 1885, Binney refigured the Idaho species as *Mesodon devius* var. *mullani*, stating that it was "formerly confounded by me with

Triodopsis harfordiana." In 1886, he gave a new description and figures of the Idaho shell under the name *Triodopsis harfordiana*, omitting Cooper as authority, and stating that "this is the shell formerly mistaken by me for *Polygyra harfordiana*." Tryon and Ancey renamed Binney's shell on the ground that *harfordiana* was preoccupied in *Helix*, to which genus they referred all helices. The author formerly accepted Tryon's change to *salmonensis*. This was opposed by Hanna and Rixford, 1923. On submitting the question to the Nomenclature Committee of the A.M.U., it was unanimously decided (opinions written by H. B. Baker and Harald Rehder) that Binney was describing a new species, for which the name *Triodopsis harfordiana* W.G.B. is valid.

***Triodopsis populi* (Vanatta)**

Fig. 504 e.

Polygyra populi Vanatta, 1924, Proc. Acad. Nat. Sci. Phila., 76: 26, figs. 3, 4.

The shell is strongly depressed, umbilicate, the umbilicus contained 6.2 times in the diameter; snuff brown (dead). The spire is convex but low, of $5\frac{1}{2}$ whorls, rather slowly increasing to the last, which is rather wide, rounded peripherally, rather deeply descending in front, not contracted behind the lip. The surface is glossy, the embryonic whorls about as in *T. mullani* (but they are somewhat worn); the last whorl is weakly finely striate, and closely engraved with spiral lines which are weak at the periphery, strong above and below. The strongly oblique aperture is elliptical, toothless. Peristome is dirty white, narrowly reflected with strongly recurved edge, of even width throughout except for the dilation at the columellar insertion. Parietal callus thin, transparent.

Height 8.8 mm., diameter 16.9 mm.; aperture 8.1 mm. high, 10.2 mm. wide; $5\frac{1}{2}$ whorls.

IDAHO: Cottonwood Tree Canyon, on Snake River 50 miles south of Lewiston, Nez Perce County (John Lorang), Type 132939 A.N.S.P.

This species is known by two specimens, both "dead" but one a fresh shell. It differs from *T. mullani hendersoni* by the shape of the aperture. In all forms of *mullani* the columellar and basal margins of the peristome meet in a conspicuous curve, while in *populi* the curve is gentle and continuous. There are some small Salmon River *T. mullani clappi* which somewhat approach *populi*, but all seen have a somewhat stronger curve between columella and basal lip. The stronger spiral lines of *populi* are a further differential feature. In this group one or two specimens are inconclusive; a series must be collected to confirm the differences mentioned, or show that it connects with other forms of *mullani*. It is a species on probation.

I cannot see any traces of papilla or "hair-scars" on these specimens. In a suitable light I think I can see a very slight thickening in the place a parietal tooth might stand.

(Named for the cottonwoods, *Populus*, of its habitat.)

TRIODOPSIS GERMANA GROUP (New Section *Micranepsia*)

The small, compact, imperforate or narrowly perforate shell is depressed with low-conic spire and matt, hairy surface. Aperture with an oblique parietal tooth and reflected but not recurved outer lip, which is thickened within but toothless.

Genitalia (Fig. 496 F) as in *Cryptomastix* except that the penial retractor is inserted lower on the epiphallus, and the vagina is about equal to the spermatheca in length,—differences of little importance.

T. germana is type of this section, which has about the distribution of *Triodopsis devia*, but it runs farther south, nearly to the California line.

Anatomy.—In specimens of *T. germana* from just south of Astoria, Oregon (Fig. 496 F) there is an extremely thin, diaphanous, loosely but distinctly adhering sheath over the swollen anterior part of the penis. At the posterior end the penis is abruptly curved and then tapers rapidly into the epiphallus. At the distal end of the epiphallus a section shows two ducts for a short distance, flagellum and vas deferens. The penial retractor is short, 1 mm., at its base enveloping the epiphallus. The talon is club-shaped, the end tuberculose, as usual. The mantle is covered with irregular black spots. Measurements in mm. follow:

Diameter of shell	8.2 mm.	Penis	4.5 mm.
Length of kidney	5.5 mm.	Vagina	4.0 mm.
Pericardium	2.0 mm.	Spermatheca	4.0 mm.

(Μικρός, ἀνηψία, little cousin—of the Cryptomastices.)

Triodopsis germana (Gould)

Fig. 505 a, c.

Helix germana Gould, in Binney, 1851, Terr. Moll., 2: 156, pl. 40a, fig. 3.—Gould, 1852, U. S. Expl. Exped., Moll. and Shells, p. 70, pl. 3, figs. 40 a-c.

Stenotrema germanum Gould, W. G. Binney, 1878, Terr. Moll., 5: 300, pl. vii, fig. a (teeth).

Polygyra germana germana E. P. & E. M. Chace, 1934, Nautilus, 47: 112.

“Shell small, solid, imperforate, depressed, low-conical above, convex beneath, slightly angular at periphery, covered with a scabrous, rusty horn-colored epidermis, beset with scattered hairs. Whorls five and a half, closely revolving, separated by a well impressed suture; aperture lunate, the basal portion being but slightly curved, and turning upward at a rather sharp angle; lip incumbent, with a deep stricture behind it, moderately reflexed, roseate; on the intruding portion of the penult whorl is a distinct, oblong, erect, white tooth, not connected with either extremity of the lip. Diameter three-tenths of an inch; axis one-fifth of an inch.” (Gould.)

OREGON: (U. S. Expl. Exped.). Near Astoria (Hemphill), and Clatsop County along Columbia River east of Astoria (H. B. Baker). “Eugene; Scottsburg, on the Umpqua River; Empire, on Coos Bay; Ophir, Curry Co.” (Chace).

WASHINGTON: Point Ellis, Columbia River, Pacific County, opposite Astoria (H. B. Baker).

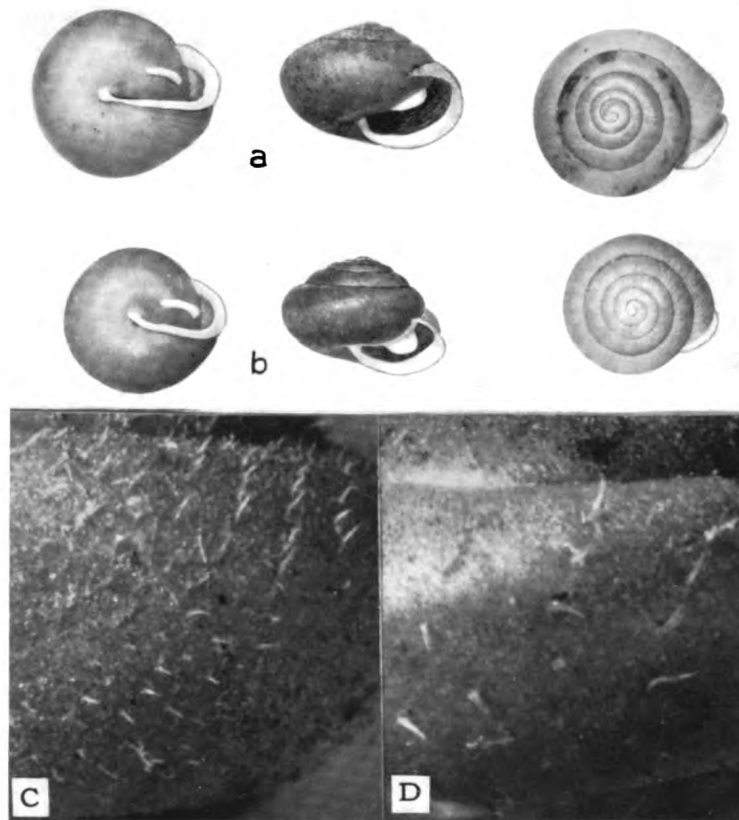


Fig. 505. a, c, *Triodopsis germana*, Astoria. b, *T. germana vancouverinsulae*, type and paratypes. d, *T. germana vancouverinsulae*, Riverdale, Multnomah County, Oregon. (Figs. a, b, $\times 3$; c, d, $\times 15$.)

The slight angularity mentioned by Gould is hardly noticeable in most specimens; and the shell is hardly to be called "solid," being rather thin. The spire is somewhat convexly conoid, obtuse at apex. The whorls are convex and increase rather slowly, the last whorl rounded peripherally, descending a little in front, and very deeply contracted behind the lip. The convex base is very little impressed around the imperforate axis. The first $1\frac{1}{2}$ whorls have rather coarse radial striae irregularly cut into oblong beads. Later whorls are microscopically roughened, matt, with sparse rather long readily deciduous hairs on the last whorl. The lunate aperture has a thin reflected lip, which is thickened within along the basal and outer margins. The transparent parietal callus bears a slightly curved oblique white tooth, well removed from both ends of the lip.

Height 5.5 mm., diameter 8.3 mm.; 5 whorls. Astoria.

I have seen the typical form of *germana* only from the vicinity of Astoria. Compared with the more widely distributed form of the species, it is slightly larger, with the umbilicus closed or very nearly so; the furrow behind the lip is deeper and wider, the ridge or crest preceding it being more prominent. These features of the typical form are not very clearly shown in the somewhat "woolly" figures in the Terrestrial Mollusks, but are brought out in those of the Exploring Expedition.

Astoria, headquarters of the Expedition while surveying the Columbia in August, 1841, is taken to be type locality of *germana*.

(*Germana*, a sister—to *Stenotrema monodon*, as Gould thought.)

Triodopsis germana vancouverinsulæ (Pilsbry & Cooke)

Fig. 505 b, d.

Polygyra germana vancouverinsulæ Pilsbry & Cooke, 1922, Nautilus, 36: 38.

Stenotrema germanum Gld., Taylor, 1891, Nautilus, 5: 92.

Polygyra germana Gld., P. B. Randolph, 1896, Nautilus, 9: 102.—A. W. Hanham, 1914, Nautilus, 28: 89.—Whiteaves, 1902, Ottawa Nat., 16: 92.

Shell similar to *T. germana*, but in the average smaller, distinctly perforate, with a shallower furrow behind the outer and basal margins of the lip, a less prominent crest preceding it. Sculpture as in *germana*, but the hairs generally lost in the adult stage. An oblique view of the columella from the outer part of the aperture shows a nearly vertical, slightly convex callus a short distance within.

Height 4.5 mm., diameter 7 mm.; 5½ whorls. Type.

Height 4.3 mm., diameter 7 mm. Near Duncan.

Height 4.8 mm., diameter 7.7 mm.; 5½ whorls. Near Duncan.

Height 4.3 mm., diameter 6.5 mm.; 5 whorls. Stanley Park.

Height 5.3 mm., diameter 7 mm.; 5½ whorls. Lake Crescent.

Height 4.3 mm., diameter 7 mm. North of Seattle.

BRITISH COLUMBIA: Chilliwack River valley (Whiteaves); not seen, but presumed to be the perforate northern form. *Vancouver Island*: Near lower end of Cameron Lake, under dead bark on the ground in open pine forest (C. Montague Cooke), Type and paratypes 44538 A. N. S. P., other paratypes in Bishop Museum. 4 mi. south of Union, in pine forest (Cooke). Near Victoria (Pilsbry). Stanley Park (Stew. Brown). Quamisham District near Duncan (A. W. Hanham).

WASHINGTON: Port Angeles, Rialto Beach and Lake Crescent, Piedmont (H. B. Baker); Lake Sutherland (C. R. Crosby), all in Clallam Co. Edmonds (Crosby) and Esperance (H. B. Baker), Snohomish Co. Environs of Seattle (R. C. McGregor, Baker). Coal Creek, near Kelso, Cowlitz Co. (Eyerdam).

OREGON: Near Warrentown, Clatsop Co. and Riverdale, Multnomah Co. (H. B. Baker).

The differential characters of this widely spread form of the species do not intergrade with those described for typical *germana* in the series seen, although the differences are not very conspicuous. The Vancouver Island specimens do not differ from those found on the mainland as far south as

the Columbia River. When describing them (under a needlessly long name) I had not observed this.

The hairs, when retained, are much more sparsely set than in *Astoria germana*, though they are not often so long or so widely separated as in Fig. 505 D, which represents a specimen from Multnomah County, Oregon. The surface between hairs has a close microscopic covering of periostracal laminae along growth lines, but somewhat waved or crimped. In the type lot of *vancouverinsulae* and some others these laminae are so fine and short that the surface appears much smoother. In some other lots the laminae are cut into little scales.

Dall (Alaska, p. 25) gives "Northern California, through the Puget Sound region to British Columbia" for *germana*, but there seems to be no reliable record in California. J. G. Cooper seems to have been in error as to the range of *germana* (Amer. Journ. Conch., 4: 223, and 5: 216). Both of these authors apparently confused *T. germana* with certain forms of *Vespericola*.

ALLOGONA Pilsbry

Allogona Pilsbry, 1939, Land Moll. North Amer., I, pt. 1, p. xvii.

The shell is rather large, umbilicate, depressed-globose or strongly depressed, with rounded periphery, smooth embryonic whorls and striate to malleate later sculpture, usually with minute, impressed spiral lines. The rounded aperture has a reflected white peristome, its inner edge usually having a blunt tooth or a low callus in the baso-columellar curve; no other teeth.

The penis has an imperfectly developed sheath; it is swollen anteriorly, containing a large "stimulator",¹ and towards the distal end tapers into the epiphallus. The cavity of the epiphallus has a very short branch at the transition to vas deferens, representing a concealed, vestigial flagellum (Fig. 506: 1c). The penial retractor is inserted on the base of the epiphallus and the apex of the penis; a penial retentor muscle running thence forward to the swollen portion of the penis at the limit of the sheath. The spermatheca is oblong, its duct short and usually swollen.

Pallial organs, ribbed jaw and teeth about as in *Triodopsis*.

TYPE: *Helix profunda* Say.

Distribution.—Upper and middle Mississippi, Ohio and lower Missouri valleys, for the typical subgenus, and Oregon to British Columbia and to eastern Montana for the subgenus *Dysmedoma*.

¹"Stimulator" is a name used for variously formed fleshy bodies in the cavity of the penis, occurring in various unrelated genera. It has apparently arisen many times anew, and is therefore not homologous in the several groups concerned. (Called *stimulus* by Von Ihering; similar bodies having been called Reizkörper by German anatomists.) See Fig. 506: 1d, 1e, and Fig. 510: 2a, 5a.

This genus is chiefly characterized by the possession of a strongly developed stimulator in the penis,—a structure not known in any other Polygyridae,—and an epiphallus with vestigial concealed flagellum. Except that the penial sheath is mainly or wholly adnate to the penis, the organization is otherwise about as in *Triodopsis*.

(Ἄλλος, other or different; γονή, genitalia.)

Allogona includes two subgenera now occupying areas about 800 miles apart; but in Tertiary times they were doubtless connected at some time when humid conditions extended to the heads of the Missouri and Columbia river systems and doubtless farther north. As fossils the eastern herd is represented in the Mississippi and lower Missouri Pleistocene by *A. profunda*, a common loess fossil.

Two subgenera are indicated mainly by the following differences in the genitalia:

Allogona Pilsbry, (type *A. profunda*), in which the anterior end of the upper division of the penis projects free within the envelope of the lower division, and the stimulator, wide at its base, projects forward in a single finger-like process.

Dysmedoma Pilsbry, (type *A. townsendiana*), in which the penial cavity is normal and the stimulator has two irregular depending processes.

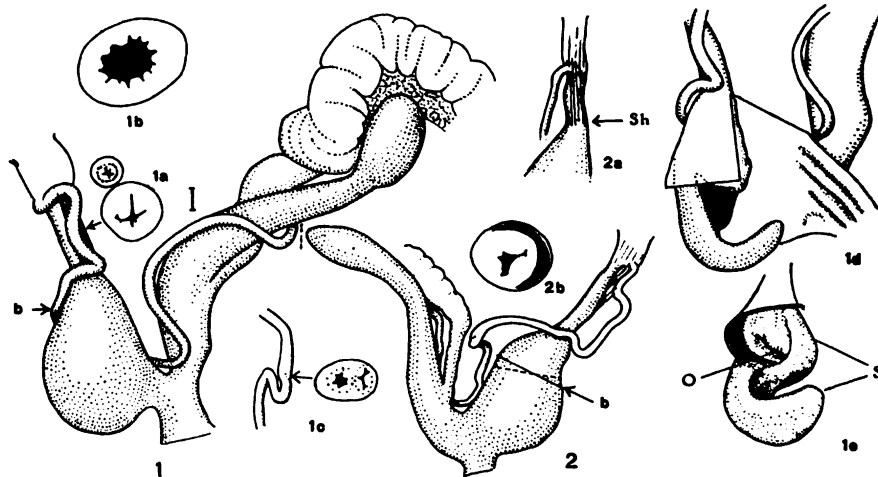


Fig. 506. *Allogona profunda*, 1, Jennings, Md., anterior part of genitalia: 1a, section of upper part of penis and epiphallus; 1b, section of penis at b; 1c, detail of end of epiphallus and beginning of vas deferens, with section showing vestigial flagellum; 1d, 1e, two views of the penial sheath opened, showing orifice of upper sac of penis, o, and stimulator, s. Fig. 2, Magnetic City, N. C., lower ducts of genitalia from above: 2a, upper part of penis viewed from below, showing retractor and retentor muscles, and at sh, upper limit of sheath; 2b, section across penis at b. (Scale mark = 1 mm.)

Subgenus ALLOGONA *s. str.***Allogona profunda** (Say)

Fig. 507.

Helix profunda Say, 1821, Journ. Acad. Nat. Sci. Phila., 2: 160 (near Cincinnati and at Engineer Cantonment on the Missouri); 1832, Amer. Conch., pl. 37, fig. 3.—Leidy, 1851, Terr. Moll. 1: 255, pl. 9, figs. 1-3 (anatomy).—Binney, 1851, Terr. Moll., 2: 177, pl. 22.—Lind, Nautilus, 8: 106.

Mesodon profunda Say, W. G. Binney, 1878, Terr. Moll., 5: 338, pl. viii, fig. q (teeth).—Marshall, Nautilus, 6: 126 (colonized in N. Y.).—Stupakoff, Nautilus, 7: 135.—E. Pleas, Nautilus, 7: 68.—Wetherby, 1881, Journ. Cincinnati Soc. Nat. Hist., 4: 326.

Polygyra profunda (Say), Ferriss, Nautilus, 14: 53.—Price, Nautilus, 14: 75.—Billups, Nautilus, 16: 119 (reversed).—Chadwick, Nautilus, 19: 58.—Walker, Nautilus, 20: 81; 1906, Ill. Cat. Moll. Mich., p. 463; 1928, Terr. Moll. Alabama, p. 29.—Hanna, Nautilus, 23: 82.—Stone, Nautilus, 25: 112.—Daniels, Nautilus, 26: 40, pl. 5, fig. 12 (pathologic).—Goodrich, Nautilus, 27: 82, 93.—Sampson, Nautilus, 28: 16; 1913, Trans. Acad. Sci. St. Louis, 22: 91.—Allen, Nautilus, 29: 19.—Greger, Nautilus, 30: 64.—Sterki, 1907, Proc. Ohio State Acad. Sci., 14: 375.—Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 115.—U. S. Grant, 1888, 16th Ann. Rep. Geol. & Nat. Hist. Surv. Minn., pp. 482, 490.—B. Shimek, 1888, Bull. Lab. Nat. Hist. State Univ. Iowa, p. 64; 1936, Nautilus, 49: 71.

Polygyra profunda alba and *unicolor*, Walker, 1899, Terr. Moll. Mich., p. 12; 1906, Ill. Cat. Moll. Mich., p. 464; Nautilus, 38: 34.

Polygyra profunda efasciata Walker, 1924, Nautilus, 38: 33.

Polygyra profunda strontiana G. H. Clapp, 1916, Ann. Carnegie Mus., 10: 537, pl. 32, figs. 13-15.

Polygyra profunda pleistocenica F. C. Baker, 1920, Nautilus, 34: 66.

Helix richardii Férussac, 1821, Tabl. Syst. Fam. Limaçons, p. 43, no. 174 (nude name); 1822 (?), Histoire, pl. 70, 3 lower figs.

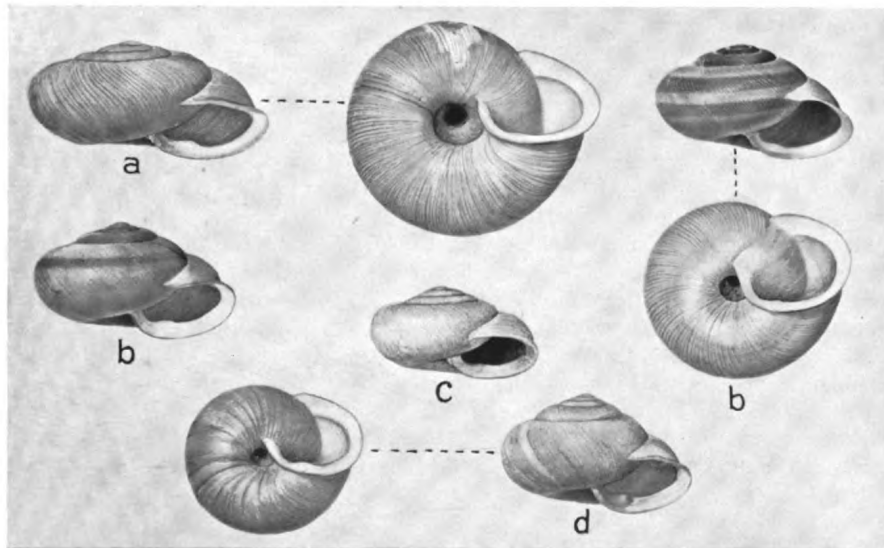


Fig. 507. *Allogona profunda*: a, Jennings, Md.; b, Morris, Ill. c, *A. p. pleistocenica*, paratype. d, *A. p. strontiana*, topotypes.

The shell is openly umbilicate, umbilicus about one-fifth of the diameter, depressed, the diameter twice the height, more or less; the spire low; rather solid; chamois colored with a cinnamon band above the periphery (often wanting, sometimes with some lines of the same color on the base). Embryonic shell with a few wrinkles following the smooth tip, after which the whorl is smooth except for quite short striae radiating from the suture. Last whorl finely and regularly sculptured with thread-like striae, and rather close spiral impressed lines, which are often punctate in places. The last whorl is rounded, descending but little in front, and is somewhat contracted behind the basal lip. Aperture lunate, the peristome wide, reflected and thickened within, with a short callus or low tooth projecting within the basal margin. Parietal callus thin, plain.

“Transverse diameter nineteen-twentieths of an inch.” (Say.)

Height 15 mm., diameter 27.3 mm.; 5½ whorls. Iowa City.

Height 17.1 mm., diameter 32.7 mm. Jennings, Md.

Height 14.8 mm., diameter 28.8 mm. Jennings, Md.

Height 15.5 mm., diameter 25.5 mm. Morris, Ill.

NEW YORK: Herkimer Co., colonized about 1873 by Dr. Lewis near Litchfield, in a branch of the ravine between Ilion and Cedarville (Albert Bailey, in State Museum).

PENNSYLVANIA: Allegheny Co. (Stupakoff). Ellwood City, Beaver Co. (J. B. Clark). Carrollton (W. Stone, and Cresson). Cambria Co. (S. N. Rhoads). Clinton Co. (A. D. Brown). Ohio Pyle, Fayette Co. (Stew. Brown). Waynesburg, Greene Co. (S. N. Rhoads). Blairsville (E. H. Harn), and Indiana (R. W. Wehrle), Indiana Co. Rockwood, Somerset Co. (S. Brown). Morganza, Washington Co. (Ortmann). Holly-wood, York Co. (F. Ottemiller).

MARYLAND: Cumberland, Allegany Co. (Howard Shriver). Jennings (W. Stone), and near Bittinger, Garrett Co. (J. B. Clark).

VIRGINIA: Natural Bridge, Rockbridge Co. (J. B. Clark, H. B. Baker). Natural Tunnel near Gate City, Russell Co. (C. Goodrich), Scott and Lee counties (Geo. H. Clapp).

WEST VIRGINIA: Wirt Co. (Wm. J. Fox).

OHIO: Kelly's Island, Put-in-Bay Island, Lake Erie (J. A. Allen). Mouse Island, Lake Erie (Goodrich), Miami Co. (G. D. Lind). Hamilton Co. (Clench), Columbus (Henry Moores). “Over the state” (Sterki).

MICHIGAN: Southern, north to Muskegon Co. (Walker). Near Ann Arbor (Clench). Cass Co. (Miles).

INDIANA: Flat Rock River, Bartholomew Co. (W. H. Fluck). Vawter Park, Kosciusko Co. (B. Walker). Lawrenceburg, Dearborn Co. (A. C. Billups).

ILLINOIS: Wills Co. (Ferriss). Morris. Grundy Co. (Daniels). Ogle, Cook, LaSalle, Winnebago, Mercer, Rock Island, and Fulton counties (F. C. Baker).

WISCONSIN: Milwaukee, Crystal Lake (Chadwick).

MINNESOTA: Albert Lea, Freeborn Co. (Hemphill). Winona (Holzinger).

IOWA: Davenport (D. S. Sheldon). Muscatine (Witter). Iowa City, and all over the state (Shimek).

NEBRASKA: Omaha (B. Walker).

KANSAS: Lawrence, Douglas Co. (G. D. Hanna).

MISSOURI: St. Louis and Washington counties (Hubricht). Providence, Boone Co., Lexington, Lafayette Co.; Lupus, Moniteau Co., all post-pliocene (Sampson). Callaway Co., post-pliocene (D. K. Greger). Courtney, Jackson Co. (Sampson).

KENTUCKY: Edmonson Co. (S. F. Price). Mississippi River bluff 2 mi. southwest of Hickman, loess (C. W. Wilson, jr.). Pine Mt., Harlan Co. (W. Stone).

TENNESSEE: Knoxville (H. B. Baker).

NORTH CAROLINA: Magnetic City and Roan Mt. (Wetherby). Paintrock, Madison Co. (Walker & Ferriss). Slick Rock Creek, Unaka Mts. (Ferriss).

ALABAMA: Princeton and Stevenson, Jackson Co. (Walker).

MISSISSIPPI: Natchez (G. W. Carpenter). Vicksburg (C. W. Johnson).

A. profunda differs conspicuously from other large helices in its area by the far wider umbilicus, the converging ends of the lip and the depressed shape.

"The species lives in deep, chiefly upland woods, especially on bluffs, but in northern and western Iowa and eastern Nebraska it extends into smaller prairie groves which suffer from summer drouth, where it is usually much smaller than the type, usually given as about 28 mm. diameter." (Shimek.)

The color varies in the same lot from between cream-buff and cartridge buff to cinnamon-buff. The banding varies also in single lots. Thus in a lot from Morris, Grundy County, Illinois, 2 are light, 3 dark, uniform; 3 light with one broad band; 4 with accessory lines or bands also. A lot from Jennings, Maryland, has 8 plain light buff, 10 with one band, 4 with several bands. Shimek states that a set of 114 recent shells from Iowa City shows 81 with bands, 6 with very faint bands and 27 unicolored. Two color-mutation names have been provided: mut. *efasciata* B. Walker for the pale, bandless shells¹ (Washtenau and Monroe Counties, Michigan). Mut. *unicolor* B. Walker, "bands coalesce and cover the entire surface." Both are found throughout the range of the species, but there are also pure colonies of the pale, bandless mutation.

Shimek and Billups have recorded 4 sinistral shells.

Say gave the diameter as about 23.5 mm.,—a very small individual, probably from Council Bluffs, Iowa. In the American Conchology he figured one of about 26 mm. The specimen which he gave the Academy, now selected as a neotype (11165 A.N.S.P.), measures 29.3 mm.

Dr. Shimek gave measurements of recent specimens from numerous localities, the size ranging gradually from 17 x 32 mm., St. Louis, to 14 x 23 mm., eastern Nebraska. Fossil specimens range from 17.5 x 33.5 mm., Hickman, Kentucky, to 12 x 19.5 mm. and 14.5 x 28 mm., Alton, Illinois. "The larger sets, both recent and fossil, form perfect series to the half millimeter between the extremes."

In the Pleistocene, this species extended much farther south along the Mississippi, where it occurs abundantly in loess deposits. The specimens

¹ *Helix richardii* Fér., was a bandless buff shell, according to the figures. That name has precedence for the uniform buff mutation, if one is needed. *Helix bulbina* Deshayes, which has been referred to *profunda* as a doubtful synonym, is not an American snail. The figure looks like an European *Hygromia* or *Monacha*.

from a Mississippi bluff, about 2 miles southwest of Hickman, Kentucky, are typical in form, 29 to 32.3 mm. in diameter. At Vicksburg, Mississippi, the diameter is 27 to 29.3 mm., and at Natchez, Mississippi, 24.5 to 26.8 mm. Sampson did not find *profunda* living in Missouri, but reported it from several post-pliocene (? loess) deposits. According to Shimek (*Nautilus*, 49: 71), "fossils have been found from the southwestern part of Indiana to the eastern counties of Nebraska south of Douglas Co., and from the southern third of Iowa to Louisiana. They are locally common in Mississippi, Arkansas, Tennessee, Kentucky and southern Illinois."

The form called *pleistocenica* F. C. Baker, (Fig. 507 c), has the "Shell uniformly smaller than typical *profunda*, more solid, with slightly higher spire and proportionally smaller aperture and umbilicus; the color bands are developed in but two specimens of the 19 specimens examined, the majority of the individuals being unicolored. Greatest diameter, 22; height, 14.7 mm. Holotype." (F. C. Baker.)

Paratypes measure 14 x 24 and 14.7 x 26 mm. and the one figured 12.1 x 21.8 mm., h/d index 55.5. The type locality is Mississippi River bluff at corner of Market and E. 6th streets, Alton, Madison County, Illinois, in pink loess; common in middle deposits, probably of Sangamon age. Type P.751A, University of Illinois; paratype 46247 A.N.S.P. Occurs in St. Louis County loess, Missouri (Hubricht).

The smaller size and small umbilicus, contained 7 times in diameter, seem to be its only differential characters, but the size of the umbilicus varies in Alton examples. Many years ago John Ford collected specimens from loess of the "outer bluff 1 mile above Alton", diameter 21.8 to 25.4 mm. This and the following seem to be probably locally dwarf ecologic forms. Say's type was also small. "The recent forms from the prairie groves of northern Iowa and eastern Nebraska are even slightly smaller" than Baker's measurements of *pleistocenica*.

***Allogona profunda strontiana* (Clapp)**

Fig. 507 d.

Polygyra profunda strontiana Clapp, 1916, *Ann. Carnegie Mus.*, 10: 537, pl. 32, figs. 13-15.

"Shell small, elevated, compact, dull-colored; umbilicus small, partly covered by the reflected lip, and contained about six times in the diameter of the shell. Whorls 5." (Clapp.)

Height 14.4 mm., diameter 23.3 mm.; h/d index 61.8. Average.
 Height 15.5 mm., diameter 25.5 mm.; h/d index 60.8. Largest.
 Height 13.5 mm., diameter 21.0 mm.; h/d index 64.8. Smallest.
 Height 15.0 mm., diameter 22.0 mm.; h/d index 68.18. Highest.
 Height 14 mm., diameter 24.5 mm.; h/d index 57.13. Lowest.

OHIO: Green (formerly Strontian) Island, Lake Erie, Type 7466 Clapp Collection, Carnegie Museum; West Sister Island.

ONTARIO: North Harbor Island, Middle Sister Island (Clapp, Goodrich and Walker).

The specimens from Middle Sister Island run from 21.5 to 27 mm. in diameter, the h/h index, 54.9 to 68.08.

The average as well as the extreme height is decidedly greater than that of typical *A. profunda*, although there is complete intergradation.

On Put-in-Bay Island "the *profunda* are of the large, flatter mainland form" according to Clapp. On Kelly Island also they are referable to *profunda* proper, though somewhat transitional, the diameter from 25.2 to 27.3 mm., the highest with h/d index of 60.9, the lowest 50.44. On the larger islands of the Lake Erie group there seems to have been very little modification of the snails, the evolution of island races being confined to very small islands.

Genitalia of a specimen of typical *profunda* from Jennings, Maryland, are drawn in Fig. 506: 1-1e; Magnetic City, North Carolina, Figure 506: 2-2b. The penis is slender in its upper third, much swollen in the lower part. The cavity is filled above by 4 large ridges (Fig. 506: 1a). It suddenly enlarges in the swollen part, (Fig. 506: 1b), where there are numerous ridges. The wholly adnate sheath extends to the upper end of the swollen portion. It becomes free from the stout, short, fleshy body of the penis in the lower half (indicated by the stippled line in Fig. 506: 2, as in the section 2b, which crosses the line of adhesion of the sheath, shown in stipple). The penis within this sheath is broad and truncate at the end, where there is a large opening into the anterior cavity (Fig. 506: 1e at o). Arising from the sides of the anterior cavity there is a wide, partly encircling stimulator which tapers downward as a long, thick, finger-shaped process, as in Figure 506: 1d, 1e, the latter viewed obliquely from below. The very short, stout penial retractor is inserted on the base of epiphallus and apex of penis, and is partly continued as a retentor muscle to the upper edge of the sheath. The epiphallus is rather long and slender, and in sections shows a vestigial flagellum (Fig. 506: 1c). The spermatheca varies in shape, and has a swollen duct.

Dimensions in mm. of two specimens follow:

	Magnetic City, N. C.	Jennings, Md.
Penis	7	...
Retractor	2	...
Epiphallus	16	...
Spermatheca	11	14
Vagina	2.5	6
Shell, diameter	25	34.2

Subgenus DYSMEDOMA Pilsbry

Dysmedoma Pilsbry, 1939, Land Moll. North Amer. I, pt. 1, p. xvii.

Dysmedoma is confined to the region west of the continental divide in Montana, Idaho, Oregon, Washington and adjacent parts of British Columbia. A large part of its area lies in the Columbia River drainage. A series of over 600 specimens collected by Dr. H. B. Baker, together with

others from Hemphill, Henderson, Daniels and older collections, supplied the data plotted for *A. ptychophora*. Information on the distribution of *A. townsendiana* has been received from the California Academy, A. G. Smith and the Chaces.

(Δυσμή, sunset, δῶμα, house.)

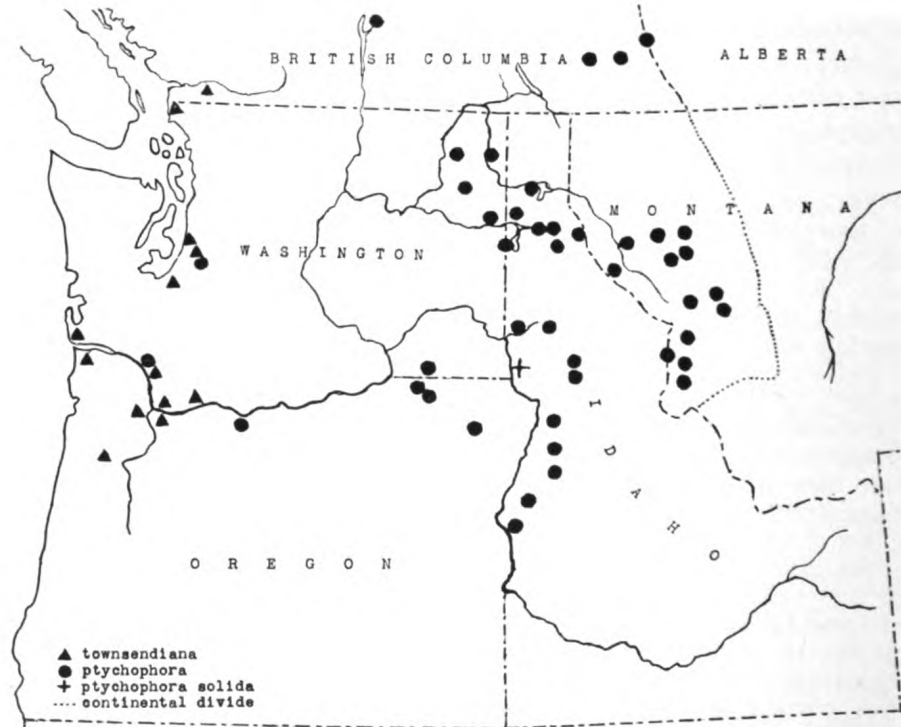


Fig. 508 Distribution of *Dysmedoma*.

***Allogona townsendiana* (Lea)**

Fig. 509 a-d.

Helix townsendiana Lea, 1838, Trans. Amer. Phil. Soc., 6: 99, pl. 23, fig. 80.—Binney, 1851, Terr. Moll., 2: 161, pl. 19.—Gould, 1852, U. S. Expl. Exped., 12: 67.

(?) *Helix ruida* Gould, 1846, Proc. Boston Soc. Nat. Hist., 2: 178; 1852, U. S. Expl. Exped., Moll. and Sh., p. 65 (young shell).

Arionta townsendiana Lea, W. G. Binney, 1878, Terr. Moll., 5: 355, pl. 19; pl. ix, fig. q and pl. xiv, fig. a, anatomy.

Polygyra townsendiana (Lea), Pilsbry, 1894, Man. Conch., 9: 76.—Dall, 1905, Harriman Alaska Exped., 13: 25.—Randolph, 1895, Nautilus, 9: 102 (Seattle); 1898, 12: 24 (Duncan's I., Alaska).—Whiteaves, 1902, Ottawa Nat., 16: 92.

Polygyra townsendiana townsendiana (Lea), Henderson, 1929, Univ. Colo. Studies, 17: 85, fig. 42.

Polygyra townsendiana brunnea Vanatta, 1924, Proc. Acad. Nat. Sci. Phila., 76: 25; 1925, Nautilus, 38: 144 (locality).—J. Henderson, 1929, *ibid.*, p. 86.

“Shell obtusely conical, longitudinally striate, rough, brownish, umbilicate; whorls 5; aperture nearly round; lip reflected; columella smooth. Diameter 1, length .6 of an inch.” (Lea.)

The general color of the last whorl of the holotype Figure 509a, is between tawny-olive and clay color, with two narrow darker growth-rest streaks, but closely examined the last two-thirds of the last whorl shows cream-buff wrinkles on a tawny-olive ground; the back of the lip and a streak adjacent being Naples yellow. The spire is dilute pecan brown. There is rather irregular striation up to a growth-rest at the front third of the last whorl, after which the striae are largely interrupted or lost in a general malleation and transverse wrinkling of the surface. The last whorl descends in front. On the last two whorls the lens shows close impressed spiral lines throughout. Aperture nearly as high as wide, the white peristome reflected and thickened within, having a slight callus of the inner basal margin near its junction with the columellar margin. It is dilated at the axial insertion, nearly half covering the umbilicus.

Height 16.2 mm., diameter 25.8 mm.; 6 whorls; h/d index 62.78.

OREGON: Willamette near its junction with the Columbia River (T. Nuttall), Type 106729 U.S.N.M. Hayden Island, opposite Vancouver (J. G. Malone, H. B. Baker). Troutdale, 16 mi. east of Portland (Hemphill in Cal. Acad. Sci.). Portland (W. H. Golisch in Willett Collection). 14 mi. above [up river from?] Astoria, Clatsop Co. (J. Henderson). Near Vernonia, Columbia Co. Near Netarts, Tillamook Co.; Corvallis, Benton Co. (Cal. Acad. Sci.). Banks of LaFollette Creek, Polk Co. (F. E. Richard).

WASHINGTON: North Head, Cape Disappointment (J. G. Cooper, H. B. Baker). Kalama (Hemphill) and near Kelso (Eyerdam), Cowlitz Co. Vancouver, Clark Co. Carson, Skamania Co. (J. G. Malone). Nisqually, Pierce Co. (S. N. Rhoads). Near Renton (E. J. Post), and Seattle (Eyerdam), King Co. Near Hoquiam, Grays Harbor Co. (Cal. Acad. Sci.). Blaine, Whatcomb Co. (Alex. Walker).

BRITISH COLUMBIA: Valley of Chilliwack River (Whiteaves).

Lea's type, described above, was a specimen of about minimum size for the region about the junction of the Willamette and Columbia Rivers. In a lot of 64 from Hayden Island, in the Columbia River opposite Vancouver, Washington, a place which cannot be far from the original locality, the diameter ranges from 26 to 33 mm. The ground color of the last whorl is from tawny-olive to cinnamon brown, with striae and wrinkles of Naples brown to cream color, the spire either remaining light or fawn color or darker, apex either whitish or dark. In some examples the somewhat coarse and uneven striation continues for some distance on the front of the last whorl (as in Lea's type); but in others the malleation and creamy variegation begin on the penult whorl, following a growth-rest.

The first growth-rest in the Hayden Island lot, is usually near the middle of the penult whorl or somewhat later. There is usually a change of color and sculpture on the resumption of growth. A second rest usually occurs about a half a whorl later, on the last whorl; it may be either definite, or in several stages. In some individuals growth rests are hardly noticeable, and there is often only one distinct resting stage. I am not sufficiently acquainted with the conditions of growth in Oregon and Washington to correlate the rests with seasons, but evidently there are two, or more frequently three, periods of growth in reaching maturity. Specimens measure:

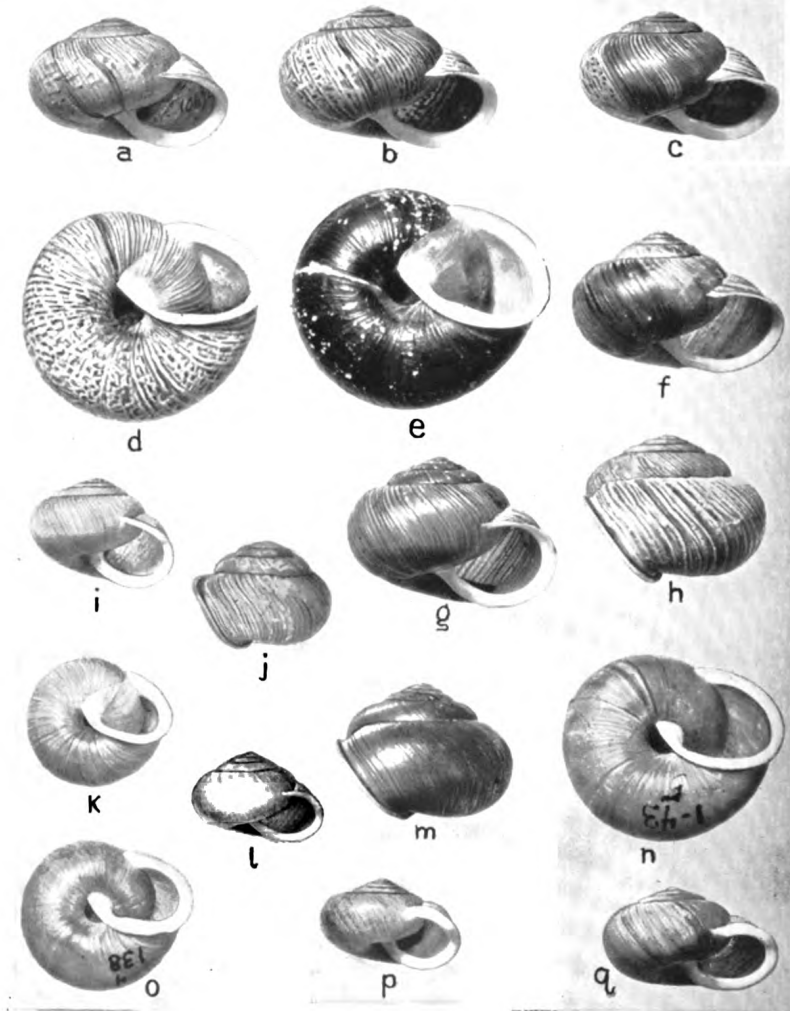


Fig. 509. a-d, *Allogona townsendiana*: a, type; b, c, Hayden I., Columbia R.; d, Carson, Wash. e, form *brunnea*, type. f, form *frustrationis*, type. g, *Allogona ptychophora* form *castanea*, Orofino Creek, near Pierce, Ida.; h, Bitter Root Mts., Shoshone Co., Ida. i, j, *A. ptychophora*, neotype, north of Ward, Mont.; k, Bitter Root Valley, Mont.; l, 11 mi. north of Slate Creek, Salmon River; m, n, smooth form, Rabbit Creek, south of Stites, Ida. o, q, *A. ptychophora solida*, Mission Creek, Nez Perce Co., Ida. p, type of *A. ptychophora solida*.

Height 17 mm., diameter 26 mm.; $5\frac{1}{2}$ whorls.

Height 18 mm., diameter 28.3 mm.; $5\frac{3}{8}$ whorls.

Height 20.7 mm., diameter 31.3 mm.; $5\frac{3}{8}$ whorls.

Height 22.7 mm., diameter 32.2 mm.; $6\frac{1}{8}$ whorls. (Highest.)

Height 18 mm., diameter 31.7 mm.; $5\frac{3}{8}$ whorls. (Lowest.)

It is obvious that Lea's type is not separable from the form usual in the Willamette-Columbia junction region, being merely a small individual of that widely spread race. The same form occurs along the Columbia from Cowlitz to Skamania Counties, Washington, and northward to Blaine, Whatcomb County, near the British Columbian border. The largest specimens seen are from Carson, Skamania County, diameter up to 35.3 mm., $6\frac{1}{2}$ whorls. In some places northward the size is reduced, those seen from Seattle measuring 24 to 28 mm. in diameter.

Very pale specimens with dilute ecru-olive ground, buff reticulation and white early whorls are before me from 1 mile east of Renton, King County, Washington. One measures 17.5 x 28.7 mm.

(This species was named for John K. Townsend.)

In the form *brunnea* Vanatta (Fig. 509 e), from near Kelso, Cowlitz County, Washington,¹ the color is sometimes very dark, olive brown to bone brown, without creamy markings, but as other specimens of the same lot agree in color with many from Hayden Island I do not consider this form racially separable from *townsendiana*. *Haplotrema vancouverense* in the same locality is also dark colored. I have seen dark specimens from Polk County, Oregon, also.

Form *frustrationis* new form, (Fig. 509 f). The shell is thinner and smoother than *townsendiana* proper, in large part cinnamon-brown (but sometimes tawny olive with some cinnamon-brown streaks); in many individuals the periostracum is largely lost showing the matt light grayish vinaceous or avellaneous color of the calcareous layer. Striae are quite irregularly developed, often absent over part of the last whorl. Malleation is sparse or wanting, but impressed spiral lines are about as in typical *townsendiana*.

Height 18.2 mm., diameter 27.2 mm. 6 whorls.

WASHINGTON: North Head, Cape Disappointment, Pacific County (H. B. Baker).

The diameter varies from 24 to 29.4 mm. It is scarcely distinguishable from some examples of *A. ptychophora* form *castanea* Hemph., but the spiral lines are more strongly developed than is usual in that Idaho form, and it reaches a slightly larger size. In a few specimens the striae of the

¹ The specimens were collected by Walter J. Eyerdam who states that the locality may be reached by auto stage from Kelso to Mt. Solo and walking $1\frac{1}{2}$ miles up an old logging road to Inman & Polson's old shops, where it is abundant around a waterfall.

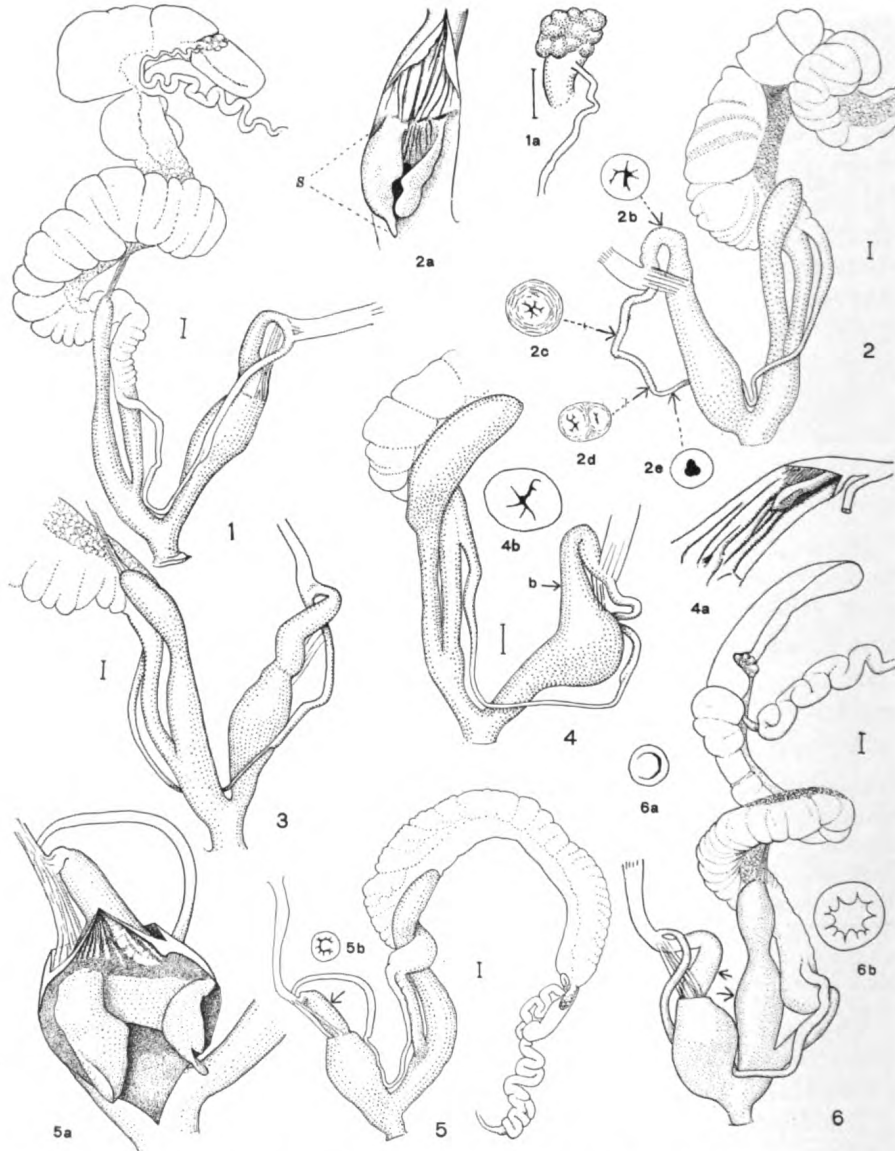


Fig. 510. 1, 1a, 3, *Allogona townsendiana* form *frustrationis*, North Head, Cape Disappointment; 1a, talon and end of hermaphrodite duct. 2, *A. townsendiana*, Seattle: 2a, interior of penis, semi-diagrammatic, at s, stimulator; 2b, 2c, sections of epiphallus; 2d, section of flagellum and vas deferens; 2e, section of vas deferens. 4, *A. townsendiana*: 4a, 4b, section of upper part of penis and the same opened. 5, *A. ptychophora*, near Meadows, Idaho: 5a, the penis opened, showing stimulator; 5b, section of upper part of penis. 6, *A. ptychophora*, Spokane Falls: 6a, section of upper part of penis; 6b, section of duct of the spermatheca. (Scale lines = 1 mm.)

last half turn are marked with buff, thus transitional to *townsendiana*. It is apparently an ecologic form, produced by the barren, exposed situation it inhabits, and parallel to *castanea* rather than genetically connected.

(*Frustratio*, disappointment.)

Genitalia (Fig. 510: 1, 1a, 3, North Head, Cape Disappointment, Washington; 2-2e, Seattle; 4-4b). The penis is variable in degree of inflation, but the upper third is always rather narrow. The sheath is thin and bound to the surface beneath by a loose mesh of connective tissue, its upper edge, at the junction of narrow and swollen parts of the penis, is quite indistinct. Internally there is a large and several smaller longitudinal ridges in the narrow upper part, as in Figure 510: 2b and 4a, b. The larger ridge is short and sometimes with a shortly free lower end, as in Figure 510: 4a. The lower part is occupied by a complex stimulator (Fig. 510: 2a, *st.*), consisting of a broad band forming about three-fourths of a circle, its lower edge free, with at each end large, irregular fleshy bodies directed downward. The band is interrupted on the ventral side of the penis. The penial retractor is attached to the base of epiphallus and apex of penis. A retentor muscle runs from the beginning of the epiphallus to the top of the sheath. The epiphallus is about as long as the penis. At its end, which tapers rather abruptly to the vas deferens, sections show the presence of a vestigial flagellum, as in Figure 510: 2d.

The vagina is quite short. Spermatheca is oblong, on a short duct which is usually somewhat swollen, but in some individuals is stout but of about equal diameter throughout.

In a specimen of *A. t. frustrationis* 27 mm. in diameter the kidney is 15 mm. long, the pericardium 6 mm. The secondary ureter is closed throughout.

Measurements of genitalia in mm. follow. Figs. 1-4 are *A. townsendiana*, 1 and 3 being the race *frustrationis*; Figs. 5, 6 are *A. ptychophora*.

Figure	2	1	3	4	5	6
Penis	16	16	14	13.5	8	11
Retractor .....	...	6	11	...	8	4.5
Epiphallus	15	12	13	9	10	11
Vagina	4	3	4	...	4	2.5
Spermatheca	15	13	12	16	10	10.5
Shell, diameter .....	...	27	26.4	...	22.6	22

Allogona ptychophora (A. D. Brown)

Fig. 509 g-n.

[?] *Helix pedestris* Gould,¹ 1846, Proc. Boston Soc. Nat. Hist., 2: 166; 1846, Otia Conch., pp. 18, 243 (not the description of locomotion or the locality); 1852, U. S. Expl. Exped., Moll. and Sh., p. 65.

Helix townsendiana, small specimens, Bland & Cooper, 1861, Ann. Lyc. Nat. Hist. N. Y., 7: 362 (both slopes of Bitter Root Mts., 2200-5600 ft.).

Mesodon townsendiana var. *minor* Tryon, 1867, Amer. Journ. Conch., 3: 46, pl. 8, fig. 6 (Idaho and Nebraska).

Helix ptychophora A. D. Brown, 1870, Journ. de Conchyl., 18: 392 (Bitter Root Mts. and Nebraska).—Tryon, 1887, Man. Conch., 3: 154, pl. 38, figs. 2, 3.

¹ The nomenclature of this snail is somewhat involved. Gould described *Helix pedestris* in 1846, from New South Wales. In 1852 he stated that it was identical with *Helix townsendiana* Lea, and that the locality and mode of locomotion assigned were incorrect; but except by implication he gave no other locality. It has never been figured, and I did not find the type when working over the Gould Collection some years

- Arianta townsendiana* var. *ptychophora* W. G. Binney, 1883, 1st Suppl., Bull. Mus. Comp. Zoöl., 11: 158, pl. 4, figs. E, F; 1885, Man. Amer. L. Sh., p. 128, figs. 101, 102.
- Mesodon ptychophorus* A. D. Br., W. G. Binney, 1886, 2d Suppl., Bull. Mus. Comp. Zoöl., 13: 38, pl. 1, fig. 16; 1890, 3d Suppl., Bull. Mus. Comp. Zoöl., 19: 215, text-fig. (small form).
- Mesodon ptychophorus* var. *major* W. G. Binney, 1886, 2d Suppl., Bull. Mus. Comp. Zoöl., 13: 39, pl. 1, fig. 3 (Salmon River, Idaho).
- Helix ptychophorus* var. *castaneus* Hemphill, 1890, Nautilus, 4: 41. (Old Mission and Rathdrum, Idaho). Not *Helix castanea* Müller, 1774.
- Polygyra townsendiana ptychophora* A. D. Br., Pilsbry, 1894, Man. Conch., 9: 76.—Elrod, 1902, Nautilus, 15: 129; 1912, Bull. Univ. Mont., no. 10, pp. 106, 114, 116, 171 (*ptychophora*).
- Polygyra ptychophora* (A. D. Br.), Whiteaves, 1906, Ottawa Nat., 20: 119 (Crowsnest Pass).—Vanatta, 1914, Proc. Acad. Nat. Sci. Phila., 66: 368.—Henderson, 1924, Univ. Colo. Studies, 13: 107, with *P. p. castanea* Hemph., p. 108; 1924, Univ. Colo. Studies, 17: 84, fig. 41.
- Polygyra ptychophora ptychophora* and *P. p. castanea*, Henderson, 1936, Univ. Colo. Studies, 23: 98.

“Shell umbilicate, depressed-globose, thin, ornamented with rather distant strong ribs; no concentric striae; spire conic, little elevated; whorls 5, rather convex, the last inflated, descending in front; aperture rounded-lunar, oblique; peristome white, reflected; columella short, dilated, half covering the umbilicus. Greater diameter 18, lesser 15½ mm., height 10 mm.” (A. D. Brown.²)

The color is slightly grayish colonial buff (grading into clay color in others of the same lot). A darker growth-rest streak is often present on the last whorl, but as frequently none is visible. Embryonic whorl smooth, the early meanic whorls very finely striate. On the penult whorl the striae become strong, and on the last are strong but unevenly developed, with spaces wider than the striae, these conditions being emphasized on the last half whorl. Fine, superficial, interrupted impressed spirals are visible in places.

Height 14 mm., diameter 19.3 mm.; 5½ whorls. Neotype.²

Height 14.5 mm., diameter 18.6 mm.; 5½ whorls. Topotype.

BRITISH COLUMBIA: Crowsnest Station, C. P. R. R., near the Alberta boundary (M. M. Green). Cold Creek Valley, near Fernie (L. S. Russell). Cranbrook (M. M. Green). Vernon, on Lake Okanagan (S. N. Rhoads). Boswell, Kootenay Lake (Cal. Acad. Sci.).

ago. The shell he described is obviously not *townsendiana*, the diameter, ⅜ inch, the sculpture and the color as described, being about as in some *ptychophora*. Some forms of the Australian group *Badistes* have the general appearance of *A. ptychophora*.

Tryon's *Mesodon townsendiana* variety *minor*, 1867, is the next name for *ptychophora*; but from the then prevalent custom of alluding to any small specimen as “var. minor” it is doubtful whether he intended to name a race (cf. Tryon, Amer. Journ. Conch., 3: 51, *introferens* var. *minor*). Moreover, in his later work (Man. Conch., 3: 154) Tryon ignored his var. *minor*. It is probably the wisest course to forget the literature prior to A. D. Brown's publication.

² Brown's type is lost, but his collection in Academy of Natural Sciences of Philadelphia contains other examples. A specimen from bluff on north side of Bitter Root River, north of Ward, Montana has been selected as a neotype, A.N.S.P., 107317.

WASHINGTON: East of Colville, and shore near Six-Mile Lake, Nelson (Roy. Ont. Mus. Zool.). 14 mi. north of Springdale, Stevens Co.; Little Pend Oreille Lakes, Pend Oreille Co. (Henderson). Around Spokane (Mrs. M. P. Olney, H. B. Baker, J. Henderson). Walla Walla (Hemphill). 1 mi. east of Renton, King Co.³ (E. J. Post). Coal Creek, 10 mi. from Kelso, Cowlitz Co.³ (W. J. Eyerdam).

OREGON: Pine Creek Valley, 5-10 mi. from Weston, Umatilla Co. (H. B. Baker). 4 mi. west of Pendleton (A. G. Smith). Milton, Umatilla Co.; 4 mi. above Le Grande, Union Co. (Henderson). The Dalles (Hemphill).

IDAHO: Shepherd Lake near Sagle, Bonner Co., 2100-2300 ft. (H. B. Baker). Rathdrum, Kootenai Co. (Hemphill). 2 mi. east of Harrison, 2100-2300 ft.; 3-4 mi. west of Coeur d'Alene; Old Mission; Coeur d'Alene River near Cataldo, in swamps and cottonwood flats; rock slides on north side of Mt. Baldy, south of Cataldo, all in Kootenai Co. (H. B. Baker). Around Avery; Willow Creek, 5400-5600 ft.; trail between Dorsey and Twin Lakes; meadows and cedar swamps along Coeur d'Alene River above Larson, 3500-3700 ft., all in Shoshone Co. (H. B. Baker). Bitter Root Mts., Shoshone Co. (Dr. Wm. Hughes). Near head Orofino Creek around Pierce, Clearwater Co., in white pine forest and boggy valleys with brush and spruce (H. B. Baker). North Lapwai, Nez Perce Co., 800-900 ft. (H. B. Baker). 12 mi. south of Lewiston, in lava rock slide (A. G. Smith). 3 mi. north of Ferdinand (A. G. Smith); 1 mi. south of Stites in lava rock slides, and on Rabbit Creek; 3-4 mi. south of Harpster, on moss-covered slopes and rock slides, 1700-2600 ft.; Elk and Lower Falls Creeks, south of Riggins; John Day Creek and along Salmon River; Lucile; vicinity of Pollock, on the Little Salmon (H. B. Baker); White Bird (Hemphill), all in Idaho Co. Near Meadows, 3700-4500 ft., Adams Co. (E. H. Ashmun, H. B. Baker). 6.3 mi. south of Tamarack, Adams Co. (A. G. Smith). Near Starkey Hot Springs, 3200 ft.; Stevens Ranch in canyon near mouth E. fork Weiser River, 2600 ft., Adams Co. (H. B. Baker). Weiser Canyon, Washington Co. (E. H. Ashmun).

MONTANA: MacDonald Lake, Sinyaleamin Lake and elsewhere in the Mission Range; Lolo Creek, 11 mi. south of Missoula (Elrod). Randolph Creek west of Saltese, and west of Deborgia, Mineral Co.; Blackfoot River 2 mi. above Milltown, Missoula Co. (Henderson). Ravalli Co., north and west of Ward; north side Ward Mt.; Lost Horse Canyon, near Charlos; near Como; near Darby, and Bitter Root Valley generally (L. E. Daniels). Byrne Resort, Hell Gate River, Granite Co. (Henderson).

A. ptychophora inhabits British Columbia and Montana west of the continental divide, the northwestern half of Idaho, Washington east of the Columbia River, and northeastern Oregon. There are also outlying localities along the Columbia at The Dalles, where Hemphill found it, and in Cowlitz County, Washington, where Eyerdam took specimens with large *A. townsendiana*. These may probably be regarded as river-borne colonists. The locality in King County, Washington, is problematic. It is based on one specimen sent with typical *A. townsendiana* by Mr. E. J. Post in 1927. I am informed that there is also a Hemphill lot from Troutdale, 16 miles east of Portland, Oregon, in the California Academy.

Dr. H. B. Baker, who has collected extensively in *ptychophora* territory, believes *ptychophora*, *solida* and *townsendiana* to be ecologic races of one

³ *A. townsendiana* also is found in these localities.

species rather than distinct species or subspecies. The occurrence of *ptychophora* in a few places in the *townsendiana* territory has influenced me to let it stand as a species. Evidently the local conditions of these places require careful study, with further collections of the snails. I have seen only single specimens of *ptychophora* from near Kelso and from Renton, Washington.

“At Old Mission, Coeur d’Alene, Idaho, Mr. Hemphill found a form of this species characterized by a heavy, dead white shell with scarcely any trace of ribs or wrinkles of growth which are usually so characteristic of the species. On the banks of the Salmon River he found a small form, the lesser diameter of which is only 12 mm.” (W. G. Binney.)

Mr. Allyn G. Smith collected a very small, light-colored or sometimes almost white form, from the vicinity of a mineral spring, 11 miles west of Slate Creek, Idaho, possibly from the locality of Binney’s small shells. One measures 16.5 mm. in diameter.

Dr. H. B. Baker found some very small shells around Lucile, the surface smoothish, with weak growth lines, diameter 15.3 mm.

The form considered typical, common in the Bitter Root Range, is small and rather coarsely sculptured, though the prominence of the striation varies individually. The minute spiral lines are also variable, being hardly visible in some examples, moderately distinct in others, but they seem rarely if ever to be as strongly developed as in *townsendiana*. Brown’s type was near the minimum size, though smaller ones occur, down to between 16 and 17 mm. in diameter. More frequently the diameter is about 22 mm.

The color varies widely, from ecru-olive to cinnamon brown in some lots (Squaw Creek, near Riggins, Idaho), while other lots may be of nearly uniform shade, light or dark. A set received from the Royal Ontario Museum of Zoology, from near shore of Six-Mile Lake, Nelson, British Columbia, are very dark, bistre to chestnut brown, but probably this is owing to the fluid in which they were preserved in the field.

Form *castanea* Hemphill, (Fig. 509 g, h), was described as large (diameter 1 inch), “of a dark chestnut color,¹ surface covered with coarse, irregular, widely separated lines of growth and crowded microscopical revolving lines.” From Old Mission and Rathdrum, Idaho. According to unpublished notes of H. B. Baker “it sparsely inhabits the mesophytic forests of the Idahoan Transition-area, and thus differs markedly in its habits from the gregarious *ptychophora* of the rock-slides and stream flats. Although it is a well-marked ecologic subspecies, it intergrades with both *ptychophora* and *townsendiana*. Usually it lacks pronounced malleation, or only develops this sculpture just below the suture near the end of the last whorl, but specimens from Bowl and Pitcher, near Spokane, Wash.

¹ The darkest fresh specimens seen are cinnamon-brown; none are chestnut, as this term is understood by Ridgway.

would almost pass for true *townsendiana*." He found it abundant in thickets of willow brush and nettles kept wet by permanent springs, on moss-covered slopes below limestone cliffs, and the largest of all in pine forests on open plateaus. Very coarsely sculptured specimens occur also in many Idaho localities, such as the Bitter Root Mountains, Shoshone County (23.7 to 28.2 mm. diameter); on the south fork of the Clearwater River, south of Harpster, Idaho County (diameter 27.2 mm.); around Pierce, Clearwater County (Fig. 509 g), and elsewhere. In all of these districts the more typical *ptychophora* or the smoothish form are found not far away. This form was first called var. *major* W. G. Binney, but that name was preoccupied in *Mesodon*.

The British Columbian specimens seen are of the form *castanea*.

In a form widely distributed in Idaho the surface is smoothish, only quite weakly striate, with slight traces of malleation and subobsolete spiral striation. It is less depressed than *A. solida*, with larger aperture, and the lip is narrower than usual in that form. The color is from uniform tawny-olive or lighter to cinnamon-brown. Usually of medium size, diameter 19 to 22 mm. (Squaw Creek near Riggins, Idaho), but also up to height 18.7, diameter 28.2 mm. (Rabbit Creek 2 miles south of Stites, Idaho).

The genitalia (Fig. 510: 5-5b, near Meadows, Idaho, and Fig. 510: 6-6b, Spokane Falls, Washington), are much as described for *A. townsendiana* except that the penial sheath is decidedly more developed, at least in the specimens examined, having a distinct upper edge, as in Figure 510: 5a. There is one large pilaster and numerous small ridges in the narrow upper part of the penis (Fig. 510: 5b, 6a). There is a smoothish space between the ribbed upper part of the cavity and the depending band bearing the stimulators. The spermathecal duct is swollen in all specimens opened.

***Allogona ptychophora solida* (Vanatta)**

Figs. 509 o, p, q; 511.

Polygyra solida Vanatta, 1924, Proc. Acad. Nat. Sci. Phila., 76: 25, figs. 1, 2.

The shell is more depressed than *ptychophora*, from a brownish cream-buff to tawny-olive or dilute cinnamon-brown; smoothish, under the lens showing striae which are much weaker than in typical *ptychophora*, and with indistinct spiral lines in some places. The rounded-lunate aperture is rather small, the peristome wider than in *ptychophora*, the edge well recurved.

Height 11.1 mm., diameter 18.2 mm. 5½ whorls. Type.

Height 12.8 mm., diameter 22.3 mm. Mission Creek.

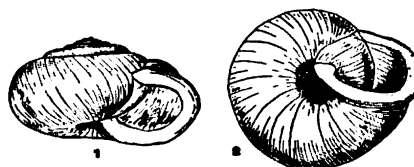


Fig. 511. *Allogona p. solida*.
(After Vanatta.)

IDAHO: Nez Perce County in Cottonwood Tree Canyon, along Snake River, 50 miles south of Lewiston (John Lorang); Type and 3 paratypes

132476 A.N.S.P. Rock slides on Mission Creek 7 to 8 miles above Jacques Spur, 2200-2400 feet, in the same county (H. B. Baker).

According to Dr. H. B. Baker the most depressed shells (*solida*) come from the interstices of rock slides or boulder-strewn flats in quite arid localities.

VESPERICOLA Pilsbry

Vespericola Pilsbry, 1939, Land Moll. North Amer., I, pt. 1, p. xvii.

The shell is globose-depressed, narrowly umbilicate to imperforate, of 5 or 6 rather closely coiled whorls, rounded peripherally at all stages of growth. The embryonic whorls, after initial smooth area, are closely granulose, or the granules may partially run into striae; they fade out near the outer suture. In some species granulation is absent and the embryonic shell is smooth except for faint lines of growth. Adult sculpture of weak growth wrinkles and usually hairs or their scars. Aperture is broadly lunate with reflected but not recurved lip, its terminations rather remote; a parietal tooth is sometimes present, but no others.

The penis is provided with a sheath and retentor muscle as in other Triodopsinae; its cavity containing a well developed verge (Fig. 512 b). Epiphallus is long, slowly tapering towards both penis and vas deferens, passing gradually into the latter; no flagellum externally, but it is present as a short branch of the cavity at the end of the epiphallus. The short, swollen duct of the spermatheca, and the rest of the genitalia, are as in *Triodopsis*.

Jaw arcuate, with numerous strong ribs (Fig. 512 E, *V. armigera*, from a drawing by Vanatta).

TYPE: *V. columbiana pilosa* (Hend.).

Distribution.—Southern Alaska, British Columbia, and the Pacific States south to Monterey County, California.

(*Vespericola*, dwellers in the evening or west.)

This genus, though otherwise clearly triodopsoid, differs from all other Polygyridae by the possession of a well developed though rather short verge, and by the peculiar shape of the epiphallus, which is very slender in the part next to the penis and tapers slowly into the vas deferens. The shell resembles *Mesodon*, *Praticolella* and *Neohelix* in form, but is usually hairy. The sculpture of the embryonic shell is a modification of the radially striate type, the fine radial wrinkles broken into granulation throughout in some species, but in others it is smooth, sculpture being reduced to short, simple striae radiating below the suture, or practically absent. *Vespericola* is a specially western genus, not closely related to any eastern group of the family.

Paleontology.—*Vespericola* is thought to be represented in the Lower Miocene of Oregon, John Day River, by *V. dalli*: described as *Helix* (*Monodon*) [error for *Mesodon*] *dalli* Stearns, in White, Bull. U. S. Geol. Surv., no. 18, p. 14, pl. 3, figs. 4-6, (1885). The shape and the rather closely

coiled whorls are like *V. columbiana*; it is said to be imperforate. Two large species of the same beds, "*Polygyra*" *expansa* Hanna and *P. martini* Hanna (Kansas Univ. Sci. Bull., 13:8, 1920), do not seem certainly referable to any recent West Coast genera of Polygyridae. I have not seen specimens.

Anatomy.—Notes on the few species dissected follow here.

V. columbiana pilosa, south of Astoria, Oregon (Fig. 512 c). The penis is very slender but inclosed in a thick sheath, thinning out at its upper edge. Its cavity is strongly 6-ribbed. The sheath is connected by muscle strands

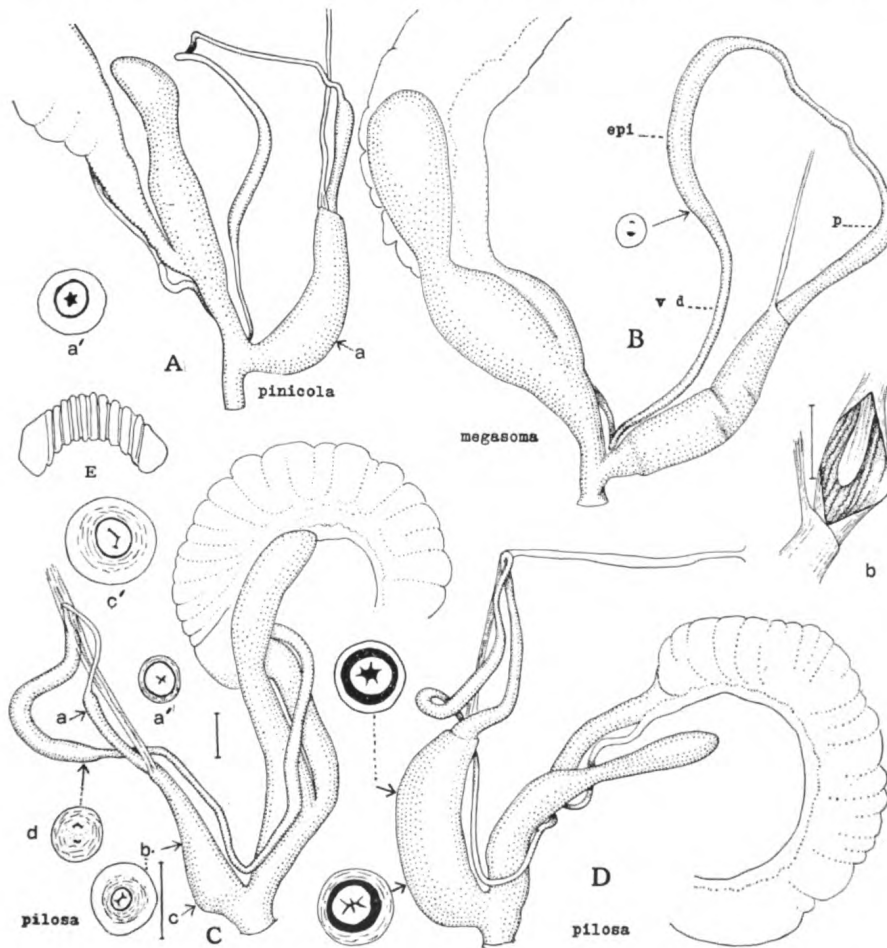


Fig. 512. A, *Vespericola pinicola*, back of Pacific Grove, with section of penis at a, a'. B, *V. megasoma*, near Inverness, with section at end of epiphallus; at b, the upper end of penis, opened to show verge. C, *V. columbiana pilosa*, south of Astoria, with section of penis and verge at a, a', other sections of penis at b and c, c', and section at end of epiphallus at d. D, *V. columbiana pilosa*, near outlet of Lake Crescent, Clallam Co., Wash., with two sections of the penis. E, jaw of *V. armigera*. Epi, epiphallus; p, summit of penis; vd, vas deferens. (Scale lines = 1 mm.)

with the penial retractor, which inserts well out on the epiphallus. The latter is slender, fusiform, tapering into the vas deferens. The mantle is closely marbled with black.

A specimen from near the outlet of Lake Crescent, Clallam County, Washington (Fig. 512 D), is much like that from Astoria.

V. pinicola, back of Pacific Grove (Fig. 512 A). Penis is slender with simple sheath and 5-ribbed cavity. The distal end is slightly swollen, very thin-walled, containing a small, club-shaped verge, 0.8 mm. long. The long epiphallus is slenderly fusiform as usual. The penial retractor muscle is not attached to the epiphallus, but only at end of the sheath, as in *V. megasoma*.

V. megasoma, near Inverness, Marin County (Fig. 512 B). In this preparation I did not find any attachment of the penial retractor on the epiphallus, in that respect being like *V. pinicola*.

Measurements in mm. of genitalia follow:

	<i>V. pilosa</i> Crescent Lake	<i>V. pilosa</i> Astoria	<i>V. pinicola</i>	<i>V. megasoma</i>
Penis	6.0	7.0	6.0	9.0 mm.
Vagina	2.5	4.0	2.0	. . mm.
Spermatheca	7.0	7.0	4.0	7.5 mm.
Diameter of Shell	12.7	16.6	13.0	14.5 mm.

Vespericola columbiana (Lea)

Fig. 513: 11, 12, 13.

Helix columbiana Lea, 1838, Trans. Amer. Phil. Soc., 6: 89, pl. 23, fig. 75; Obs. Gen. Unio, 2: 89.—Binney, 1851, Terr. Moll., 2: 169, pl. 5.

Mesodon columbianus Gld., Binney, 1878, in part, Terr. Moll., 5: 333, pl. 5.

Polgyra columbiana Lea, Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 182, figs. 11, 12, 13.—J. Henderson, 1936, Univ. Colo. Studies 23: 254.—Dall, 1905, Harriman Alaska Exped., 13: 24.

“Shell obtusely convex, rounded below, shining, longitudinally striate, horn colored, transparent, umbilicate; whorls 6, roundish, aperture rather round; outer lip white and reflexed, slightly callous below; columella smooth. Diameter 0.7, length 0.4 of an inch.” (Lea.)

The shell is narrowly umbilicate, partly covered by the columellar reflection, depressed with conoid spire of closely coiled, rather strongly convex whorls; chamois colored (varying to cinnamon-buff); slightly glossy. Embryonic shell of $1\frac{1}{2}$ whorls has sculpture of a few curved radial ripples on the first half turn, then fine radial wrinkles more or less completely broken into an uneven granulation. The last whorl has weak, irregularly spaced wrinkles and more or less fine wrinkling and granulation, with, in places, inconspicuous dots of hair insertions, rather widely spaced, and only rarely bearing (deciduous) hairs. The last whorl descends a little in front, and is either distinctly or hardly at all contracted behind the peristome. The aperture is rather deeply lunate. Peristome white, reflected and thickened within, the basal margin wider in some examples.

Height 10.5 mm., diameter 15.6 mm.; 6 whorls. Topotype.

Height 9.3 mm., diameter 13.4 mm.; 6 whorls. Topotype.

Height 11 mm., diameter 16.3 mm.; 6 whorls. The Dalles.

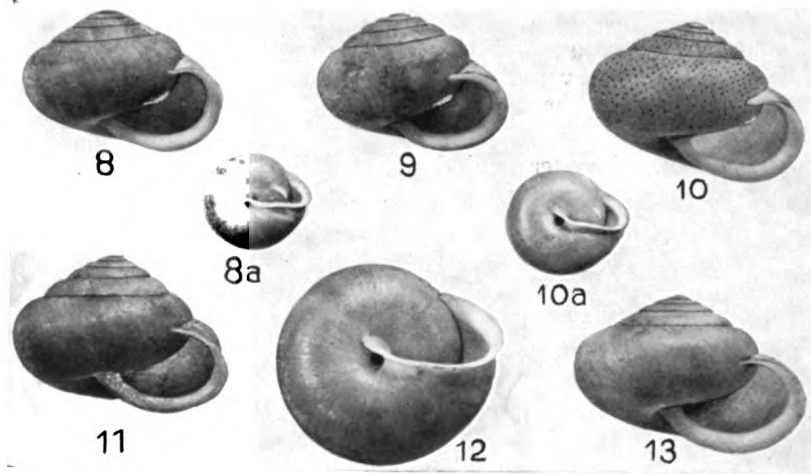


Fig. 513. 8, 8a, 9, *Vespericola megasoma*, neotype and paratype. 10, 10a, *Vespericola columbiana pilosa*, type. 11, 12, 13, *Vespericola columbiana*, topotypes. (Figs. 8a, 10a, actual size, the rest $\times 2$.)

WASHINGTON: Vancouver (Nuttall), Type 106774 U.S.N.M. "Four miles above Satsop, Castle Rock, hills east of Chehalis, Holcomb, above Winlock, Knappton, Friday Harbor, San Juan Islands and Port Townsend" (J. Henderson).

OREGON: Hayden Island, opposite Vancouver (J. G. Malone). The Dalles (Hemphill). "Portland, Troutdale, Hayden Island, Jewell and Port Crescent" (J. Henderson).

The typical form of *V. columbiana* is known by the widely spaced hair-points, often indistinct, the semi-matt surface rarely showing a few hairs in adult shells, but usually none. *V. c. latilabrum* and *V. c. pilosa*, the common forms of Oregon and Washington, are profusely hairy.

So far as my knowledge of specimens goes, it is a form of the Columbia River around Vancouver and the Dalles. Some of the other localities quoted above from Henderson appear doubtful. Dall, 1905, recorded *columbiana* from "mountains of Idaho, Western Montana and Washington." I have not seen it from Idaho or Montana, and doubt the occurrence of the genus in those states. See under *V. c. latilabrum*.

Vespericola columbiana depressa (Pilsbry & Henderson)

Fig. 514.

Polygyra columbiana depressa Pilsbry & Henderson, 1936, Nautilus, 49: 134, pl. 7, fig. 2.

"Shell small, thin, compact, light brown or tan; surface dull, covered evenly and rather closely with very short hairs which are weaker on the base and show in some specimens a slight tendency toward arrangement in parallel diagonal rows at about right angle with the fine growth lines; no other spiral sculpture. Spire low, but variably elevated. Whorls $5\frac{1}{2}$ or 6, closely, regularly coiled, increasing regularly in size, somewhat contracted

behind the outer lip, which is reflected about one millimeter, and is evenly rounded from the upper termination over the periphery, slightly flattened on the base and passes by a more abrupt curve into the columella. Umbilicus small, open, but little covered by the slightly reflected columella. There is no trace of parietal or other apertural denticle on any specimen examined." (Pilsbry and Henderson.)

Height 9 mm., diameter behind reflected lip 13 mm. Type.

Height 8.7 mm., diameter 14.7 mm. Paratype, A.N.S.P.



Fig. 514. *Vespericola columbiana depressa*.

OREGON: The Dalles (H. Hemphill), Type 5870 Stanford University type collection; paratype 162435 A.N.S.P.

"This form is quite unlike *P. mullani hendersoni* Pils., which was described from The Dalles. It is closely related to *P. columbiana pilosa* Henderson, but is smaller and decidedly more depressed, less dome-shaped, though somewhat variable in this respect." (Pilsbry and Henderson.)

***Vespericola columbiana pilosa* (Henderson)**

Fig. 513: 10, 10a.

Polygyra columbiana pilosa J. Henderson, April, 1928, Nautilus, 41: 143.—Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 181, figs. 10, 10a.—J. Henderson, 1929, Univ. Colo. Studies, 17: 80, fig. 35; 1936, 23: 255.

Aplodon columbiana and *H. columbiana* J. G. Cooper, 1868, Amer. Journ. Conch., 4: 223, 225.

Polygyra columbiana in part, Dall, Harriman Alaska Exped., 13: 24, and of many authors. Cf. Henderson, 1929, Univ. Colo. Studies, 17: 79, for full references.

[?] *Polygyra columbiana* var. *santacruzensis* Dall, 1905, Harriman Alaska Exped., 13: 24.

The narrowly umbilicate shell has the shape of Vancouver, Washington, *V. columbiana*, of very pale brown (dilute isabella) color; surface matt. Umbilicus about one-fourth covered by the reflected columellar lip. Sculpture of fine granulation on the embryonic shell. Last whorl with weak smooth wrinkles and close short hairs, partly arranged in forwardly descending series, the hair bases typically spirally lengthened. On the base they are smaller and less regularly placed. The last whorl is contracted behind lip and descends shortly in front, as usual. The reflected peristome is thickened within, the thickening disappearing gradually or somewhat abruptly at the junction of the straightened basal margin with the columella. In basal view the basal lip is straightened in the middle and bends forward at the columella. The thin, transparent parietal callus bears a small, strongly oblique tooth well within its margin at the outer third of its width (in the type; but this tooth is more often wanting than present).

Height 10.3 mm.; diameter 14.7 mm.; 6 whorls. Type.

Height 9.8 mm., diameter 13.3 mm. Paratype.

Height 9.5 mm., diameter 14.6 mm. Inverness.

Height 9 mm., diameter 12.7 mm. Inverness.

CALIFORNIA: San Francisco (W. J. Raymond), type and paratypes 11142 A.N.S.P. San Pablo, Contra Costa Co. Lagunitas (Witmer Stone) and Inverness (E. P. Chace, H. B. Baker), Marin Co. Crescent City, Del Norte Co.

OREGON: South of Astoria, Clatsop Co. (H. B. Baker). Blaine, Tillamook Co. Near Corvallis, Benton Co. Elkton and north of Azalea, Douglas Co. Lithia Park, Ashland, Jackson Co.

WASHINGTON: Lapush, Rialto Beach and Port Angeles, Clallam Co.; Olympic Mountains. Carnation, and west shore Lake Washington, King Co. Longmire, Ranier State Park, Nesqually, Pierce Co. Yakima, Yakima Co. Near Kennewick, Benton Co.

BRITISH COLUMBIA: Langara, Queen Charlotte Is.; Stanley Park and 4 mil. south of Union, Vancouver I.; Vernon.

ALASKA: Sitka; Duncan's I.; Forrester I.; Yakutat Bay (Dall). Unalaska (Eyerdam).

The somewhat open umbilicus and close persistent pile separate this from other Californian species. Although Professor Henderson selected a toothed form as typical, this is somewhat exceptional, most of the lots from the San Francisco Bay region being toothless, though in other respects typical. However, it is variable. In some specimens the columellar end of the lip is a straight continuation of the basal lip, as in *armigera*, but the umbilicus is larger than in *armigera* and *megasoma*. I have not the abundant material needed for an adequate consideration of central California forms of *pilosa*.

Whether the range of *pilosa* in central California is continuously connected with that from Oregon north is another question left open, as there is a gap of many miles in the known records.¹ Judging by what I have seen, *pilosa* is absent in northern California, but the evidence is negative.

Sitka specimens and those from Forrester Island, Duncan's Island and from Queen Charlotte Islands, are well developed, diameter up to 16.5 mm. Eyerdam believed the Unalaska specimens to be an accidental importation. Those seen from Vancouver Island and British Columbia are small, diameter 12 to 12.5 mm. In Washington and Oregon the size is small or intermediate, diameter 11.8 mm. (Carnation, Wash.) to about 15 mm.

Usually a parietal tooth is absent. A small one is present in some of the examples from Lithia Park, Ashland, Jackson County, Oregon, and above Longmire, Pierce County, Washington, size 10 x 15.5 mm., the tooth rather long. Dall reported a reversed specimen from Yakutat Village.

Polygyra columbiana variety *santacruzensis* Dall, referred here with doubt, was described as follows:

¹ Records published prior to the division of "*columbiana*" into several species and subspecies are useless until confirmed.

"The variety *santacruzensis* is in form more like the type [of *columbiana*] but much smaller, thin, lighter colored, with a sparser pelage, and about half the specimens have a trace of a parietal tooth, while in a lot of about 700 *columbiana* from Sitka I found only one specimen which had any parietal tooth."

No locality was given except as implied by the name, and no specimens in the National collection were marked *santacruzensis* or otherwise denoted as Dall's type. Five specimens, 180371 U.S.N.M., marked in Dall's hand "*Polygyra columbiana* Lea, var., Santa Cruz, Cal., Cooper, Dall" are possibly what he had in view. Two measure:

Height 9.3 mm., diameter 13.8 mm.; $5\frac{3}{4}$ whorls.
Height 8.8 mm., diameter 12.8 mm.; $5\frac{1}{2}$ whorls.

The larger one is toothless, the other has a small parietal tooth. The characters throughout are exactly as in San Francisco *V. c. pilosa* Hend., the hairs, or what remain of them, being spaced the same. In Dall's comparison with *columbiana* he probably did not use typical *columbiana*, which is almost hairless, as he stated, but had northern or Sitka specimens of *pilosa*. This would account for his statement that *santacruzensis* is "much smaller" and "with a sparser pelage;" the Sitka form of *pilosa* running about 16 mm. in diameter, and having a copious coat of rather stiff hairs.

It is not likely that these U.S.N.M. specimens came from Santa Cruz. Cooper mentioned *columbiana* as "common on the west and north side of the [San Francisco] bay, the former especially." Gabb adds the note "very common in the woods about Pilarcitos Creek, 20 miles south of San Francisco," but it is not known what form he had. Cooper apparently knew the Santa Cruz *V. armigera* Anc., which he mentioned under "*Aplodon germana*. Pending definite Santa Cruz records of *V. columbiana pilosa*, it seems likely that the specimens noticed above were really from the San Francisco Bay region.

On account of the effectual disguise afforded by Dall's descriptive notes, the doubt as to the locality, and the fact that no specimens are susceptible of positive identification as his types, I think that *santacruzensis* Dall can not be recognized, unless specimens "smaller, lighter colored, with a sparser pelage" than the type of *columbiana* are found. Dr. Berry (*in litt.*) writes concerning this case: "I am not much of a believer in trying to resurrect poorly defined and debatable old names unless one can bring such evidence to bear that the conclusion is beyond reasonable doubt, and keeping in mind the final paragraph of the International Commission's Opinion 1, that 'In no case is the word 'indication' to be construed as including museum labels, museum specimens or vernacular names.'"

Vespericola columbiana latilabrum new name

Fig. 515.

Helix labiosa Gould, 1846, Proc. Boston Soc. Nat. Hist., 2: 165; U. S. Expl. Exped., 12: 67, pl. 4, fig. 52 (Astoria and Ft. George); in Binney, 1851, Terr. Moll., 2: 170, pl. 13a, fig. 1. Not *Helix labiosa* O. F. Müller, 1774.

Mesodon columbianus labiosa and *Mesodon labiosus* Gld., Binney, 1886, 2d. Suppl., Bull., Mus. Comp. Zoöl., 13: 39, 44, 47, pl. 1, fig. 4.

Polygyra columbiana labiosa Gld., Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 185.—Henderson, 1929, Univ. Colo. Studies, 17: 79; 1936, 23: 254.

The shell is quite narrowly, partly covered, umbilicate, rather solid, with strong periostracum closely set with rather stiff, persistent hairs. Last



Fig. 515. *Vespericola columbiana latilabrum*: a, right, Astoria; left, Seattle; b, Oswego, Oregon.

whorl is deeply contracted behind the lip. The curve of the lip is concave, being more or less receding in the outer margin, advanced above. Lip broader than in other races of *V. columbiana*.

Height 11.5 mm., diameter 17.2 mm.; $5\frac{3}{4}$ whorls. (Astoria, type.)

Height 8.0 mm., diameter 12.5 mm. Astoria.

Height 12.8 mm., diameter 18.0 mm. Long Beach.

Height 9.1 mm., diameter 13.3 mm. Kalama.

Height 12.3 mm., diameter 17.2 mm. Seattle.

“Animal slender, tentacles much elongated. Color pale ferruginous, with a lilac tint, darker on the neck. Whole surface, even the tentacles, marked with coarse, elliptical granules, in longitudinal series; no marginal border.” (Gould.)

OREGON: Astoria and Fort George (U.S. Expl. Exped.), Astoria (Type 1886 A.N.S.P.) and between Warrentown and La Maura Beach, Clatsop Co. (H. B. Baker). Riverdale, Multnomah Co. (Baker). Portland, Washington Co. Salem, Marion Co. (J. Henderson). Salmon River 12 mi. from Mt. Hood, Clackamas Co. (J. G. Malone). “Westport, Stella, above Vernonia, Portland, Vesper, Jewell, and 1 mile north of Azalea” (J. Henderson).

WASHINGTON: Long Beach, Pacific Co. (H. B. Baker). Kalama, Cowlitz Co. (Hemphill). “Seattle, Kalama and Bellingham, 8 miles north of Kelso and 15 miles north of Castle Rock” (J. Henderson). See below.

The lip is wider than in *columbiana* or *pilosa*. The hairs are stiff, more persistent than in *pilosa*. There are specimens somewhat intermediate in both of these characters.

W. G. Binney reported *columbiana* var. *labiosa* from Coeur d'Alene Mountains, Idaho (2d. Suppl., pl. 1, figs. 4, 5, and from Deer Lodge Valley, Montana, collected by Hemphill. I have not seen Binney's Coeur d'Alene specimens, but that from Montana (no. 12782 M.C.Z.), has been examined

through the kindness of Mr. Wm. J. Clench. It is quite typical *labiosa*, not distinguishable from some Seattle examples. These places in Idaho and Montana are so remote from the *labiosa* territory, and in such a different region, that label mistakes in the localities seem probable.

***Vespericola columbiana oria* (Berry)**

Fig. 516.

Polygyra columbiana oria S. S. Berry, 1933, *Nautilus*, 47: 15, pl. 2, figs. 11, 11a.

"Shell low-conic, narrowly umbilicate, the umbilicus partially covered by the columellar reflection; aperture rounded, flattened basally, without teeth; peristome of moderate width, narrowed and somewhat angled below

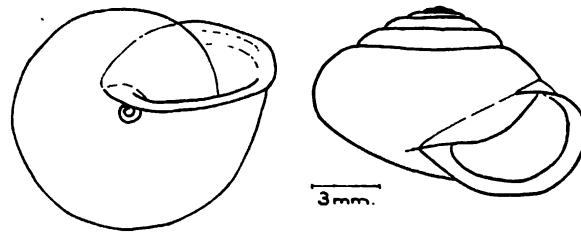


Fig. 516. *Vespericola columbiana oria*. (After Berry.)

the columella; parietal callus usually simple and but weakly arcuate. Periostracum finely but rather weakly pilose, lustrous, the color a nearly uniform saccardo's umber.

"Holotype: Max. diameter 14.7 mm., min. diameter 12.4 mm., alt. 10.3 mm., diameter umbilicus 12 mm.; 6 whorls. Paratypes measure: 16.4 x 14.3 x 11.5 mm., umb. 1 mm.; 6½ whorls; 15.1 x 13 x 11 mm., umb. 1.2 mm.; 6½ whorls; 14.7 x 12.3 x 9.3 mm., umb. 1 mm.; 5¾ whorls; 14.6 x 12.2 x 9.3 mm., umb. 1.1 mm.; 5¾ whorls; 14.3 x 12 x 9.1 mm., umb. 1.2 mm.; 5¾ whorls; 13.1 x 10.8 x 8.5 mm., umb. 1 mm.; 5¾ whorls." (Berry.)

CALIFORNIA: South Fork of American River Canyon near Riverton, Eldorado County (Allyn G. Smith), Type 7441 Berry Collection, paratypes in same and in collection of Allyn G. Smith.

"The mid-Sierran shells of *columbiana* type are not very strongly differentiated, but in their own way the characters appear constant throughout the considerable series seen and it is believed that a name for the race will be found of service. From all California coastal forms seen *oria* differs in its darker and browner coloring, weaker and more distinct pilosity, and polished surface.

"A series taken by Mr. Smith in the vicinity of Riverton, May 21, 1916 (Cat. No. 3734) and another collected by him near Camp Creek, 3 miles east of Pleasant Valley, Eldorado County, July 11, 1926, average considerably smaller than the material described but otherwise seem essentially similar. The name selected is a Latinized form of the Greek ὄρειος, mountain-dwelling." (Berry.)

The embryonic whorls have clearly defined, close granulation, the granules running into striae in places. Later whorls have small hair points, sparser than in *V. c. pilosa*, from which the noticeable gloss of the surface further separates *oria*.

***Vespericola hapla* (Berry)**

Figs. 517, 518 a, b.

Polygyra hapla S. S. Berry, 1933, *Nautilus*, 47: 14, pl. 2, figs. 13, 13a.

"Shell small, depressed-conic, thin. Growth-lines numerous, irregular and somewhat coarse. Embryonic whorls transparent, polished, smooth except for the very weak growth-lines. Later whorls with rather large distant papillae, each bearing a stout periostracal hair when first formed, but the hairs eventually becoming generally dehiscent in the later stages.

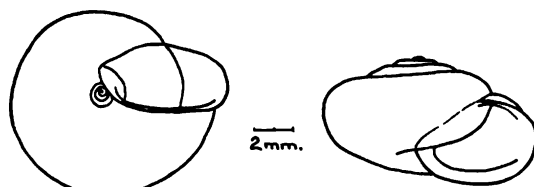


Fig. 517. *Vespericola hapla*. (After Berry.)

Spire low, the slopes nearly straight. Whorls about $5\frac{1}{2}$, strongly convex, with deep sutures. Body whorl slightly shouldered, weakly descending to the aperture, and suddenly narrowed just back of the peristome by a furrow-like constriction; base moderately tumid. Lip light brown, rather narrow, well reflected anteriorly and below, but only moderately thickened; angled and slightly narrowed below the pillar. Umbilicus permeable to apex, but narrow, contained 8 to 9 times in the major shell diameter; only slightly encroached upon by the columellar reflection. Color of shell near snuff brown of Ridgway." (Berry.)

"Holotype: max. diameter 12.2 mm., min. diameter 10.3 mm., alt. 7.2 mm., diameter umbilicus 1.4 mm.; $5\frac{1}{2}$ whorls. Paratypes measure: 11.8 x 10.1 x 6.6, umb. 1.4 mm.; $5\frac{1}{2}$ whorls. 11.6 x 9.7 x 7.2, umb. 1.4 mm.; $5\frac{1}{2}$ whorls. 11.4 x 9.6 x 6.5, umb. 1.2 mm.; $5\frac{1}{2}$ whorls. 11.1 x 9.3 x 6.3, umb. 1.2 mm.; 5 whorls. 10.9 x 9.2 x 6.4, umb. 1.4 mm.; $5\frac{1}{2}$ whorls. 10.3 x 8.6 x 6.2, umb. 1 mm.; $5\frac{1}{2}$ whorls." (Berry.)

CALIFORNIA: Butte Creek Canyon about 10 miles from Chico, Butte County (L. G. Ingles), Type 7440 Berry Collection.

***Vespericola sierrana* (Berry)**

Fig. 518 c, d.

Polygyra sierrana S. S. Berry, 1921, *Nautilus*, 35: 36, pl. 2, figs. 8, 9; 1922, *Nautilus*, 36: 32 (correction of locality).

"Shell small, conical, thin. Growth lines numerous and strong enough almost to resemble fine ribbing under a lens. Embryonic whorls at first almost smooth, then finely radially wrinkled, the periostracum soon showing a system of dot-like papillae, bearing minute periostracal hairs over most of the surface of the shell. Spire moderately low, slightly convex, with im-

pressed sutures. Whorls about $5\frac{1}{2}$. Body whorl with a suggestion of an angle at the shoulder, and a deep, abrupt constriction just back of the peristome, the base moderately swollen; slightly descending in front. Lip light brown, thickened and reflected, but not very wide; narrowed below the pillar, then very slightly flaring again. Umbilicus small but distinct; contained about eleven to fourteen times in the diameter of the shell. Lip sometimes with a slight extra thickening at base, otherwise without evidence of teeth, although a small, whitish, narrowly crescentic parietal tooth is sometimes developed. Color close to verona brown of Ridgway's nomenclature." (Berry.)

	Type mm.	Paratype mm.	Paratype mm.
" Greater diameter	9.0	9.0	8.4
" Lesser diameter	7.7	7.7	7.4
" Height	5.7	5.8	5.2
" Diameter of umbilicus	0.8	0.7	0.6
" Number of whorls	$5\frac{3}{8}$	$5\frac{1}{2}$	$5\frac{1}{4}$

CALIFORNIA: 2 miles north of Weed, Siskiyou County (Allyn G. Smith). Type 5087 Berry Collection. Paratypes have been deposited in the collections of the California Academy of Sciences, and the Academy of Natural

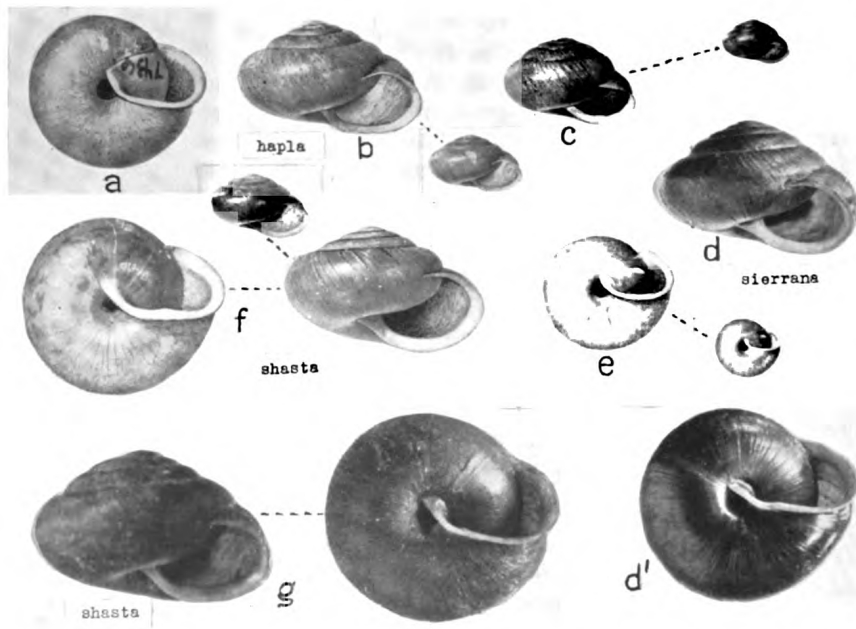


Fig. 518. a, b, *Vespericola hapla*, topotypes from Berry. c, *Vespericola sierrana*, north of Weed. d, d', *Vespericola shasta*, 24 miles east of Placerville (the label "sierrana" was transposed, it belongs to fig. c). e, *V. sierrana*, toothed form from Shasta County. f, *Vespericola shasta*, La Moine. g, *V. shasta*. (Figs. a, b, c, e, f, actual size and $\times 2$.)

Sciences of Philadelphia 130455, as well as the private collection of Allyn C. Smith, 2236 (Berry). Shasta County (F. L. Button).

"From the evidently nearly allied *loricata* the present species differs in its larger size and more simple toothing of the aperture. In some ways it more nearly resembles *germana*, but again is larger, has a much less tumid body whorl and differs strongly in being distinctly umbilicate. From *columbiana* it differs in its compactness and smaller size, but it is nevertheless not very unlike this species on a greatly reduced scale.

"I have a small series of a similar but rather thinner-shelled and more depressed race of *Polygyra*, collected in the high Sierras of central California between Glenbrook and Al Tahoe, by Mr. E. P. Chace in 1919. The differences are not great, however, and they are apparently referable to the same species as the Shasta [Siskiyou] County form." (Berry.)

In the paratype figured the embryonic $1\frac{1}{2}$ whorls have some growth-ripples radiating from the suture part way across the whorl, elsewhere smooth. There are a few impressed spiral lines on the last whorl below the suture. Height 5.8 mm., diameter 8.7 mm.

The small size and the absence of granulation on the embryonic shell are characteristic; perhaps the spiral lines, also, but as these were not mentioned by Dr. Berry, they may be inconstant.

Dr. H. B. Baker collected it near Weed under logs in a swampy meadow.

A specimen labelled Shasta County, sent as *H. loricata* by Mr. Button in 1899, has a small but distinct parietal tooth (Fig. 518 e). It has irregular engraved spiral lines on the peripheral and upper parts of the last whorl, and beyond the end of the first whorl there are some very weak traces of granulation near the suture.

"This quite distinct little *Polygyra* appears to require no especially close comparison with any of the Californian representatives of the genus hitherto known. In general effect one may picture it as a small, depressed, narrow-lipped, umbilicate, toothless *columbiana*, without the fine close pelage possessed by southern forms of the latter species, but the *umbilicus* is of entirely different type from what we see there, as is the periostracal ornamentation, and I think it at best doubtful whether it is in that direction that its near affinities properly lie. The name chosen is derived from the Greek ἀπλῆ, simple." (Berry.)

The plain embryonic shell, without wrinkles or granulation, is an important distinctive feature of this species. It is figured from topotypes of the original lot, received from Dr. Berry (Fig. 518 a, b).

Vespericola shasta (Berry)

Fig. 518 d, d', f, g.

Polygyra columbiana shasta S. S. Berry, 1921, Nautilus, 35: 37, pl. 2, figs. 6, 7.

"Shell of moderate size, conic, thin; *smooth*, except for the numerous and fairly strong incremental lines, which, however, become much weaker

on the base; surface *polished and lustrous*, especially on the base. Embryonic whorls, where not eroded, at first rather rudely radially wrinkled, but, at least after the first half turn, *strongly, coarsely papillose*, as well. Spire low, almost straight sided except toward the summit; sutures well impressed. Whorls usually $5\frac{1}{2}$ to 6. Body whorl subangulate at the shoulder, but becoming more rounded as the aperture is approached; slightly descending and rather abruptly constricted just back of the peristome, the base moderately swollen and rounded. Lip whitish or stained a very light brown; thickened and reflexed but not very wide; obscurely angled and narrowed below the pillar, which is somewhat reflexed over the narrow but permeable umbilicus; lip often showing a slight extra thickening on the base, but aperture otherwise without denticles save for an occasional specimen showing the merest tract of a parietal tooth. Color of body whorl fairly near tawny olive, deepening to snuff brown or saccardo's umber on the earlier whorls." (Berry.)

	Type mm.	Paratype mm.	Paratype mm.	Paratype mm.
" Greater diameter	14.0	13.5	13.3	12.7
" Lesser diameter	12.0	11.4	11.3	10.6
" Height	9.0	8.2	8.7	8.0
" Diameter of umbilicus ..	1.0	1.1	1.0	0.8
" Number of whorls	6	$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{1}{2}$ "

CALIFORNIA: La Moine, Shasta County (Allyn G. Smith), 25 adult specimens. Type 5089 Berry Collection. Paratypes have been deposited in the collections of the California Academy of Sciences, Academy of Natural Sciences of Philadelphia, 130454, and Leland Stanford Junior University, as well as the private collection of Allyn G. Smith. Roadside spring 24 miles east of Placerville, on the Lincoln Highway (H. N. Lowe).

"The present form is not like anything which has been seen by me heretofore. Its warm brown color, smooth, polished surface, lack of any sort of persistent periostracal fringes and narrow, though permeable umbilicus, are features serving to set it quite distinctly apart." (Berry.)

The specimens taken by Lowe in Eldorado County east of Placerville, agree closely with a paratype, though the locality is rather remote. One measures, height 8.4 mm., diameter 13.3 mm., (Fig. 518 d, d').

The sculpture of the last embryonic whorl is not as strong in the specimens seen as one would infer from Dr. Berry's description.

Vespericola megasoma ('Dall' Pilsbry)

Figs. 513: 8, 8a, 9; 519.

(?) *Helix columbiana* var. *dentacula* Andrus, 1897, The Oregon Naturalist, 4: 53.

(?) *Polygyra germana* variety *megasoma* Dall, 1905, Harriman Alaska Exped., 13: 26.

Polygyra columbiana megasoma Dall, Pilsbry, 1928, Proc. Acad. Nat. Sci. Phila., 80: 182, figs. 8, 8a, 9.

Mesodon (megasoma, subsp. ?) eritrichius Berry, 1939, Nautilus, 53: 56, figs. 1 b, c.

"A variety *megasoma*, more than four times the size of the typical *germana*, but otherwise quite similar, is occasionally found; some from northern California (Stearns) are in the National Museum." (Dall.)

The globose-depressed shell has a low conoid spire a narrow, half-covered perforation, and is cinnamon-buff colored, varying in places towards tawny-olive. Embryonic whorls with sculpture of radial wrinkles broken into granules except near upper suture. Last whorl with very fine, close, short hairs or their bases. The last whorl has a broadly rounded periphery, is constricted behind the lip, and descends shortly in front. The aperture is somewhat triangularly lunate, the face of the reflected lip convex and well thickened within. The outer edge of the columellar lip is curved backward, the margin over the umbilical perforation being distinctly concave (or in one of the type lot, notched). The thin, transparent parietal callus bears a short, obliquely placed tooth.

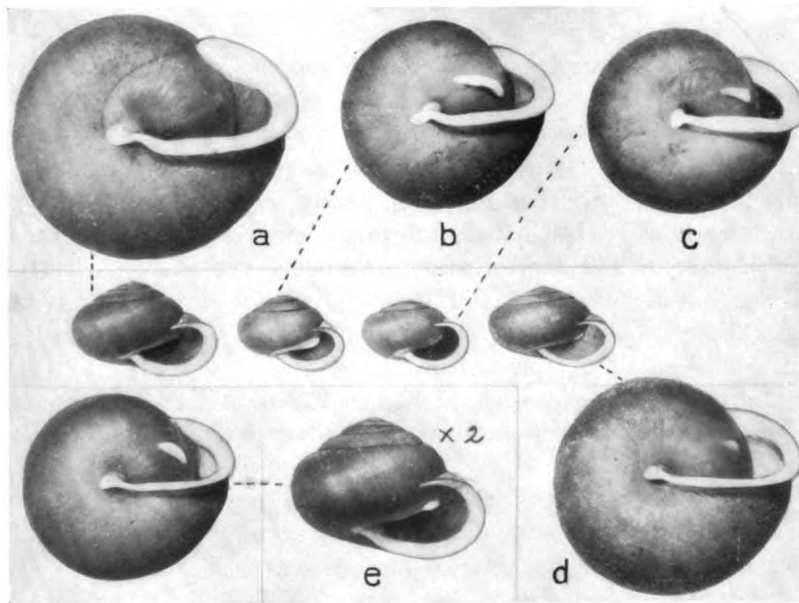


Fig. 519. *Vespericola megasoma*. a, b, Mill Creek 5 miles east of Crescent City; c, Clam Beach, north of Arcata. d, Inverness, Marin Co.; e, Douglas Co., Oregon. (Figs. a-d $\times 2$ and actual size; fig. e $\times 2$.)

Height 9.8 mm., diameter 13.5 mm.; $5\frac{1}{2}$ whorls. Neotype.

Height 9.4 mm., diameter 13.3 mm. Howland Hill.

Height 10.3 mm., diameter 13.3 mm. Howland Hill.

Height 10 mm., diameter 14 mm. Mill Creek.

CALIFORNIA: Humboldt County (Hemphill), Neotype 11140 A.N.S.P.; Siskiyou County (W. M. Gabb). Russian River (E. D. Cope). Del Norte County, in woods near Crescent City; east side Howland Hills, 3 miles north, and Mill creek, 5 miles east of Crescent City (E. M. and E. P.

Chace). Humboldt County, in a canyon back of Williams' ranch, across river from Requa (Chace). About 4 miles south of Eureka, and Jordan Creek near Scotia (Chace).

Of the "*germana* variety *megasoma*," named but not really described by Dall, no type or specimens so marked could be found in the National Museum (*cf.* Proc. Acad. Nat. Sci. Phila., 80: 183); I therefore defined what I take to be Dall's form, by the key and figures given in the place cited above.

The last whorl of this shell is less depressed than that of *V. armigera* (Ancey), and in an apical view it is somewhat wider. There is little difference in the sculpture, but the hairs of *megasoma* are perhaps a trifle shorter and closer. In life the hairs hold more or less dirt, sometimes an even, blackish layer. The lip over the umbilicus is somewhat more curved backward, or even slightly notched in *megasoma*.

The parietal tooth varies from well developed, as in the neotype, to weak or even absent. On those from Howland Hill near Crescent City, all seen have a white parietal tooth and typical form and size, diameter about 13.3 mm. On Mill Creek part are similar, but there are also large shells with the parietal tooth very weak and transparent, one measuring 12.4 x 18.6 mm., 6½ whorls (Fig. 519 a, b). In woods near Crescent City there are typical *megasoma*, together with large specimens without a parietal tooth.

Farther south, near Eureka, the form and size (diameter about 13.5 mm.) are typical, but the parietal tooth varies from somewhat smaller than typical to very small, but present in all seen.

At Requa they vary from about 12.7 to 16.2 mm. diameter, the parietal tooth being present though small in those under 13.5 mm., but absent in those of 15.3 and 16.2 mm.

At Scotia the diameter varies from 13 to 14.6 mm. In the smallest and largest a small or weak tooth is seen, and in several apparently quite adult shells of 13 to 13.5 mm. diameter, no trace of a tooth is visible.

Clam Beach, 11 miles north of Arcata, diameter 12.4 to 13.9 mm., a quite small parietal tooth present (Fig. 519 c).

These data indicate either that we have (1) a single species, variable in presence of a parietal tooth, as in *Vespericola c. pilosa*, the eastern *Mesodon thyroidus*, *Triodopsis albolabris* and many others, or (2) two forms, *megasoma* and a toothless form, occurring together with intergrades. Further field work is needed to settle this question, but the former alternative seems to me more reasonable.

Far to the south a form of *megasoma* was taken by the Chaces and by Dr. H. B. Baker near Inverness, Marin County (Fig. 519 d). The shells are rather large, with the lip narrower than in most Humboldt County examples. A small parietal tooth is present.

Height 10.7 mm., diameter 15.7 mm.; 6 whorls.

Height 9.7 mm., diameter 15.1 mm.

In a lot of 22 from Douglas County, Oregon, sent by F. H. Andrus, the shells measure 11 to 13 mm. in diameter, and all of the adults (17) have a short parietal tooth. The basal lip is straightened as in *V. megasoma*, but it is less recurved at the columellar end than usual in *V. megasoma*, though there is a trace of such recurvature. The umbilicus is slightly larger than in *megasoma*. In fact, these shells appear somewhat intermediate between *pilosa* and *megasoma*, but somewhat nearer the latter (Fig. 519 e). Mr. Andrus wrote of this form as follows: "The *H. columbiana* are the most abundant and of these nearly all are of the toothed variety,—var. *dentacula*." This name cannot be dated from his article (1897), as there is no adequate description, a tooth being found in several forms of the *columbiana* stock.

Since the above account was written, Dr. S. S. Berry has published two forms of this species. I consider his *eritrichius* wholly synonymous with *megasoma*, since it does not seem practicable to name every lot in a continuous series. The description of *eritrichius* follows.

"Shell small, low-conic, rather thin; base tumid. Spire low, the slopes nearly straight. Whorls about $6 \pm$, convex, with well-marked sutures, quite regularly enlarging; body-whorl strongly swollen basally, slightly but rather suddenly descending at the suture to the aperture; abruptly constricted just back of the peristome. Lip white in front, well thickened and reflected; rounded anteriorly, flattened below, narrowed parietally and again at the columella, where it is suddenly widened and reflected to kink over and nearly cover the umbilicus. Aperture usually toothless, but a trace of a parietal tooth is sometimes present and an occasional shell has this quite well developed, whitish and arcuate. Terminations of lip connected by a thin but sharply bounded parietal wash of callus, the outer margin of which flares forward in a wide sweep in front of the columella and then abruptly recedes to it. Umbilicus very narrow, hardly permeable, heavily pilose within, and almost completely covered by the columellar flare even in very young shells.

"Embryonic whorls tumid, translucent, polished, closely finely axially wrinkled, with a minute granulation superimposed. On the later whorls these granules become elongate and extremely numerous, showing an alignment in obliquely descending series, and when not crushed or abraded bearing each a short erect acute hair-like process which gives the surface a fine satiny plush-like surface if clean, but in life causes the adherence of much finely particulate mud or humus, which must be carefully washed away if the true ornamentation is to be seen. Growth-lines, other than those marking the rather frequent resting stages, hardly evident due to the papillation and pilosity, but there is an extremely fine and close axial microscopic wrinkling of the periostracal surface between the papillae. Color of shell in the main close to snuff brown, but paling on the anterior portion of the last whorl to honey yellow or chamois, and to cream buff behind the peristome.

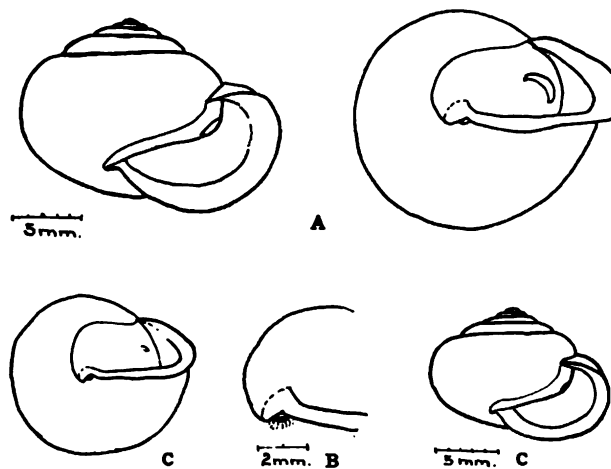


Fig. 520. A, *Vespericola megasoma euthales*. C, C, *V. megasoma* form *eritrichius*; camera outlines of the holotypes. B, Camera sketch of columellar region of specimen c, more enlarged. (After Berry.)

"Max. diameter 14.4 mm., min. diameter 12.2 mm., alt. 10.2 mm.; 5.8 whorls. Type.

"Max. diameter 16.4 mm., min. diameter 14.0 mm., alt. 11.2 mm.; 6.1 whorls. Paratype.

"Max. diameter 13.4 mm., min. diameter 11.5 mm., alt. 9.6 mm.; 5.5 whorls. Paratype.

"Type-locality: Foot of bluff on ocean side of peninsula at Table Bluff Light, Humboldt County, California; among moist ferns, poison oak, wild blackberries, Equisetum, etc.; Leo Shapovalov and Elden H. Vestal. Holotype: Cat. No. 8971 Berry Collection; Paratypes No. 8815 of same collection; others to be deposited in the collections of Stanford University, the Academy of Natural Sciences of Philadelphia, the United States National Museum, and the private collection of Mr. Allyn G. Smith.

"This species, which is the dominant Mesodon in the coastal belt of Del Norte and northern Humboldt Counties, appears very distinct from *columbiana* in all its forms, and these two at least I believe to be specifically separable. Probably its nearest ally is *megasoma* "Dall" (1905: 26) as redefined by Pilsbry (1928: 182) to cover a low-conic shell having a very narrow umbilicus and a long strong parietal tooth, and in size apparently somewhat smaller (13.3 mm.) than the commonality of *eritrichius*. From this latter our form differs most notably in its peculiar rounded form, swollen body-whorl, and usual obsolescence or absence of the parietal tooth. Other peculiar features are the curiously kinked columellar reflection of the peristome, the equally unique forward sweep of the parietal callus, and the *extremely* fine and close pelage. It is possible that these features may be

partly shared or foreshadowed in *megasoma*, but I have seen no specimens which agree in all respects with Pilsbry's description and figures of the latter." (Berry.)

Vespericola megasoma euthales (Berry)

Fig. 520 A.

Mesodon (*megasoma* var. ?) *euthales* Berry, 1939, *Nautilus*, 53: 60, fig. 1 A.

"Shell similar to *eritrichius* in most characters, but with a strongly developed arcuate parietal tooth, a much wider and more sinuate peristome, and the attainment of enormously greater size." (Berry.)

Max. diameter 20.2 mm., min. diameter 16.6 mm., alt. 14.8 mm.; 6.5 whorls. Paratype.

Max. diameter 19.0 mm., min. diameter 16.0 mm., alt. 13.4 mm.; 6.3 whorls. Paratype.

Max. diameter 18.7 mm., min. diameter 15.5 mm., alt. 13.3 mm.; 6.7 whorls. Type.

Max. diameter 17.8 mm., min. diameter 15.0 mm., alt. 12.2 mm.; 6.1 whorls. Paratype.

CALIFORNIA: Chaffey Ranch, 7 miles above mouth of Klamath River, Del Norte County, in redwoods, Leo Shapovalov, 22 Aug. 1934; 4 adult shells. Type 8972 Berry Collection. Paratypes 7830 same collection and another in the collection at Stanford University.

"This is very much the largest *Mesodon* known to me from within the bounds of California, although it is still a pygmy as compared with the giants of Oregon and Washington. I have as yet seen it only from the type-locality where it occurs in association with a very much smaller race¹ scarcely separable from the typical form of the species, except for the presence of a strong parietal tooth. Dimensions of two specimens of the smaller form are appended for comparison:

Max. diameter 13.0 mm., min. diameter 11.1 mm., alt. 9.3 mm.; 6.0 whorls.

Max. diameter 13.0 mm., min. diameter 11.2 mm., alt. 8.7 mm.; 5.9 whorls.

"The subspecific name is derived from the Gr., *eu*, well, + *thales*, fed." (Berry.)

Vespericola armigera (Ancey)

Fig. 521 a.

Mesodon columbiana variety *dentata* Tryon, 1867, *Amer. Journ. Conch.*, 3: 42; pl. 8, fig. 12. Not *Mesodon albolabris* var. *dentata*, l.c. p. 39.

Helix (*Mesodon*) *columbiana* Lea var. ? *armigera* Ancey, 1881, *Le Naturaliste*, 1: 404, 3me année. (correctly *armigera* in paragraph following).

Helix armigera Ancey, 1887, *Conchol. Exch.*, 2: 64.

Mesodon armigera Ancey, W. G. Binney, 1885, *Man. Amer. L. Sh.*, p. 474; 1886, 2d Suppl., *Bull. Mus. Comp. Zoöl.*, 13: 44, 47, pl. 1, figs. 1, 2, 8.

Polygyra columbiana armigera Anc., Pilsbry, 1928, *Proc. Acad. Nat. Sci. Phila.*, 80: 185 (Santa Cruz, Cal.).

¹ A not infrequent phenomenon with this genus in northern California, but one as yet without satisfactory explanation.

“Of *Helix columbiana*, a characteristic and well known species of the Pacific Coast of the United States, I possess an example which has a well developed parietal tooth, and a very narrow umbilicus, almost wholly covered by the columellar part of the peristome, which dilates in such a way as to almost completely close it. I propose the name of *armigera* for this variety (?) interesting especially by the last character, which I have never met with among the quite numerous individuals which have passed

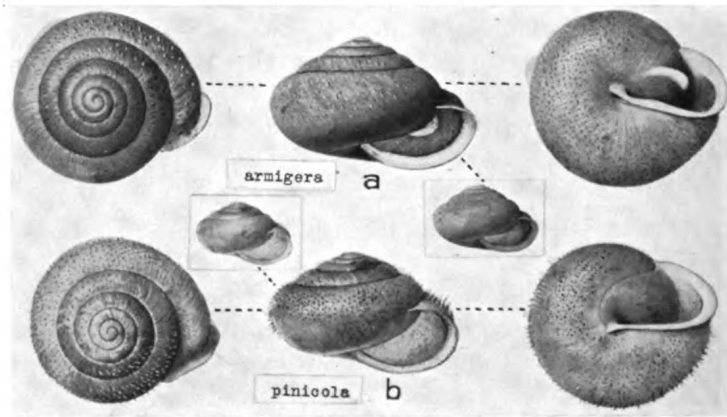


Fig. 521. a, *Vespericola armigera*, Santa Cruz. b, *Vespericola pinicola*, back of Pacific Grove. (Actual size and $\times 2$.)

under my eyes, belonging to sendings from different parts of California (San Francisco, Oakland, Sacramento, Monterey etc.). The specimen in my possession came from the Museum Godeffroy. . . . I have a specimen of *Helix columbiana* which shows a parietal tooth, but with the umbilicus open; it is this variety which was mentioned by MM. Binney and Bland.” (Ancy, translation.)

The umbilicus is reduced to a perforation, partly closed by the straightened end of the lip. The last whorl is depressed, sometimes indistinctly subangular at periphery, constricted behind the lip. The spire is low conoid. The hairs of the surface are close, about as in *V. columbiana pilosa*. The face of the reflected lip is convex, and is somewhat thickened at the basal margin. The parietal tooth is oblique, rather short and curved.

Height 8.8 mm., diameter 12.9 mm.; $5\frac{3}{4}$ whorls.

Height 10.5 mm., diameter 15.5 mm.; $5\frac{3}{4}$ whorls.

CALIFORNIA: Santa Cruz. “Hills back of Stanford University, San Mateo County (part of the Santa Cruz Range), to the San Juan Grade in northern Monterey County.” (S. S. Berry.)

The reduced umbilicus, as Ancy noted, is a prominent feature of this species. The parietal tooth varies in single lots from as well developed as in Figure 521 a, to about half that size.

Ancey gave no locality for *armigera*. His shell was from a German dealer, and probably not located nearer than "California." Binney gave a note on this type, sent him by Ancey, in his Manual, 1885, and in the following year figured a specimen, probably the type, though he does not so state. These figures correspond well with the Santa Cruz shells (Fig. 521 a), and in 1928 I accepted that place as the type locality.

Tryon's *Mesodon columbiana* variety *dentata* was based upon this form, but he had used the same varietal name for another "*Mesodon*."

J. W. Taylor named *Helix columbiana* form *unidentata* based upon Binney's remark "There is a variety with a well developed parietal tooth." This might be any of the toothed species. Name preoccupied in *Helix*.

***Vespericola pinicola* (Berry)**

Fig. 521 b.

Polygyra pinicola S. S. Berry, 1916, Univ. Cal. Pub. Zool., 16: 110.

"Shell small, roundly conic, thin, covered copiously with numerous small, slender, epidermal hairs, arranged almost quincuncially in lines oblique to the very weak lines of growth. Embryonic whorls at first nearly smooth, then finely radially wrinkled, and showing a sculpture of small elongate granules. Spire low, somewhat convex, sutures impressed. Whorls about 5½. Body whorl almost angled at the first third, deeply constricted back of the peristome, the base swollen and rounded; very slightly descending in front. Lip white, thickened and reflexed, but not very wide; narrowed below the pillar, then again flaring slightly so as partially or even entirely to close the minute, scarcely permeable umbilicus; lip sometimes with a slight extra thickening at the base, otherwise without evidence of teeth; upper and lower ends connected by a barely perceptible wash of callus. Color a light brownish horn, without trace of a band.

"Greater diameter of largest shell, 13 mm., of type, 12.5 mm., of smallest, 11 mm. Lesser diameter of largest shell, 11.5 mm., of type, 11 mm., of smallest, 9 mm. Height (umbilicus to apex), of largest shell, 6.5 mm., of type, 6.7 mm., of smallest, 5 mm." (Berry.)

CALIFORNIA: Just back of Pacific Grove, Monterey County, under logs in the pine and oak woods (S. S. Berry). Type 3482 Berry Collection, paratypes in collections of the University of California and the California Academy of Sciences. Salmon Creek, at the southern edge of Monterey County (H. N. Lowe, Morris E. Caruthers).

"A shell of this species taken by me in the summer of 1906 was then reported (Nautilus, vol. 22, p. 40) as *P. columbiana armigera* Ancey. *Armigera*, however, as evidenced by one of Ancey's original specimens now in my possession, is quite a different thing. *P. pinicola* is well characterized by the complete absence of even traces of teeth, its almost imperforate umbilicus, narrow peristome, thin transparent shell, and small size. . . Shells of the usual type found in the neighborhood of Santa Cruz, just across Monterey Bay, are widely different, having less similarity to *pinicola* than some of the more northern forms." (Berry.)

The last whorl, in apical view, is noticeably wider than in *V. armigera*, and the hairs are usually a little longer. In about 20 specimens seen, none shows any trace of a parietal tooth; but the lip and nearly closed umbilicus are similar to *armigera*.

Specimens from Salmon Creek, the farthest point south for the genus, measure:

Height 8.7 mm., diameter 14 mm.; $5\frac{1}{2}$ whorls.

Height 8.5 mm., diameter 12.6 mm.

Height 7.5 mm., diameter 12.6 mm.; $5\frac{1}{3}$ whorls.

ASHMUNELLA Pilsbry & Cockerell

Ashmunella Pilsbry & Cockerell, 1899, Nautilus, 12: 107; 1899, Proc. Acad. Nat. Sci. Phila., p. 188.—Ancey & Murdoch, 1901, Journ. Malacol., 8: 73.—Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 223.—Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 503; 1910, p. 95; 1917, p. 88.

The *Polygyra*-like or *Triodopsis*-like shell is umbilicate, depressed, thin, one-colored; the aperture with reflected lip, toothless or with one to four teeth. Size moderate (the diameter about 9 to 23 mm. in known species).

Genitalia characterized by the short, more or less distinctly bipartite penis, which has unequal internal ridges but no verge or penispapilla; epiphallus very long; flagellum present but extremely short. The penial retractor is inserted on the epiphallus and diaphragm, is very short and rarely wanting; a weak retractor (the retentor muscle) passes from the intimate sheath of the epiphallus to that of the penis. The spermatheca is long, and not differentiated into duct and terminal sac. Talon varying from lobular to nearly simple. Reproduction oviparous.

Lung plain or maculate. The pulmonary vein has numerous small branches on both sides. Heart from a third to a half the length of the kidney, which is narrow and about half as long as the lung. Secondary ureter closed.

Free retractor muscle system as in *Polygyra*. Right and left ocular and tentacular retractors unite before their union with the pharyngeal retractor

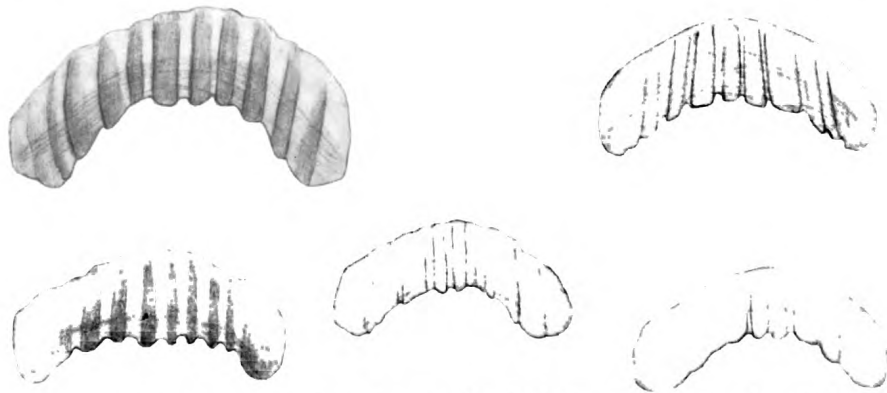


Fig. 522. Jaws of: upper left, *Ashmunella chiricahuana*; upper right, *A. levettei* *angigra*; center, *A. angulata*; lower left, *A. esuritor*; lower right, *A. proxima*.

into a single posterior band. Right ocular retractor passes between penis and vagina.

The jaw is ribbed, lower margin denticulate (Fig. 522).

Teeth of ordinary Polygyrid type. Centrals tricuspid, laterals bicuspid, the mesocone and often the ectocone bifid on the marginal teeth (Fig. 523).

TYPE (Pilsbry, 1905): *A. rhyssa miorhyssa* (Dall).

Distribution.—Mountains of New Mexico and southeastern Arizona; south in Mexico to about 28° 15' in the Sierra Madre of Chihuahua.



Fig. 523. *Ashmunella levettei angigyra* Pilsbry. Conservatory Canyon, Huachuca Mountains. General view of half row of teeth, some of the marginals omitted.

The embryonic shell of one and one-half whorls is smooth at first, but radial striae soon appear below the suture, and on the last half embryonic turn they extend across the whorl, either as continuous striae or interrupted into long granules. There is some diversity in the development of these sculptural features among the species. In the Mexican *A. meridionalis* Pilsbry, all but the tip is covered with radially lengthened granules. The passage from embryonic to neanic growth usually is not distinctly marked.

Under the microscope shells in perfect condition show extremely fine, close, spiral striation. Usually this is not mentioned in the descriptions.

The essential characters of *Ashmunella* briefly stated are: the Polygyroid shell; the short penis without papilla or verge; a very long epiphallus and a vestigial flagellum; a cylindric spermatheca, not enlarged distally; and the Polygyroid free muscles. The retentor muscle uniting epiphallus and penis apparently serves to retract the penis, its contraction throwing the lower part of the epiphallus into a loop. The penial retractor proper seems to be too short to perform its usual function.

Anatomy.—Anatomically the genus appears to be quite homogeneous, the only material distinctions noted being in the shape of the penis and of the talon, and the lengths of epiphallus and spermatheca. In all of the Huachuacan species, most of those of the Black and Mogollon Ranges, the *mearnsi* Group and some others, the upper portion of the penis is as wide as the lower, or nearly so, as in Figures 524: 2, 4 and 525: 10. In the Chiricahuan species, part of those of the Black Range and the Organ Mountains, the upper part of the penis is only about half as wide as the

lower, and sometimes hardly distinguishable from the epiphallus.¹ Such forms are represented in Figures 524: 1, 524: 3 and 525: 9. There remain some species intermediate in character, at least in some specimens, such as *A. thomsoniana* and the *A. rhyssa* group. The genitalia of many species additional to those mentioned above have been illustrated in Murdoch's paper of 1901 and my papers of 1900, 1905, 1910, 1917; some of these rather rough outline figures are lacking in detail. The relative lengths of epiphallus and of spermatheca, though variable in wide limits, are sometimes specifically characteristic.

The jaw is ribbed in all species I have dissected. No extended study of the radula has been made.

Ashmunella is the only genus of Polygyridae having a flagellum, though in some other genera a vestige of this structure is concealed at the junction of epiphallus and vas deferens. It is not closely related to the other genera, differing by the structure of the penis, the long epiphallus and the peculiar spermatheca.

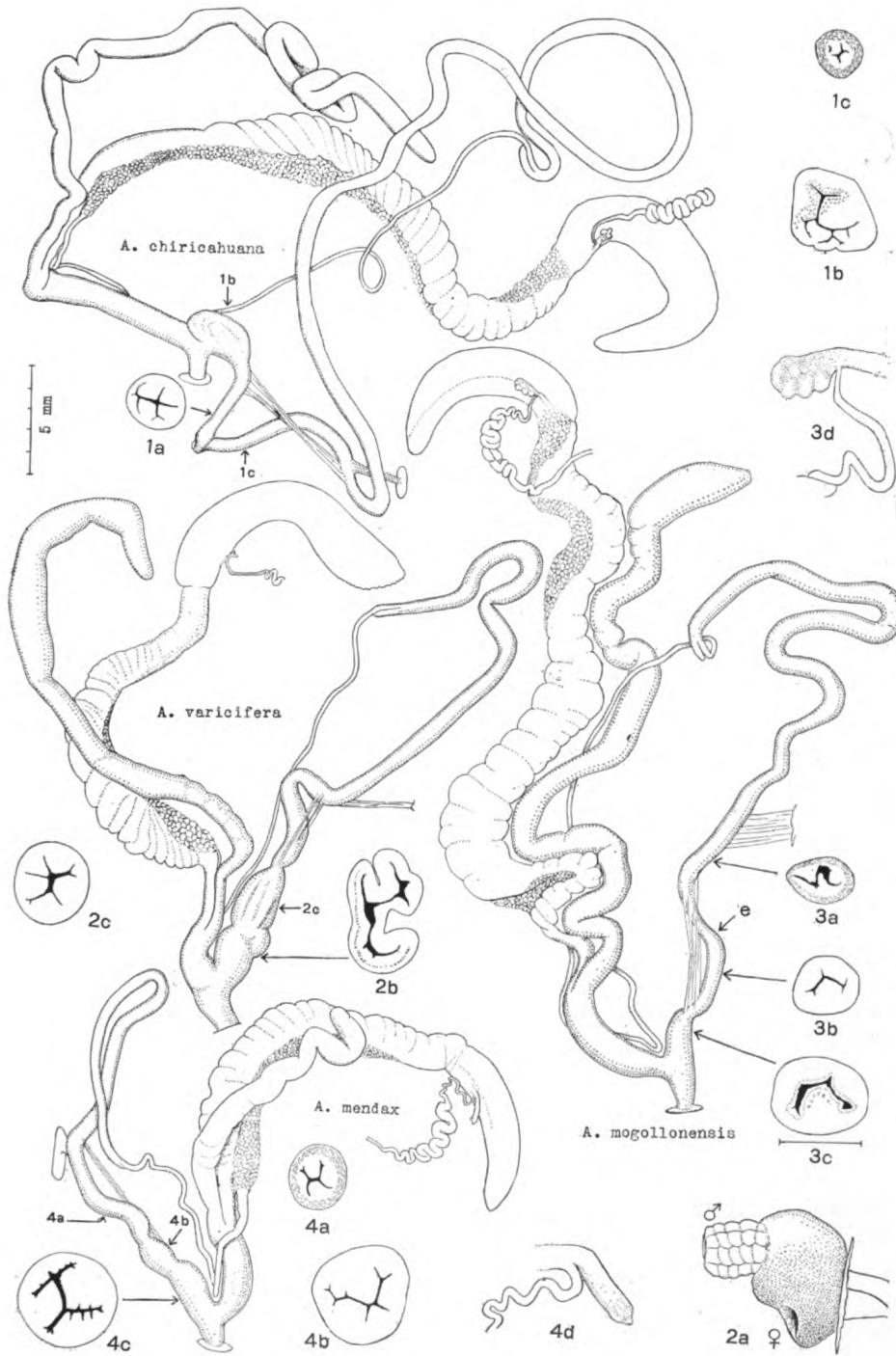
Range.—The range of *Ashmunella* (Fig. 526) is nowhere coincident with that of *Polygyra*. It partially overlaps that of *Sonorella*, but it extends much farther northeast and also farther south in Mexico. Its area measures about five hundred miles from north to south and about three hundred and thirty east and west, but only a small fraction of this country is actually inhabited. "Its northern limit is nearly that of the supposed southern limit of glaciers in the Rocky Mountain region during the Ice Age." All of the species are narrowly localized. It may be inferred that the present distribution of the genus was acquired during a humid Neocene climate, and the disintegration into small mountain populations followed progressive desiccation of the region beginning as far back as some time in the Pliocene.²

Ashmunella is confined mainly to forested mountains, where the conditions are moderately humid, but species of the group of *A. mearnsi* in southern New Mexico and Chihuahua live in arid desert ranges. In such treeless mountains these snails are nearly always calcicoles, often burrowing in the soil, as the whole Mearnsi Group and the species of the bare northern end of the Chiricahua range; the rare exceptions, such as *A. lepiderma*, live on basic volcanic rock. In the more humid forested ranges *Ashmunella* is

¹ The epiphallus is readily distinguishable in a section by its relatively thick layer of glistening circular muscle fibers, as in Fig. 524: 4a.

² This inference is based upon the strongly marked specific differentiation in several mountain ranges, which cannot reasonably be compressed within the limits of Pleistocene time.

Fig. 524. Genitalia of: 1, *Ashmunella chiricahuana*; 1a, 1b, sections of upper and lower sacs of penis; 1c section of epiphallus. 2, *A. varicifera*; 2a, atrium and penis partly extended; 2b, 2c, sections of lower and upper sacs of penis. 3, *A. mogollonensis*; 3a, section of epiphallus; 3b, 3c, sections of upper and lower sacs of penis; 3d, talon. 4 *A. mendax*; 4a, section of epiphallus; 4b, 4c, upper and lower sacs of penis; 4d, talon. Figure on p. 915.



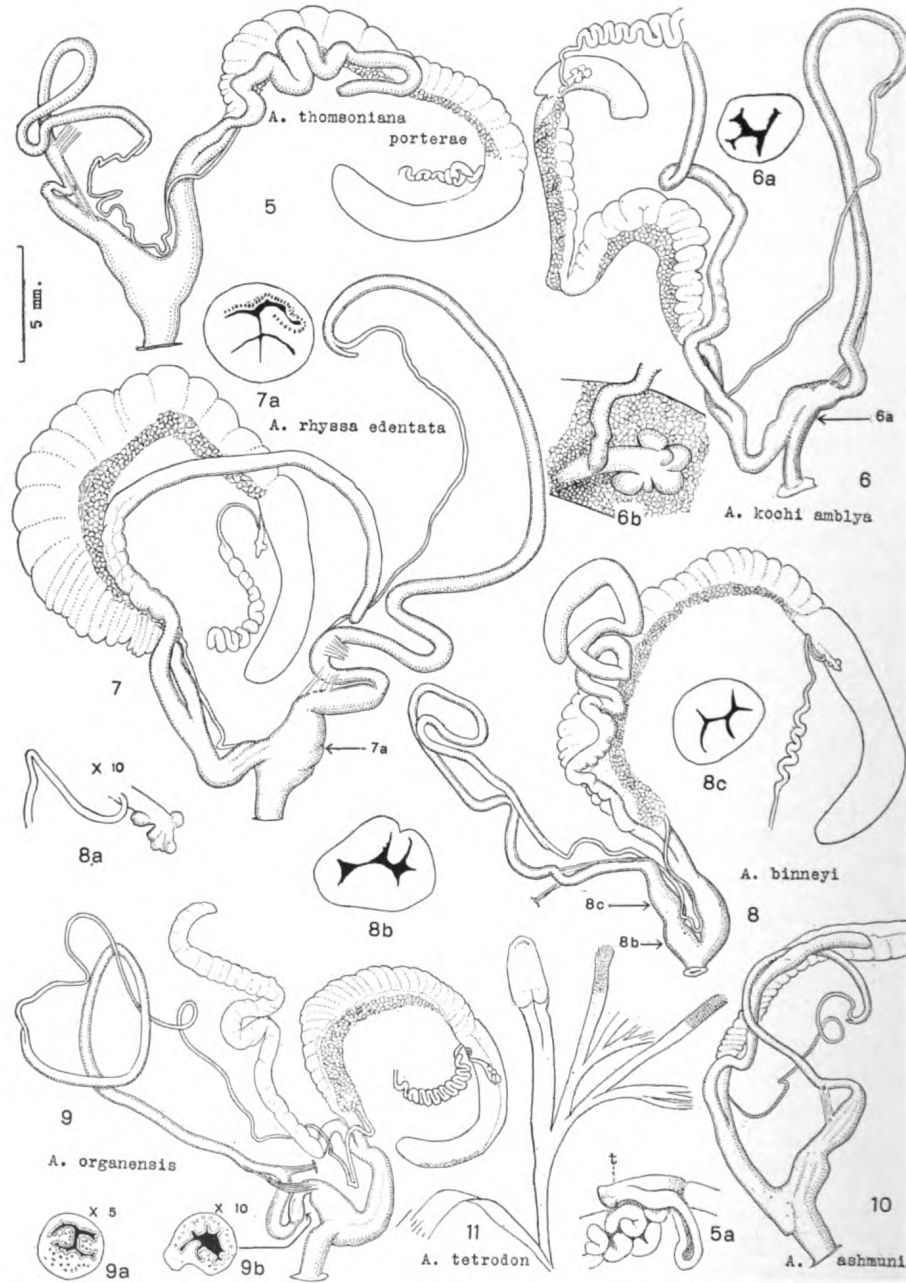


Fig. 525. Genitalia of: 5, *Ashmunella thomsoniana porterae*; 5a, talon and part of hermaphrodite duct. 6, *A. kochi amblyia*; 6a, section at base of penis; 6b, talon. 7, *A. rhyssa edentata*; 7a, section of lower penis sac. 8, *A. binneyi*; 8a, talon; 8b, c, sections of lower and upper sacs of penis. 9, *A. organensis*; 9a, 9b, sections of lower and upper sacs of penis. 10, *A. ashmuni*. 11, *A. tetrodon*, retractor muscles. (Sections drawn to scale of fig. 3c.)

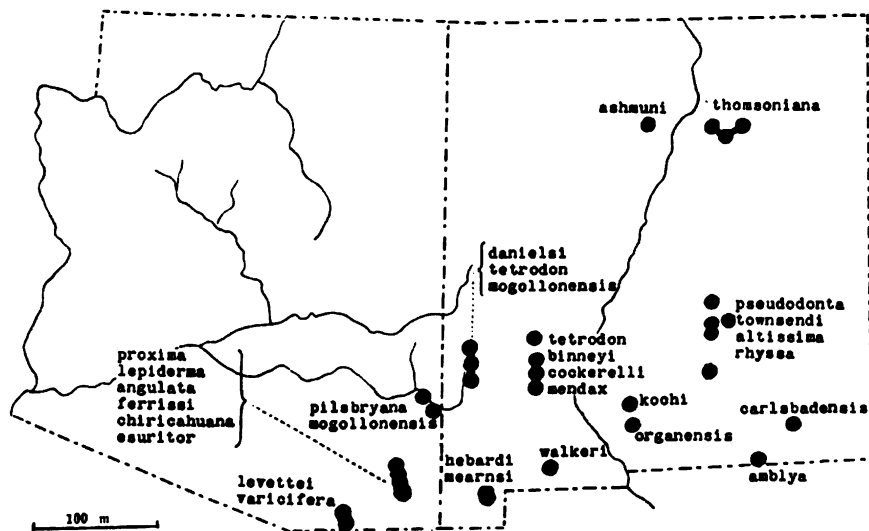


Fig. 526. Distribution of the species of the genus *Ashmunella*, in Arizona and New Mexico.

not confined to limestone terrains, but may occur wherever there is suitable forest floor, and stones or dead wood for shelter, as in the higher Chiricahuas, the Mogollons, Black Range, Sacramento and Sierra Blanca Ranges and others.

In most of the larger mountain ranges the *Ashmunellae* are perplexing on account of the multiplicity of local races and forms of which the taxonomic status remains uncertain. Future collecting, more fully covering the ground, will doubtless alter our conceptions of some of these. A further source of difficulty has been the remarkable parallel development of similar toothless species in different ranges, such as *A. chiricahuana*, *A. varicifera*, *A. mogollonensis*, *A. ashmuni robusta* and others, with shells so much alike that they were formerly united specifically. By their anatomic structure these species prove to be most nearly related, not to one another, but to dentate species of their respective ranges. The inference that existing toothless species are secondarily so, and derived from dentate ancestors, seems to be justified.

Ashmunella is unique among our land snails for the occurrence of polymorphic populations such as *A. levettei heterodonta* in the Huachuclas and *A. tetradon mutator* in the Mogollons—forms in which the variations in single colonies connect very different species.¹ I do not know of any such extraordinary variability among other land snails, and am disposed to view these polymorphic colonies as products of hybridization on a large scale between otherwise distinct species.

¹ Cf. G. G. Simpson's notes on *Notioprogonia*, 1937, Amer. Nat., 71: 247.

Although fifty species and subspecies are now known from New Mexico and Arizona, there is still abundant opportunity for productive field work in the *Ashmunella* territory. The region of the Blue and Mogollon Ranges, the Sacramento-Sierra Blanca Range, the Organ and San Andraes Range, to mention only a part, are merely scratched in spots, and may yield further rich returns. With the exception of the last, which is a little too dry for comfort, they are delightful mountains for camping during six months of the year.

History.—The history of *Ashmunella* began in 1880, when the first species was described by Bland as *Triodopsis levettei*. It was obtained by Dr. G. M. Levette, and thought to be from near Santa Fé, New Mexico. Explorations in that region have shown that the *Ashmunellae* there are of a different type, and the true habitat of the species was not known until Binney in 1886 reported it from the Huachucas. *A. varicifera* Ancey, 1901, also from the southern Huachucas, was taken by a Mr. Cox, who sent specimens to Dr. Isaac Lea many years ago, with the locality "Tucson." Nothing is known of Cox beyond his name on the label. At the time these shells were collected Tucson was no doubt the nearest settlement or army post to the Huachucas, and hence was put down as the locality. The Santa Fé species was described by Ancey in 1887 as *Helix levettei* var. *thomsoniana*, the collector unknown. After this, the researches of Dr. Mearns along the International boundary, Rev. E. H. Ashmun in New Mexico, J. H. Ferriss and the author in Arizona and New Mexico, with others mentioned in the following pages, brought knowledge of the genus to its present point. In 1935 three additional species were found by the author in the Mexican State of Chihuahua.

The genus was recognized as distinct from *Polygyra* and *Triodopsis* by Professor Cockerell and the author in 1899, and was dedicated to the Rev. E. H. Ashmun.¹

Species Groups.—In the following account the species are grouped geographically. Each of the areas contains allied species of a single natural group, with the exception of the first and third, each containing species of two groups. In the sixth area, closely related species are widely scattered, the distribution of the Mearnsi Group being conspicuously discontinuous.

1. Northern New Mexico (east and west of Santa Fé).
2. Southern half of New Mexico, east of the Rio Grande.
3. Blue Mountains, Arizona, and Mogollon and Black Ranges, New Mexico.
4. Chiricahua Mountains, Arizona.
5. Huachuca Mountains, Arizona.
6. Arid ranges of southern New Mexico (*mearnsi* Group).

¹ Nautilus, 18: 121, 1905.

1. SPECIES OF NORTHERN NEW MEXICO (SANDOVAL, SANTA FÉ AND SAN MIGUEL COUNTIES)

This district includes species inhabiting the southern end of the Rocky Mountains, about one hundred miles north of any other area inhabited by *Ashmunella*. The *ashmuni* Group in the Jemez Mountains and the *thomsoniana* Group east of the Rio Grande each consists of a single species, with several races.

Key to Species of the Santa Fé Region and all east of the Rio Grande

1. Aperture with three or four teeth, one in the outer lip2
Aperture with no tooth in the outer lip; one to three teeth or none present4
2. Two well-separated basal teeth; periphery angular or carinate3
One basal tooth or two contiguous denticles; periphery rounded*A. thomsoniana*
3. Diameter 16 to 21 mm.; periphery angular; umbilicus wide*A. kochi*
Diameter 13 mm.; carinate; umbilicus smaller*A. carlsbadensis*
4. Aperture toothless; Jemez Mountains, northern New Mexico5
Usually with one to three teeth or traces of them; southern New Mexico6
5. Diameter about 13 to 14 mm.*A. ashmuni*
Diameter about 17 to 19 mm.*A. ashmuni robusta*
6. Small twinned basal denticles; usually a parietal tooth7
Basal tooth simple when present8
7. Diameter 12 to 15 mm.; Capitan Mountains, near Whiteoaks*A. pseudodonta*
Diameter 17 to 18.5 mm.*A. pseudodonta capitansensis*
8. Species of the Sierra Blanca and Sacramento Ranges9
Organ Range; shell thin, glossy, with very fine striation*A. organensis*
9. Shell coarsely ribbed10
Shell striate, or with some irregular ribbing on the last half whorl.
A. rhyssa and varr.
10. Umbilicus about five times in the diameter of 11 to 12 mm.*A. altissima*
Umbilicus eight to ten times in diameter11
11. Diameter 14.5 to 17.5 mm.; Sierra Blanca Peak*A. townsendi*
Diameter 11 to 13 mm.; Nogal Peak*A. townsendi nogalensis*

***Ashmunella thomsoniana* (Ancey)**

Fig. 527: 2, 2a, 3.

Helix levettei Bland var. *thomsoniana* and var. *oroboena* Ancey, 1887, Conchologist's Exchange, 2: 64.

Ashmunella thomsoniana (Ancey), Pilsbry & Cockerell, 1899, Proc. Acad. Nat. Sci. Phila., p. 192.—Ancey, Journ. Malacol., 1901, 8: 75.—Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 108, fig. 2 (genitalia); 1905, Idem, p. 234, pl. 13, figs. 27-30.—Cockerell & Cooper, 1902, Nautilus, 15: 109 (with mut. *alba*), p. 110.—Cockerell, 1903, Nautilus, 16: 105; 1912, Nautilus, 26: 69; 1903, Proc. Acad. Nat. Sci. Phila., p. 615 (varieties).

Ashmunella thomsoniana cooperae Cockerell, 1901, Nautilus, 15: 35; 1903, Nautilus, 17: 36.

Ashmunella antiqua Cockerell, 1901, Science, p. 1009 (Pleistocene, Las Vegas).—Cockerell & Cooper, 1902, Nautilus, 15: 110 (as synonym of *A. porterae*).

The shell is depressed with rounded periphery and rather narrow umbilicus, contained from four and three-fourths times in diameter in the type, to five and two-thirds times in a topotype; cinnamon to cinnamon-buff; with

low conoid spire of about five convex whorls, the last shortly descending in front, constricted behind the lip. Surface glossy, with fine, irregular wrinkle-striae and sometimes minute engraved spiral lines in places. Aperture oblique, nearly as high as wide. Peristome cream white, the lip reflected throughout, recurved, with a blunt, oblique or somewhat flat-topped tooth in the outer margin, a smaller, tubercular tooth in the middle of the basal margin. Parietal tooth rather short, nearly straight.

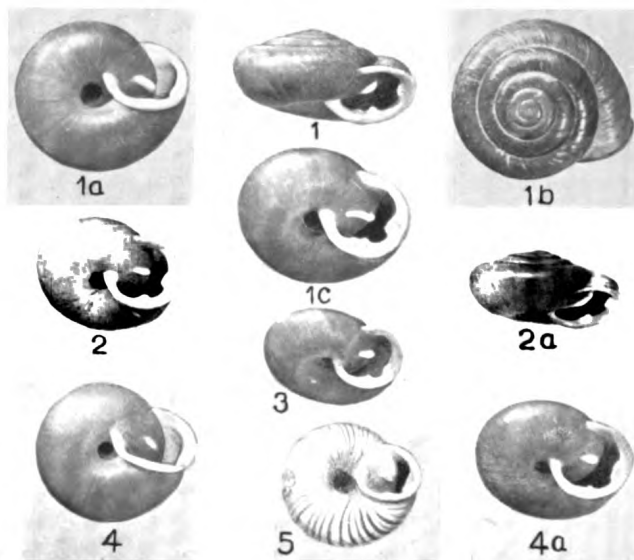


Fig. 527. 1, 1a, 1b, 1c, *Ashmunella thomsoniana porterae*, Sapello Canyon; type at c. 2, 2a, *A. thomsoniana*, topotypes; 3, Canyon Diablo. 4, 4a, form *cooperae*, paratype and type. 5, *A. thomsoniana pecosensis*, type. (All $\times 1\frac{1}{2}$.)

Height 6.6 mm., diameter 12.8 mm., $5\frac{1}{3}$ whorls. Type.

Height 6.7 mm., diameter 12.2 mm., 5 whorls. Topotype, original lot.

Height 6.33 mm., diameter 11.33 mm., $4\frac{1}{3}$ whorls. Pecos R. canyon (Cockerell).

NEW MEXICO: Southern part of the Santa Fé National Forest, in Santa Fé and San Miguel Counties. Santa Fé Canyon (Thomson, Cockerell, Ashmun), Type in Bryant Walker Collection, Museum of Zoology, University of Michigan. Various forms occur east to Sapello Canyon and Las Vegas, south to the Pecos Canyon near and above Rowe.

A. thomsoniana is quite distinct from neighboring species by its three- or four-toothed aperture. *A. ashmuni*, occurring about forty miles west, being toothless, and geographically separated by the Rio Grande valley. The related species southward do not possess a distinct tooth within the outer lip, and over one hundred miles of country destitute of *Ashmunella* lies between.

I have not collected this species, which is known chiefly by the work of Prof. T. D. A. Cockerell and his pupils. I have seen the type and others of the original lot from J. H. Thomson, for whom the species was named (figs. 2, 2a). In typical Santa Fé Canyon examples the size is from 12 to 13 mm., and the basal tooth is a simple tubercle. It is not recorded where in Santa Fé Canyon this typical form occurs; probably at and below 7500 feet. At Monument Rock, 8000 feet, in the aspen and scrub oak region, the teeth are typical but the size greater, 7.2×14.6 mm., five and one-third whorls. I have seen no shells from this canyon having a tendency to double the basal tooth, but from farther east, in Pecos Canyon, Canyon Diablo, near Rowe, (fig. 3), and in the canyons of the eastern slope, Sapello and Las Vegas, this tooth is usually twinned, or with a sloping callus in place of the inner denticle, thus agreeing with the race *porterae*. Prof. Cockerell has noted that shells from high stations are larger than in the lower colonies, "although size is not connected closely with altitude, regarding the whole series together." Whether size is of racial significance, aside from the condition of the teeth, seems to me doubtful; it may be that larger size is a response to longer humid seasons higher up. However, Cockerell and Cooper (1902) concluded "that the character of the basal tooth, whether double or single, is highly variable and not to be relied on to separate races. On the other hand, the size is much more distinctive." Those concerned with this topic can find measurements of numerous lots in the papers of Cockerell, 1902, 1903, and of Pilsbry, 1905.

Ancey's variety *oroboena* was said to be very similar to *thomsoniana* "but differs by having the last whorl higher, scarcely descending at its end, aperture larger and less oblique." It was one of the original lot from Thomson, and evidently merely an individual variant.

A. thomsoniana cooperae Cockerell (Fig. 527: 4, 4a, paratype and type) was described as having the "shell with max. diam. from 13 to 15 mm., but usually of the smaller size; basal tooth single, occasionally slightly double; umbilicus narrower than in type or var. *porterae*, exposing less of the penult whorl." This weakly characterized race is intermediate between *thomsoniana* and *porterae*, nearer to the latter. It is from Las Vegas Hot Springs, at about 7000 feet, in the transition zone, Type 83946 A.N.S.P., collected by Mary Cooper, also reported from the Kin Kale ranch, Pecos, at about 6700 feet. In discussing the latter lot Cockerell notes that "on plotting out the curves of shell diameter it was found that the mode for *cooperae* fell exactly between *thomsoniana* and *porterae*."

Albino specimens of both typical *thomsoniana* and the race *porterae* have been found and named mutation *alba* Cockerell & Porter. Not otherwise defined.

(Named for John H. Thomson, conchologist of New Bedford, Mass., 1824-1896.)

Ashmunella thomsoniana porterae Pilsbry & Cockerell

Fig. 527: 1-1c.

Ashmunella thomsoniana porterae Pilsbry & Cockerell, 1899, *Nautilus*, 13: 49.—Cockerell & Cooper, 1902, *Nautilus*, 15: 109 (with mut. *alba*); p. 110.—Murdoch, 1901, *Journ. Malacol.*, 8: 82, pl. 7, fig. 8 (genitalia). Pilsbry, 1900, *Proc. Acad. Nat. Sci. Phila.*, pp. 107, 108, fig. 3 (genitalia); p. 559, pl. 21, fig. 6 (pallial organs); 1905, *Idem*, p. 236, pl. 13, figs. 38-46.

Shell larger than *thomsoniana*, light brown, glossy, a little translucent, with distinct growth-wrinkles and fine incised spiral lines. Whorls five and one-third to six, convex, the last deeply constricted behind the lip, swollen behind the constriction. Lip brown-tinted above. Parietal tooth moderately developed. Outer lip-tooth long and concave. Basal tooth bifid, the inner denticle smaller, sometimes reduced to a low callus. Umbilicus rather broadly open, exposing the penultimate whorl more than in *thomsoniana*.

Diameter 14 to 16 mm.

Genitalia of a Beulah specimen figured (525: 5). The penis is rather between the group with wide upper half and that with it narrow, but probably never the former. Penial retractor strong but short. Length of penis 6 mm., of epiphallus 21 mm., spermatheca 22 mm. The talon (fig. 5a) is short and cylindrical with a few low tubercles. Hermaphrodite duct strongly knotted.

NEW MEXICO: Sapello Canyon, 8000 feet. Beulah (Wilmatte Porter Cockerell), Type 76789 A.N.S.P. Manzanares Valley near Rowe. Head of Dailey Canyon, in uppermost Canadian zone (Cockerell); and other places in Pecos Canyon.

Ashmunella thomsoniana pecosensis Cockerell

Fig. 527: 5.

Ashmunella thomsoniana pecosensis Cockerell, 1903, *Nautilus*, 16: 105.—Pilsbry, 1905, *Proc. Acad. Nat. Sci. Phila.*, p. 237, pl. 13, fig. 38.

"Small (diam. max. 12, min. 10.5 mm.); last half of last whorl very distinctly transversely ribbed, recalling *A. altissima*; lip and teeth strongly developed, basal tooth single."

NEW MEXICO: "Vallé Ranch, Pecos, in a light reddish deposit of uncertain age" (T. D. A. & W. P. Cockerell), Type 84209 A.N.S.P.

Known by a single specimen.

Ashmunella ashmuni (Dall)

Fig. 528 a.

Polygyra ashmuni Dall, 1896, *Proc. U. S. Nat. Mus.*, 19: 342.

Ashmunella ashmuni (Dall), Pilsbry & Cockerell, 1899, *Proc. Acad. Nat. Sci. Phila.*, p. 192.—Dall, 1902, *Proc. U. S. Nat. Mus.*, 24: 501, pl. 28, figs. 4, 6, 9.—Pilsbry & Ferriss, 1905, *Proc. Acad. Nat. Sci. Phila.*, p. 233, pl. 12, figs. 19, 20.—J. Henderson, 1912, *Nautilus*, 26: 81.

The shell is depressed, the umbilicus contained about five times in the diameter; sayal brown to cinnamon-buff, often with a buff growth-rest streak; of five weakly convex whorls, the last rounded at periphery, descending very little in front, constricted behind the lip. Surface glossy, with weak,

irregular wrinkles of growth and minute, weakly engraved spiral lines, often subobsolete. The oblique aperture is lunate, toothless, the cream-white lip rather narrowly reflected and recurved, thickened within. Parietal callus thin.

Height 7 mm., diam. 14 mm. Type.

Height 6.6 mm., diam 12.7 mm., $4\frac{3}{4}$ whorls. Smallest topotype.



Fig. 528. a, *Ashmunella ashmuni*; b, *A. ashmuni robusta*, type and paratype. ($\times 1\frac{1}{2}$.)

NEW MEXICO: Eastern slopes of Jemez Mountains, Sandoval County, near Bland, at 8000 feet (E. H. Ashmun), Type 107610 U.S.N.M., paratypes 73599 A.N.S.P. Rita de los Frijoles Canyon, 7000 feet, about 35 miles northwest of Santa Fé (J. B. Clark, J. Henderson).

By the entire absence of teeth this species resembles *A. chiricahuana* and *A. mogollonensis*, and differs from the species of northern and central New Mexico. *A. pseudodonta* of the Capitan Mountains is similar but it has one or two little basal teeth.

The shells from Frijoles Canyon are larger than the type lot, 8.2×15 mm. to 7.7×15.9 mm., with five and one-third whorls and a brownish outer lip, thus somewhat approaching *A. ashmuni robusta*. One of this lot dissected (Fig. 525: 10, 10a), has the upper sac of the penis large. No penial retractor seen in the poorly preserved specimen. Length of penis 6 mm., of epiphallus 16 mm., of spermatheca 15 mm.

***Ashmunella ashmuni robusta* Pilsbry**

Fig. 528 b.

Polygyra chiricahuana Dall, (in part), 1897, Proc. U.S. Nat. Mus., 19: 342. (Specimens from Jemez Mts.)

Ashmunella ashmuni robusta Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 233, pl. 12, figs. 24-26.

The shell is larger, but similar in form and sculpture to *A. ashmuni*; dilute cinnamon-brown to tawny olive, glossy, sculptured with low, irregular growth-wrinkles which are strongest below the suture, and weaker on the base, and very fine incised spirals, close and numerous but very lightly impressed. The spire is very low conoid. Whorls five and one-half, convex, the last about double the width of the preceding, its last third decidedly swollen, inflated behind the deep constriction back of the lip. The aperture is roundedly lunate, without teeth. The lip is coffee-tinted, rather narrowly reflected and recurved, and a little thickened within. The umbilicus is cylindrical within, rather broadly expanding at the last whorl.

Height 9.2 mm., diameter 19 mm.; smallest adult 9×17 mm.

NEW MEXICO: Jemez Mountains west of Bland, and at Jemez Sulphur Springs, 8-10,000 feet (E. H. Ashmun), Type 73576 A.N.S.P.

This race occurs at higher elevations than the typical *A. ashmuni*. Mr. Ashmun states that in coming down the mountains toward Bland, *robusta* was abruptly replaced by *A. ashmuni*. It was at first referred to *A. chiricahuana*, from which it differs chiefly in the greater inflation of the latter part of the last whorl. This is noticeable in a side view, and is seen prominently above the aperture in a front view. It differs from *A. pseudodonta capitansensis* chiefly by wanting any traces of basal teeth. Mr. Ashmun found one albino specimen.

2. SPECIES OF SOUTHERN NEW MEXICO EAST OF THE RIO GRANDE ¹

Two species from east of the Rio Grande, *A. kochii* and *A. carlsbadensis*, are closely related to *A. mearnsi*, and are described under that group. *A. organensis* of the Organ Range, Doña Ana County, appears related to *A. mogollonensis* and others from west of the Rio Grande, though it is a rather isolated species. The remaining species form a closely interrelated group inhabiting the Capitan, Sierra Blanca and Sacramento Mountains, these names applying to several sections of a single range. Collecting has been carried on in four rather small areas spaced along forty miles of the range, in Otero and Lincoln Counties. These species do not seem closely related to any living west of the Rio Grande. They are variable in a high degree. The genitalia are somewhat intermediate between the group with the upper half of the penis wide and that with it narrow; being much like *A. thomsoniana*.

Ashmunella pseudodonta (Dall)

Fig. 529 a.

Polygyra pseudodonta Dall, 1897, Proc. U. S. Nat. Mus., 19: 343.

Ashmunella pseudodonta (Dall) Pilsbry & Cockerell, 1899, Proc. Acad. Nat. Sci. Phila., p. 192.—Murdoch, Journ. Malacol., 8: 79, pl. 7, figs. 1-7 (anatomy).—Dall, 1902, Proc. U. S. Nat. Mus., 24: 500, pl. 27, figs. 13, 15; pl. 28, fig. 7.—Pilsbry & Ferriss, 1905, Proc. Acad. Nat. Sci. Phila. p. 232 pl. 12, figs. 15-18.

"Shell closely resembling *P. ashmuni* in form and size, but with the whorls slightly flattened above and below and of a yellowish straw color instead of livid brown, the spiral striation less sharp and largely obsolete. The aperture with a narrowly reflected lip, pink or whitish, which has, on the internal edge of the basal part, a slight callosity which is divided by a narrow sulcus in the direction of the coil of the shell. Within the aperture and nearly midway between the outer and pillar lips is a small, low, simple, short, oblique parietal tooth or ridge, with the outer end nearer the pillar.² Greater diameter 13.5 to 15 mm., minor diameter 11 to 13.5 mm., altitude 5.5 to 7 mm., in different specimens." (Dall.)

¹ See page 919 for a key to species of this group.

² An enigmatic statement.

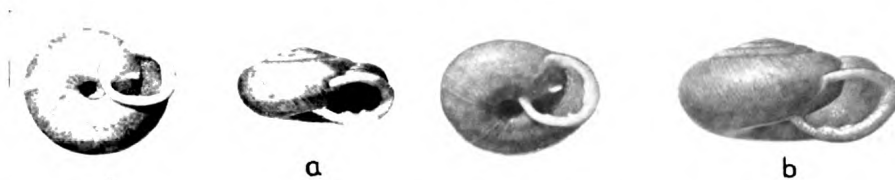


Fig. 529. a, *Ashmunella pseudodonta*. b, *A. pseudodonta capitansensis*, type. ($\times 1\frac{1}{2}$.)

Murdoch, 1901, has given a good account of the anatomy. The free muscles are as described for *A. tetradon*. "Penis is short and stout, somewhat abruptly contracted, its cavity with three large plications and several smaller threads." Spermatheca of the usual shape but shorter than in any species I have opened; as figured, it does not much exceed half the length of the uterus. Jaw with five or six broad, unequal ribs in the middle area, ends with a number of small ribs. 25.1.25 to 27.1.27 teeth.

NEW MEXICO: Capitan Mountains, White Oaks, Lincoln County, at 7500 feet (E. H. Ashmun), Type 107611 U.S.N.M.

The outer lip is thickened within in form of a somewhat receding flange, more prominent in some examples than in others. On the thickened inner margin of the basal lip two low, obtuse, contiguous tubercles stand. They may be distinct or weak, but are present in all shells seen. The parietal tooth is small and sometimes reduced to a mere pimple, but is readily perceptible in all seen. The diameter varies from 12 to 13.5 mm. in topotypes from Ashmun. Some specimens found with the original lot of *A. pseudodonta capitansensis* measure 13.5 to 15 mm. in diameter.

The twinned basal teeth and the more depressed form separate this species from all members of the *A. rhyssa* complex.

Ashmunella pseudodonta capitansensis Ashmun & Cockerell

Fig. 529 b.

Ashmunella pseudodonta (Dall) subsp. *capitansensis* Ashmun & Cockerell, Cockerell, 1899, Nautilus, 12: 131.—Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 232, pl. 12, figs. 21-23.

"Shell depressed, shining, dark horn color or even reddish; the usual striae distinct but not sharp; spiral impressed lines visible with a lens; whorls five and one-half rounded; aperture oblique, semi-lunar; lip expanded, broad, reflected, strongly tinged with pinkish or coffee color, edentulous, except that the basal part bears within a distinct but slight callus, which is more or less livid; parietal either rudimentary or distinct, but never large; umbilicus, broadly exposing the penultimate whorl.

"Diameter, maximum 17 to 18.5 mm., minor, 14.5 to 15 mm.; altitude 8 to 10 mm." (Cockerell.)

NEW MEXICO: Near Baldonado Springs, Capitan Mountains, Lincoln County, altitude 8200 feet (E. H. Ashmun), Type 74556 A.N.S.P.

This form is at present well separated from *pseudodonta* by the uniformly much larger size. The teeth are less developed or even almost entirely obsolete, and the lip comparatively narrower. It is to *pseudodonta* as *robusta* is to *ashmuni*. It has reached about the same stage of evolution as *A. rhyssa edentata*, *A. a. robusta* and *A. chiricahuana*. In the lot of 100 specimens taken by Mr. Ashmun there is one pale greenish-corneous albino.

Ashmunella rhyssa (Dall)

Fig. 530 a.

Polygyra rhyssa Dall, 1897, *Nautilus*, 11: 2.

Ashmunella rhyssa (Dall), Pilsbry & Cockerell, 1899, *Proc. Acad. Nat. Sci. Phila.*, p. 192.—Dall, *Proc. U. S. Nat. Mus.*, 24: 500, pl. 27, figs. 11, 14.—Pilsbry, 1905, *Proc. Acad. Nat. Sci. Phila.*, p. 227, pl. 12, figs. 1-4.

"Shell of six rounded whorls, dark yellowish-brown, the suture rather deep and the spire low but not flattened; nuclear whorls nearly smooth, the rest of the shell rather coarsely obliquely striated, the last fourth of the last whorl with rather sharp elevated riblets with wider interspaces and a marked constriction behind the reflected peristome; umbilicus small, deep; periphery above the middle of the whorl, rounded, the entire surface more or less distinctly finely spirally striate; aperture subcircular, oblique, with a reflected and rather solid peristome with a small obscure thickening on its basal part, a light wash of callus over the body, and slightly within the aperture a small oblique elongated parietal denticle. Major diameter 17, minor diameter 14; height 9 mm." (Dall.)

Height 10 mm., diameter 17.5 mm.; 5 $\frac{1}{4}$ whorls. } Topotypes

Height 9.9 mm., diameter 15.9 mm.; 5 $\frac{1}{2}$ whorls. } from Ashmun.

NEW MEXICO: Sierra Blanca (E. H. Ashmun), Type 107633 U.S.N.M.

The shell is more globose than any other known *Ashmunella*, having about the proportions of the large eastern mesodons. It is dull and roughly sculptured on the last whorl with coarse, curved, irregular wrinkles, between and over which fine incised spirals may be traced. The rather small aperture is contracted by a wide, heavy lip, the outer margin of which is indistinctly thickened within. There is a low, indistinct basal tooth or callus, and a very small, deeply placed, oblique parietal tooth, sometimes absent. The umbilicus is narrow and deep, but slightly enlarging at the last whorl, contained from 5.8 to 6.4 times in the diameter, in specimens of the original lot.

Ashmun did not state just where he collected the type lot of *A. rhyssa*, but presumably it was somewhere on the eastern flank of Sierra Blanca Peak, above the town of Ruidoso. No other collector has found that exact form, which is characterized by the high last whorl, which is less depressed than in any of the allied forms.

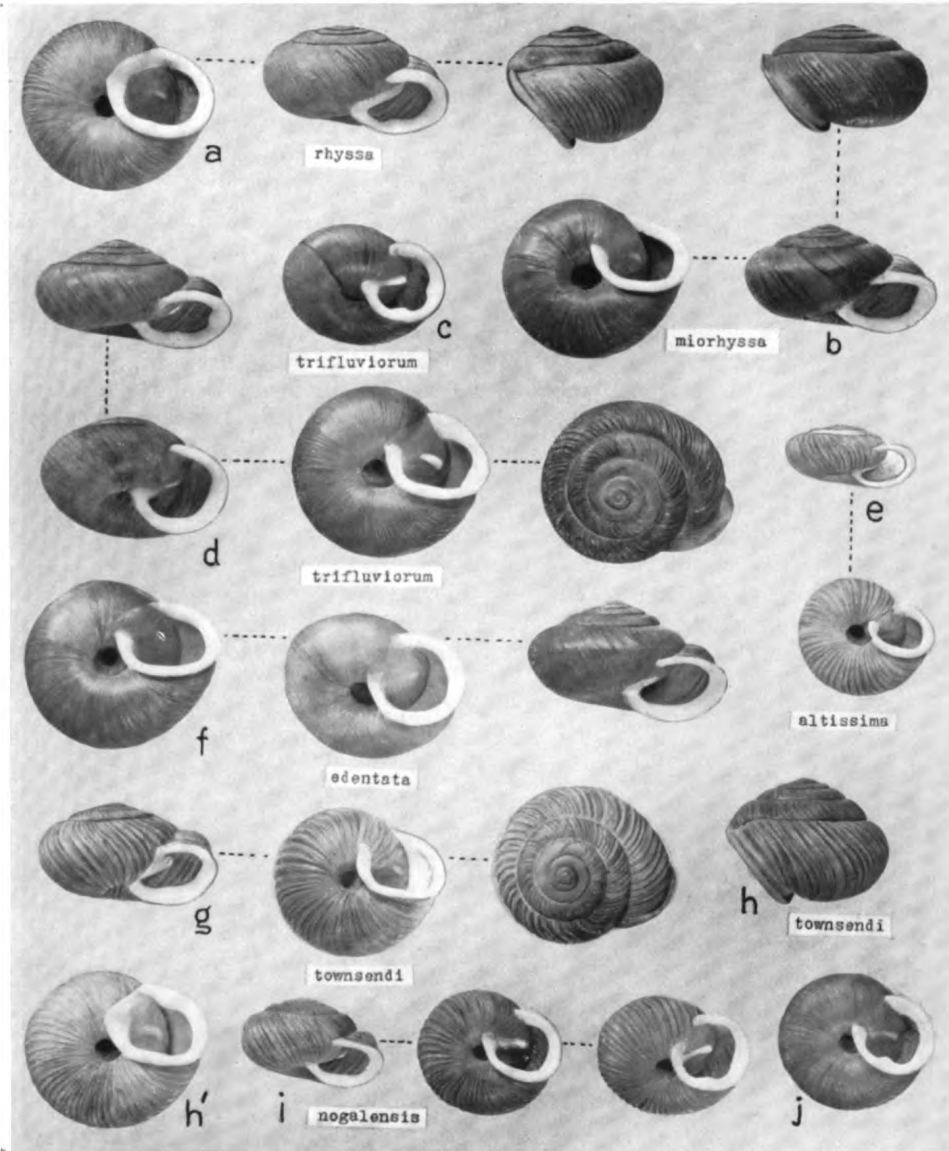


Fig. 530. a, *Ashmunella rhyssa*, topotypes. b, *A. rhyssa miorhyssa*, paratype and topotypes. c, *A. rhyssa trifluviorum*, var. d, *A. rhyssa trifluviorum*, type and paratypes. e, *A. altissima*, co-type. f, *A. rhyssa edentata*, topotypes. g, *A. townsendi*, type. h, h', specimens from near head of Carrizo creek. i, *A. townsendi nogalensis*, type and paratypes. j, var. of same. (All figures $\times 1\frac{1}{2}$.)

Ashmunella rhyssa miorhyssa (Dall)

Fig. 530 b.

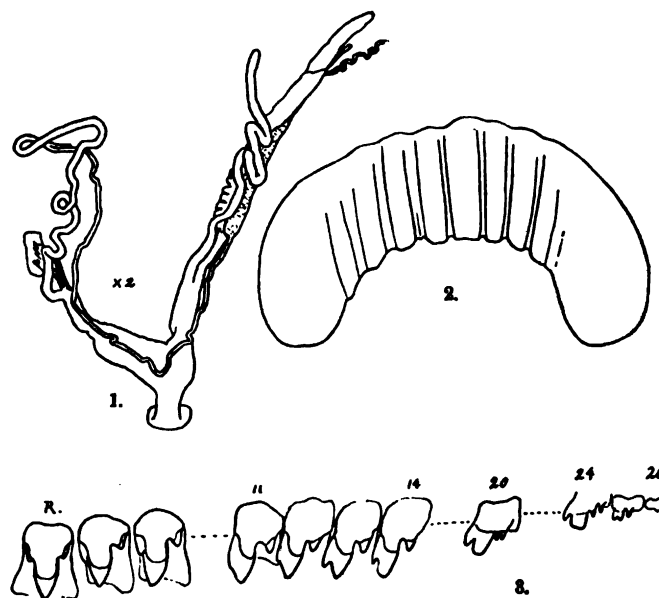
Polygyra miorhyssa Dall, 1898, Nautilus, 12: 75.*Ashmunella miorhyssa* (Dall), Pilsbry & Cockerell, 1899, Proc. Acad. Nat. Sci. Phila., pp. 189, 193, figs. 1-3 (anatomy).—Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 108.*Ashmunella rhyssa miorhyssa* (Dall), Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 228, pl. 12, figs. 5, 6.*Ashmunella rhyssa hyporhyssa* Cockerell, 1898, Nautilus, 12: 77.—Pilsbry, 1907, Nautilus, 20: 134, pl. 8, figs. 3-5. (Not *A. hyporhyssa* Cockerell, 1900, Nautilus 14: 72. Not *A. rhyssa hyporhyssa* Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 228.)

“Shell depressed, dark brown with about five and one third rounded whorls, the periphery somewhat above the middle of the outer whorl; suture distinct, umbilicus small, deep, narrowing rapidly toward the apex; surface polished, with microscopic revolving striae and fine, small, slightly irregularly distributed oblique transverse ridges; aperture subcircular with a reflected white peristome continued over the body by a thin, translucent callus; within the aperture is small, oblique, white parietal tooth, the reflected peristome has an obscure thickening inside the peripheral part, and another more distinct inside the base. Alt. 8.5, lat. 15.5 mm.” (Dall.)

Height 9, diameter 16.3 mm. Topotype.

Height 10.3, diameter 16.3 mm. Near Eagle Creek.

Genitalia (Fig. 531: 1) with the penis about as figured for *A. rhyssa edentata*; retractor very short. Length of penis 10.5 mm., epiphallus 31 mm., flagellum 2 mm., spermatheca 27 mm. Jaw with eight ribs grouped in the median area. 26.1.26 teeth.

Fig. 531. *Ashmunella rhyssa miorhyssa*. 1, genitalia; 2, jaw; 3, teeth.

NEW MEXICO: Sierra Blanca, Lincoln County (E. H. Ashmun), Type 150688a U.S.N.M. Near Eagle Creek (C. H. T. Townsend).

The last whorl is distinctly more depressed than in *A. rhyssa*, and the sculpture consists of unequal striae as far as the second half of the last turn, where coarser, unequal wrinkles appear.

The umbilicus is contained in the diameter 6.5 and 7 times in a topotype and a paratype. Eight paratypes in the U.S. National Museum measure from 15.2 to 16.7 mm. in diameter. The smallest specimen seen has a diameter of 14 mm.

A. rhyssa hyporhyssa Cockerell, the holotype of which is drawn in Figure 532 does not appear to me separable from *miorhyssa*. It was described as "Like *rhyssa* in size and form, but umbilicus wider, exposing

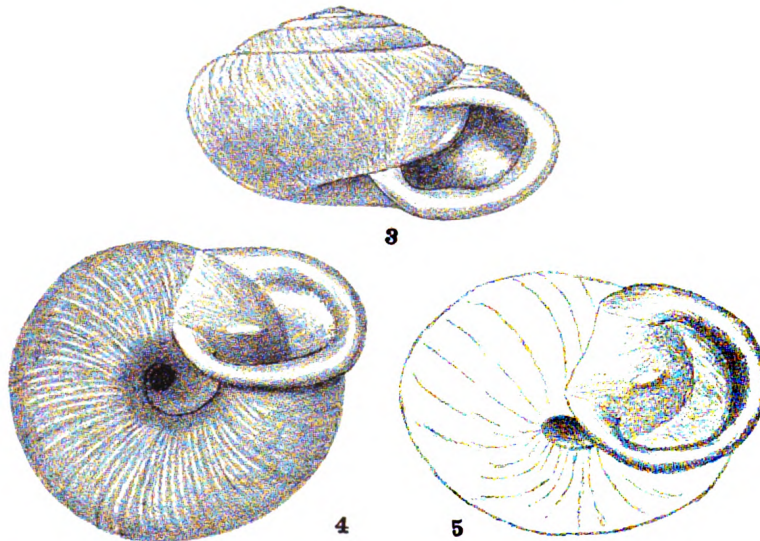


Fig. 532. *Ashmunella rhyssa miorhyssa* (type of *A. rhyssa hyporhyssa*). ($\times 32$.)

the penultimate whorl; sculpture finer, consisting of striae rather than riblets. One specimen, diameter max. 15, min. $12\frac{3}{4}$, alt. 9 mm." It was taken on the lower slopes of Sierra Blanca, New Mexico, above head of Ruidoso Creek, in the aspen belt at about 9500 feet altitude, by Prof. C. H. T. Townsend on August 14, 1898.

The unique type, no. 113056 A.N.S.P., is bleached, having lost the cuticle. There is a slight thickening in the basal margin and a small oblique parietal tooth about 2 mm. long. The umbilicus is 3 mm. wide, thus contained five times in the diameter. Sculpture of coarse, sigmoid striae on the last half whorl as in *miorhyssa*. The umbilicus is slightly larger than that of typical *miorhyssa*, but I can detect no other difference.

The Sacramento Range race *edentata* was at first confused with *hyporhyssa* by Prof. Cockerell and myself, and is to be found under that name in some collections.

Ashmunella rhyssa trifluviorum new subspecies

Fig. 530 c, d.

The shell is much more depressed than *A. rhyssa*, with more open umbilicus exposing more of the penult whorl; base less convex; outer lip more thickened within, typically in form of a low, wide tooth; basal tooth typically distinctly developed, but both lip teeth may be weak or obsolete. Parietal tooth small, often quite weak. Sculpture varying from as strongly wrinkled as *rhyssa* to largely striate as in *miorhyssa*; the spiral engraved lines moderately developed. The last whorl is more depressed than in *miorhyssa*. Color dilute buckthorn brown to warm buff, the base paler than the upper surface.

Height 9 mm., diameter 16.3 mm.; 5½ whorls. Type.

Height 8 mm., diameter 14.8 mm.; 5½ whorls. Topotype.

NEW MEXICO: Western slope of Sierra Blanca in Three Rivers Canyon, from about 6700 feet, half a mile above the dam, to the aspen belt at about 8500 feet (Pilsbry); Type from about 7500 feet, 165911 A.N.S.P. Also in a canyon about four miles south, about a mile above cultivation.

This is the only race from this part of New Mexico in which the callus in the outer lip becomes somewhat tooth-like, as in *A. thomsoniana*. Its development, however, is highly variable. Young shells are angular peripherally and form a white lip-callus at growth-rests.

Size is variable, averaging somewhat smaller in the highest stations, but the largest shells came from intermediate elevations. Out of fifty from 6700 feet, forty were from 14 to 15 mm. in diameter, nine larger, one smaller; extremes 13.8 and 16 mm. About the same proportions hold in several higher stations, including the type lot. In a small lot of thirteen, at 8000 feet, eleven were from 14 to 15 mm., the extremes 13.9 and 15.5 mm. In a lot of seventeen from the aspens, about 8500 feet, the size is slightly smaller, fourteen being from 13.3 to 14 mm., the largest 15.2 mm. Shells were much less abundant here than lower.

The largest specimens were found in Dry (north) Branch of Three Rivers Canyon, at an intermediate elevation, 7500-8000 feet; twenty-five taken at random measure from 16.5 to 18.5 mm., the mode at 17 mm. At a lower station in Dry branch the diameter runs from 15 to 18 mm.

Albino shells are not uncommon. It was found abundant in October hibernating in the earth under stones on well shaded leafy slopes.

Ashmunella rhyssa edentata Cockerell

Fig. 530 f.

Ashmunella hyporhyssa var. *edentata* Cockerell, 1900, Nautilus, 14: 72 (with color-mutations *rufescens* and *alba*).

Ashmunella rhyssa hyporhyssa Cockerell, Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., pp. 107, 108, fig. 1 (genitalia); 1905, Proc. Acad. Nat. Sci. Phila., p. 228, pl. 12, figs. 7-13 (exclusive of synonym "*Polygyra r. hyporhyssa* Ckll." and quoted description of same).—Vanatta, 1902, Nautilus, 16: 58.

Ashmunella rhyssa edentata Cockerell, Pilsbry, 1907, Nautilus, 20: 135.

The shell is glossy, rather finely striate except on the last half whorl which is irregularly, more or less coarsely wrinkled. The aperture is toothless (or rarely with a very small or vestigial parietal tooth).

Height 9.7 mm., diameters 15.2×17.6 mm., Type. Paratypes measure from 10.5×19 mm. to 8.6×15.5 mm.

Genitalia (Fig. 525: 7, 7a). The penis is stout in its lower half, which is nearly double the diameter of the cylindric upper part. Retractor well developed, inserted 4 mm. from the anterior end of epiphallus. Talon with one or two small tubercles, almost simple. Length of penis and epiphallus 47 mm., spermatheca 28 mm., the vas deferens looped around it, as in most other species.

NEW MEXICO: Sacramento Mountains at Cloudercroft, head of James Canyon, at 8750 feet (T. D. A. Cockerell); Type 162028 U.S.N.M., (*edentata*); 162030 U.S.N.M., (*rufescens*); 162029 U.S.N.M., (*alba*). Cloudercroft and Highrolls (J. A. G. Rehn & H. L. Viereck). Alamo Canyon, 14 miles from Alamogordo (Ferriss). Near head of southern branch of Alamo Canyon, subfossil (Pilsbry).

This race though not strongly differentiated from *miorhyssa*, is frequently more depressed with wider umbilicus and generally without a parietal tooth, which is present in less than five per cent of the specimens examined. It is characteristic of the northern end of the Sacramento Range. At Cloudercroft it is "excessively abundant under pine logs and pine bark on the ground."

In a lot of 200 from James Canyon, Cloudercroft, New Mexico, the diameter varies from 13 to 17 mm., 86 being 15 mm.; 163, or 81.5 per cent fall between 13.8 and 15.2 mm. diameter. There are five albinos; however, the series from lightest to darkest is uninterrupted.¹ Nine shells show a very small parietal tooth. A lot from another place near Cloudercroft consists of larger shells, 9.2×16.8 mm. to 12×19.3 mm. Two are albinistic, none toothed.

In specimens from Alamo Canyon the diameter varies from 13.5 to 16.2 mm. Some show a weak basal tooth, but none has a parietal. Subfossil shells from the now arid south branch of the same canyon are small, about 13.7 mm., none toothed.

The young form a rather thin callus in the lip at growth rests, appearing as a buff streak in many adult shells.

¹ Professor Cockerell defined stages in the color-scale as follows: "(1) *Edentata* proper: shell horn-color or pale greyish-brown. The commonest form. (2) *Rufescens*, n. mut.: shell deep ferruginous or chestnut color, lip tinged with pink. Quite common. (3) *Alba*, n. mut.: shell creamy white. Rare, only three or four found. The first albino reported in *Ashmunella*."

Ashmunella altissima (Cockerell)

Fig. 530 e.

Polygyra altissima Cockerell, 1898, *Nautilus*, 12: 76.*Ashmunella altissima* (Ckll.), Pilsbry & Cockerell, 1899, *Proc. Acad. Nat. Sci. Phila.*, p. 192.—Pilsbry, 1905, *Proc. Acad. Nat. Sci. Phila.*, p. 231, pl. 12, fig. 14.

"Shell with five and one-third whorls, pale yellowish-brown, suture moderately deep, spire flattened and low, periphery rounded; apical whorls nearly smooth, with little sculpture as far as the middle of the penultimate whorl, after which the shell becomes distinctly and strongly obliquely ribbed, the ribs near the aperture being particularly strong; the last whorl bears about forty-eight of these ribs. Umbilicus narrow and deep. Aperture obliquely semilunar; the peristome subcircular except where interrupted by the parietal wall, strongly thickened, recurved with a sharp edge, yellowish-white, without teeth. No parietal denticle. Diameter max. 12, min. 10 mm.; alt. 6 mm." (Cockerell.)

Height 5.4 mm., diameter 11.2 mm.; fully 5 whorls. Cotype.

NEW MEXICO: Highest summit of White Mountain (Sierra Blanca), Lincoln County, altitude 11,092 feet, three under a rock (C. H. T. Townsend), Cotype 73558 A.N.S.P.

A. altissima is most like *A. townsendi* by the possession of strong ribs, but compared with that species and *A. rhyssa* it "is not only much smaller but also much flatter, with the aperture consequently narrower and the last whorl more evenly rounded." The umbilicus is contained five times in the diameter.

Ashmunella townsendi Bartsch

Fig. 530 g, h, h'.

Ashmunella townsendi Bartsch, 1904, *Smiths. Misc. Coll.*, 47: 13.*Ashmunella rhyssa townsendi* (Bartsch), Pilsbry, 1907, *Nautilus*, 20: 133 (exclusive of specimens from Nogal Peak and figures).

The shell is moderately depressed, the narrow umbilicus contained 8 times in the diameter; pale brown to bluish-white; of five and one-half convex whorls, the last rounded at periphery, which is above the middle, somewhat descending in front, strongly constricted behind the lip. Surface rather dull, the first whorl smoothish, next half turn finely striate, post-embryonic whorls following are more coarsely but weakly striate, changing rather suddenly to the coarse costation of the last two and one-fourth whorls. The last whorl is strongly and coarsely ribbed, the ribs somewhat unevenly spaced, and has rather strongly incised spiral lines. The oblique aperture is as high as wide, the peristome reflected, strongly thickened within the outer margin, the basal margin with a very low, broad tooth. The thin transparent parietal callus bears a weak, oblong tooth.

Height 8.7 mm., diameter 14.8 mm. Type.

NEW MEXICO: Eastern flank of Sierra Blanca Peak, on slopes of the ridge on the south fork of Rio Ruidoso at 8500 feet, about five miles above the town of Ruidoso (C. H. T. Townsend), Type 152953 U.S.N.M.

The umbilicus is narrower and the surface much more strongly ribbed than *A. rhyssa*. On the last whorl of the type figured there are about 40

strong ribs, or about 45 if minor riblets and short ribs are counted. The bluish tint of the albinistic one of the two composing the type lot is owing to being a "dead" shell; normally the albinos are of a warmer tint, ivory white. The darkest specimens are cinnamon to cinnamon-buff.

Many were taken by Wharton Huber from the crops of wild turkeys shot on the head of Carrizo Creek at about 8000 feet, and later he found the snails alive about four miles northward, near the west fork of Rio Ruidoso. Many of these specimens are larger than the type, and generally the spire is higher. The ribs are as in typical *townsendi* or a little smaller, 40 to 50 on the last whorl. In some of the smallest shells in the lot the periphery is bluntly angular in front. The parietal tooth is sometimes wanting in fully adult shells. Specimens measure: 11×17.4 mm., 11.2×16.3 mm., 8.3×14.5 mm.

***Ashmunella townsendi nogalensis* new subspecies**

Figs. 530 i, j; 533.

Ashmunella rhyssa townsendi (Bartsch) (in part), Pilsbry & Ferriss, 1907, Nautilus, 20: 133 (Nogal "Creek" specimens and pl. 8, figs. 1, 2 only).

The shell is depressed, the narrow umbilicus contained 9 to 10 times in the diameter; light ochraceous buff, a little paler at the base; of five to five and one-half whorls, the last with rounded periphery above the middle, slightly descending in front, strongly constricted behind the lip. Surface rather dull, the first two whorls smoothish, striae and small riblets then gradually developed, the last one and one-half to two whorls strongly ribbed

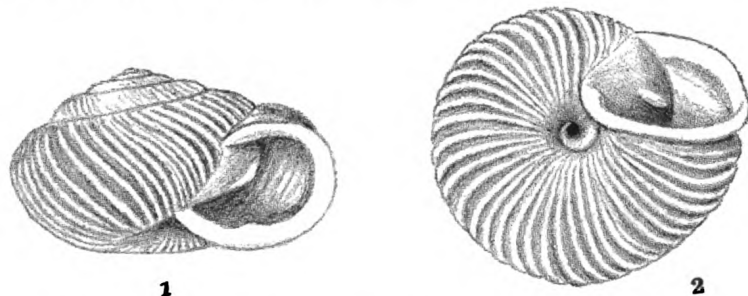


Fig. 533. *Ashmunella townsendi nogalensis*, Nogal Peak. ($\times 3.2$)

throughout, about 40 ribs on the last whorl in the type; with spiral incised lines chiefly visible in the intercostal intervals. Aperture oblique, with white, reflected and recurved peristome, which is thickened within and bears a small blunt tooth in the basal margin. Parietal callus thin and transparent, bearing a small, oblique parietal tooth.

Height 6.8 mm., diameter 12.2 mm. Type.

Diameter 11 to 13 mm. Topotypes.

NEW MEXICO: Nogal Peak, White Mountains (Sierra Blanca), in Water Canyon, on the western flank (Pilsbry & Ferriss, October 1922); occurring from about half a mile above the mouth (type locality) to about

500 feet below the summit), Type 166064 A.N.S.P. Also in a canyon on the southwestern flank, the mouth of which is about four miles south of Water Canyon (Pilsbry); and on the north slope at about 7500 feet (F. J. Phillips).

The Nogal Peak *Ashmunella* is constantly smaller and more depressed than *A. townsendi* of Sierra Blanca Peak. It is less depressed than *A. altissima*, and possesses teeth. It occurs in profusion in the canyons explored, which are densely shaded with walnut, ash, oak and maple, with aspens at the upper tree limit. Above these the steep slope is covered with bunch grass and scruboak, finally with large lichens only on the rocks of the bare summit (9983 feet). In mid October the snails were hibernating in the mellow mould under stones on the leafy slopes.

Not much variation in size is observable among the 100 collected, but series of measurements possibly would show slightly smaller average diameter at the highest stations. The extreme diameter at two intermediate stations are 10.5 to 13 mm., and 11 to 13.5 mm., the last being the largest *nogalensis* detected. In the aspen zone the extremes are 12.7 mm. and 5.4×10.7 mm. Some of this lot are strongly depressed, with about the shape of *A. altissima*, but with well developed teeth.

As in all *Ashmunellae* of the region, there is considerable individual variation in the size of the teeth. Occasionally the callus within the outer lip bulges noticeably in the position of an outer tooth. Sometimes the teeth are almost obsolete.

A series collected in the canyon south of Water Canyon (nos. 165926-9 of the collection), forms a sub-race. It differs from typical *nogalensis* about as *A. rhyssa miorhyssa* differs from *A. rhyssa*. The ribbing is strongly developed only on the last half whorl, the surface before that being coarsely striate rather than ribbed. Size and apertural characters are as described for *nogalensis*. The four lots were collected in a head branch of the canyon, the highest lot among aspens, estimated to be at about 9500 feet.

***Ashmunella organensis* Pilsbry**

Fig. 534.

Ashmunella organensis Pilsbry, 1936, *Nautilus*, 49: 101.

The shell is depressed, the narrow umbilicus contained 6 to 7 times in the diameter; thin; buckthorn brown, translucent; of five to five and one-third moderately convex whorls, the last rounded at the periphery, above the middle, descending very little in front, constricted behind the lip. Surface very glossy; the embryonic one and one-half whorls appear smooth except for weak radial wrinkles below the suture, but under the microscope close spiral lines of punctures are seen; following one or one and one-half whorls have weak growth wrinkles and an indistinct pattern of low papillae. The remaining whorls have weak fine growth wrinkles, which become rather

close, sharp striae behind the prelabral constriction; the base more glossy with the striation weaker. All postembryonic whorls have a microscopic sculpture of close spirals, which appear more or less punctate under sufficient magnification. The aperture is rounded-lunate. Peristome faintly flesh tinted, reflected, a little thickened within, with a low, tubercular tooth in the outer part of the basal lip. Parietal callus thin, transparent, bearing a very weak, short, obliquely placed parietal tooth.

Height 5.8 mm., diameter 13 mm. Type. Topotypes measure from 6.4×12 mm. to 7×14 mm.



Fig. 534. *Ashmunella organensis*, type and paratypes. ($\times 1\frac{1}{2}$.)

Genitalia (Fig. 525: 9-9b). The penis is very stout in the lower half, slender and cylindric in the upper. Retractor short (1.7 mm.), but well developed. Talon club-shaped, weakly tuberculate. Length of penis 4 mm., epiphallus 32 mm., spermatheca 23 mm.

NEW MEXICO: Western slope of the Organ Mountains, above Dripping Spring (La Cueva), in the northeast branch of the canyon, estimated elevation 7000 to 7500 feet (Ferriss & Pilsbry, 1922), Type 165909 A.N.S.P.

The brilliant gloss of "live" shells is a conspicuous feature. The small basal tooth is often reduced to a mere vestige; when well developed there is usually also the trace of an inner basal tooth. The parietal tooth is variable, rarely distinct, and entirely wanting in a few shells. No lip-callus was found in young shells.

There seems to be no nearly related species. It belongs to the series having the upper part of the penis far more slender than the lower. Probably other more fully toothed forms may turn up in the Organ Range, which has been explored for shells only in one place; if so, they may give a clue to the relationships of *A. organensis*.

It occurred in long, narrow slides of small stone on a very steep incline. There is sparse growth of scrub oak, scrub maple, and a few yellow pines, pinyons and cedar. Though this station is not very high, it is one of the steepest climbs anywhere.

3. SPECIES OF THE BLUE MOUNTAINS, ARIZONA, AND THE MOGOLLON AND BLACK RANGES, NEW MEXICO

Part of these species have the upper part of the penis nearly as ample as the lower, but others belong to the series with the upper part slender.

Both series contain toothless as well as 4-toothed species. Good anatomical material from the Mogollons is not extant. These ranges are heavily wooded.

Key to Species and Subspecies

1. Aperture with strong teeth2
Aperture with only weak teeth or none6
2. Parietal and lip teeth both strongly developed3
Lip teeth strong; no parietal tooth*A. danielsi*
3. Periphery carinate; surface papillose; Blue Mountains*A. pilsbryana*
Periphery weakly or scarcely angular in front; surface smoothish4
4. Three lip-teeth about equally spaced5
Two basal teeth contiguous; Black Range*A. tetradon animorum*
5. Teeth strong; Mogollon Mountains, etc.*A. tetradon*
Teeth weaker; shell thin, more angular in front; Black Range.
A. tetradon fragilis
6. Periphery strongly carinate, at least in front; surface granulose7
Periphery angular in front; not granulose8
Periphery rounded10
7. Periphery carinate throughout; Black Range9
Last whorl becoming rounded in its latter part; granulation very fine.
A. cockerelli perobtusa
8. No spiral lines; 5½ whorls; Mogollon Mountains*A. tetradon inermis*
Some very weak spirals; 5 whorls; Black Range*A. binneyi*
9. Granulation of last whorl coarse, pebbly*A. cockerelli*
Granulation very fine*A. cockerelli argenticola*
10. Small or rudimentary teeth present*A. tetradon mutator*
No teeth; spiral lines more or less developed*A. mogollonensis*
A. mendax

***Ashmunella pilsbryana* Ferriss**

Fig. 535.

Ashmunella pilsbryana Ferriss, 1914, *Nautilus*, 27: 109.—Pilsbry & Ferriss, 1915, *Nautilus*, 29: 42, pl. 2, fig. 3.—Ferriss, 1915, *Nautilus*, 28: 110.

The carinate, lens-shaped shell is openly umbilicate, umbilicus contained about five times in diameter, narrowing rapidly within. Pale brownish buff. The whorls are convex, increasing slowly, the last carinate, somewhat impressed above the keel, descending very little in front, guttered behind the lip. Surface with somewhat silky luster, minutely striate, regularly papillose throughout except the glossy initial one and one-half whorls. The aperture is strongly oblique; peristome white, narrow, reflected, the outer lip with a wide, flat-topped tooth, basal lip with two compressed teeth, the three



Fig. 535. *Ashmunella pilsbryana*. (× 1½.)

teeth separated by about equal intervals; parietal callus thin and transparent, bearing an oblique parietal tooth which is nearly straight, or it may be bent at the ends.

Height 5.7 mm., diameter 14 mm.; $5\frac{1}{2}$ whorls. Type.

Height 6.6 mm., diameter 14.3 mm. Topotype.

Height 6.2 mm., diameter 15.1 mm.

ARIZONA: Rock slide on the east bank of San Francisco River about ten miles above Clifton (Ferriss), Type 109529 A.N.S.P. Also farther up, about two miles above the mouth of the Blue River, Greenlee County.

It is much larger and more distinctly striate than *A. lepiderma*, with the two basal teeth more widely separated. It seems more nearly related to the Chiricahuan *A. angulata*. The carination and the papillose surface distinguish it from all toothed species of the Mogollon Mountains and Black Range.

The localities for *A. pilsbryana* are all in rock slides along the San Francisco River, scattered from about 4 miles above Clifton north for a distance of about 25 miles by the river, less than 20 miles as the crow flies, at elevations of about 4000 feet and less.

Ashmunella tetrodon Pilsbry & Ferriss

Fig. 536.

Ashmunella tetrodon Pilsbry & Ferriss, 1915, *Nautilus*, 29: 15, 29, pl. 1, figs. 1-3a.—
Pilsbry & Ferriss, Proc. Acad. Nat. Sci. Phila., 1917, p. 88, pl. 10, fig. 6
(genitalia).

The shell is umbilicate, width of umbilicus contained nearly six times in the diameter of the shell; depressed, angular in front, the angle situated above the middle, and nearly or quite disappearing on the last third of the last whorl; spire and base convex. Thin; cinnamon or cinnamon-brown above, fading on the base. The surface has a silky luster, and is very weakly marked with growth-lines; on the base some excessively weak spiral lines may be seen under strong magnification. There are $5\frac{1}{2}$ convex, closely-coiled whorls, the last descending a little in front, having a deep, narrow

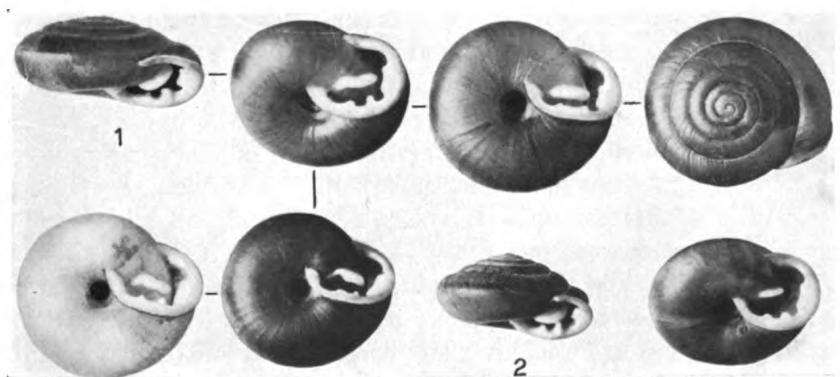


Fig. 536. *Ashmunella tetrodon*. ($\times 1\frac{1}{2}$.)

constriction or gutter behind the peristome; behind this gutter it is rather swollen and distinctly striate. The umbilicus is cylindric within, and enlarges at the last whorl. The aperture is very oblique; peristome white or pinkish, reflexed throughout, with a recurved edge, the face rounded. Outer margin bears a long, very slightly retracted, flat-topped or slightly notched tooth. Basal margin is armed with two marginal teeth, the outer one slightly larger. These two teeth are somewhat compressed laterally, and are yoked together by a callus on the edge of the broad lip. The spaces between the three teeth are about equal. The transparent parietal callus bears an obliquely radial tooth, set rather far in, and in old examples having the inner end slightly curved towards the basal lip. The outer end often has a low callus outwardly and sometimes one running in.

Height 6.7 mm., diameter 15 mm.

Young shells form a quite thin lip-callus at resting stages, but these seem to be absorbed subsequently, as no opapue streaks are visible in the adult stage.

A toptype dissected has the upper half of the penis nearly as wide as the lower. There is a strong retractor muscle inserted at about the anterior third of the epiphallus. Jaw with eight strong ribs. As the material is imperfect, no figure is given. The free retractor muscle system is figured, Fig. 525: 11.

NEW MEXICO: Socorro County: southwestern slope of the Mogollon Mountains, in Dry Creek in and above the "box", 6-7,000 feet (Ferriss & Daniels), Type and Paratypes 111924 A.N.S.P. San Mateo Mountains, in the Cibola National Forest (Ferriss).

Compared with *A. proxima* Pilsbry of the Chiricahua Range, this species differs as follows: "It is less depressed. The peripheral angle becomes weak and then nearly or quite disappears at the last part of the whorl, where it is more swollen above. There is a furrow behind the lip up to the suture, and the *upper lip is reflexed*, while in *A. proxima* the upper lip is straight, not expanded, and there is a triangular whitish patch and no gutter above the end of the outer lip."

In the type lot the diameter varies from 12.8 mm. with five and one-fourth whorls to 15 mm. with five and one-half whorls. This is the usual range of variation in size. In some places all are rather small, from 11.3 to 13 mm. in diameter. The smallest have barely 5 whorls.

In several stations, there are very beautiful albino specimens of a transparent marguerite-yellow tint among the dark ones. See first two figures within second row of Figure 536, representing an albino and one of the darkest examples.

"Dry Creek is dry at the crossing of the Silver City and Mogollon road. Six miles above it becomes a large and beautiful trout stream, boxed in for two miles so closely and roughly that the banks are not used for grazing, and are never disturbed. Twenty snail colonies were found in the rock slides during a hasty search of these, two or three more miles above. Above

the box shells were found in the grass and weeds also. In nearly every instance the colonies differed in size and in the character of the teeth." (J. H. Ferriss.)

Many specimens from the southern part of the San Mateo Range, where the rock is granitic, are not distinguishable from the typical *tetrodon*; these range from 12 to 15 mm. in diameter.

Possibly *A. tetrodon inermis* might be viewed as a species, and the colonies of *A. tetrodon mutator* may then be *tetrodon* × *inermis* hybrids. Fuller collections in the Mogollons may throw light on this perplexing series. The *tetrodon* forms are now known in these mountains by a single series of colonies along the bed of one canyon. As the species reappears in the San Mateo Range, about 60 miles eastward, and varietal forms in the Black Range, it may be expected to occur widely in the central and eastern Mogollons, still unexplored.

The following two forms are named as subspecies in order that we may have a convenient means of referring to them. They intergrade, but their modification has been as great as that usually distinguishing species of helices.

***Ashmunella tetrodon mutator* Pilsbry & Ferriss**

Fig. 537.

Ashmunella tetrodon mutator Pilsbry & Ferriss, 1915, Nautilus, 29: 31, pl. 1, figs. 3-6.

In color, shape and sculpture this subspecies is like *A. tetrodon*. As in that species, the upper lip is well reflected from the insertion out; former resting stages are often marked by an opaque light streak on the base. In the typical colony there is no parietal tooth and the lip-teeth are much reduced; there are vestiges of the long tooth within the outer margin, and of the two teeth of the basal margin, but in many individuals of the typical colony these vestiges are exceedingly weak, hardly noticeable. There are about five and one-third whorls.

Height 6.25 mm., diameter 14 mm.	} Station 60.
Height 6.9 mm., diameter 13.8 mm.	
Height 6 mm., diameter 12.5 mm.	
Height 7 mm., diameter 14 mm.; 5½ whorls	} Station 61.
Height 8 mm., diameter 15 mm.; 5¾ whorls	

NEW MEXICO: Dry Creek Canyon, Mogollon Mountains (Ferriss & Daniels), Type 111945 A.N.S.P.

This is very abundant in some places, where large series of fresh "bones" were taken, but living ones were rare. It is one of those lawless species, such as we have described from the Huachucas—a species which has been caught in the act of losing its teeth. Its affinities are clearly with *A. tetrodon* of the same canyon, and there seems to be no decided break between the most fully toothed *mutator* and the *tetrodon* with smallest teeth.

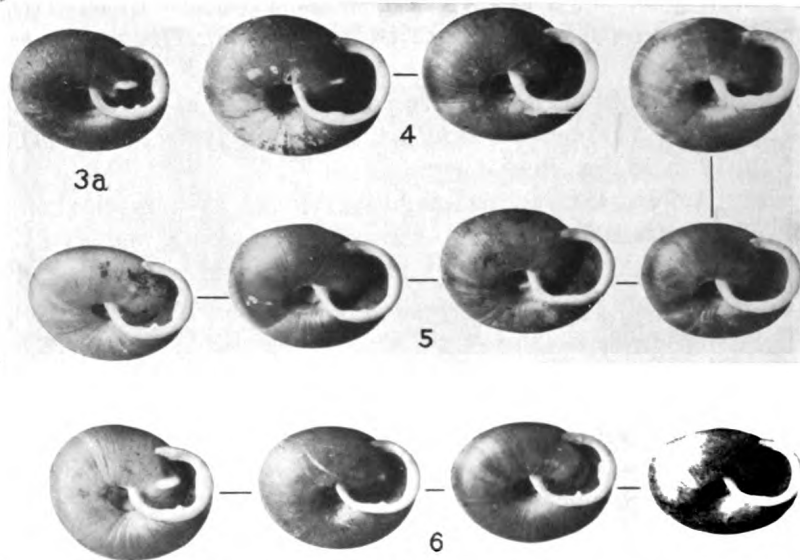


Fig. 537. *Ashmunella tetradon mutator*. ($\times 1\frac{1}{2}$.)

The specimen described as type of *mutator* is from a colony in which no specimens have a parietal tooth. Varying forms from this colony (Station 80) are represented in Figure 537: 5, all being perfectly adult shells. Similar are those from Stations 61, 62, 68.

In the lot from Station 60 all the shells are rather distinctly striate. The most fully toothed examples (Fig. 537: 3a) agree with *A. tetradon*, except that the parietal tooth is smaller. There are others with all of the teeth smaller than in *tetradon*, and still others, found with them have the lip-teeth very small, partly wanting, the parietal tooth either wanting or minute (Fig. 537: 4). This is the only instance where almost fully toothed *tetradon* and *mutator* occur in the same colony; but here without transitional individuals in the large series collected.

Lots from Stations 67 (Fig. 537: 6, four adult shells) and 78 vary from shells having four small teeth (like *tetradon* fig. 3a) to shells having only weak rudiments of teeth. The lots from these stations therefore connect *tetradon* and *mutator*, and cause us to rank the latter as a variety of the former.

***Ashmunella tetradon inermis* Pilsbry & Ferriss**

Fig. 538.

Ashmunella tetradon inermis Pilsbry & Ferriss, 1915, *Nautilus*, 29: 33, pl. 1, fig. 7.

Larger than the other forms of *tetradon*, biconvex, bluntly angular above the middle in front, the periphery becoming rounded on the last third of a

whorl. There are five and one-half to six convex, closely-coiled whorls, the last descending a little in front, guttered behind the lip, a little swollen behind the gutter. Surface lightly marked with growth-lines, without spiral



Fig. 538. *Ashmunella tetrodon inermis*. ($\times 1\frac{1}{2}$.)

striae, indistinctly, very finely papillose. The aperture has no teeth, or in some specimens shows extremely weak traces of them. The narrow lip is reflexed, the edge recurved.

Height 8, diameter 17.5 mm.

Height 7.3, diameter 15 mm.

NEW MEXICO: Mogollon Mountains, Dry Creek, Station 69 (Ferriss & Daniels), Type 111948 A.N.S.P. Also Station 63, where it is rare.

This is a smaller and especially more depressed shell than *A. mogollonensis*, differing, moreover, by the noticeable peripheral angle in front and the absence of spiral incised lines. It has nearly a whorl more than *A. binneyi*. While it seems at first rather absurd to connect this form with *A. tetrodon*, yet except by its greater size and weak, fine papillae it does not differ in any important respect from the least toothed of the variety *mutator*. We regard it as a final stage in the degeneration of teeth, like *Ashmunella esuritor* in the Chiricahuas. It has not been dissected.

At first glance it seems to be without teeth, but it carries a suggestion of teeth in the slight thickening of the lip in the outer margin and a mere pimple at the basal position. Two in 24 had two "pimples" in the basal lip. Seven had none. One with a "pimple" also had the mere trace of a parietal lamella. Parietal callus thin and colorless. One or two buff growth-rest streaks in every specimen, usually at or near the end of the penult whorl.

Ashmunella tetrodon fragilis Pilsbry & Ferriss

Fig. 541: 1-1b.

Ashmunella tetrodon fragilis Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., 69: 89, pl. 7, figs. 1-1b.

The shell is markedly thinner than *A. tetrodon*, and subangular peripherally, the periphery situated high. Basal teeth small and well separated. Parietal tooth smaller than in *A. tetrodon*. There is no denticle between its inner end and the upper termination of the lip.

Height 6.5 mm., diameter 14 mm.; $5\frac{1}{3}$ whorls.

NEW MEXICO: Socorro County, slides on south side of Cave Creek, near its mouth, and an equal distance from where the wagon road starts up a long-grade hillside on the trail from Chloride to Hillsboro, in the eastern foothills of the Black Range (Ferriss), Type 115753 A.N.S.P.

Ashmunella tetrodon animorum Pilsbry & Ferriss

Fig. 541: 2-2b.

Ashmunella tetrodon animorum Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., 69: 89, pl. 7, figs. 2-2b.

The shell resembles *A. tetrodon*, but differs by having the basal teeth much closer together and united by a callus. The parietal tooth is simple; the outer lip-tooth is long. Color light buff, with a slightly brownish tinge above. Under a strong lens some imperfect granulation is produced by the interruption and irregularity of the growth striae on the penult whorl. There is also an extremely minute spiral striation on the later whorls.

Height 7 mm., diameter 15 mm.; 5½ whorls. Type.

Height 5.4 mm., diameter 12 mm. Station 36.

NEW MEXICO: Socorro County: Black Range, from Holden's Spring, Type 115747 A.N.S.P.; northward to Black Canyon (Reed's Ranch) and Morgan Creek (Pilsbry & Ferriss). Taken at 15 stations.

This is a common snail at high elevations in the mountains north of Hillsboro Peak, especially in the labyrinth of canyons forming the heads of Las Animas Canyon, but also on the western slope of the range. Most of the stations are between 8000 and 9000 feet. It was found mainly under dead wood on shady and rather humid slopes.

Very often the inner of the two basal teeth is wanting, being reduced to a sloping callus against the other tooth.

Ashmunella danielsi Pilsbry & Ferriss

Fig. 539, upper.

Ashmunella danielsi Pilsbry & Ferriss, 1915, Nautilus, 29: 34, pl. 2, fig. 1.

The shell is similar to *A. tetrodon* in shape, luster and color; but it differs in the following characters. The fine spiral lines, when the surface is perfectly preserved, are numerous and distinct. There is never any trace of a parietal tooth. The two teeth of the basal margin are closer together, and the inner one is much smaller than the outer, the umbilicus is a trifle smaller. Finally, the callous rim strengthening the lip of the young, in resting stages, is not absorbed, but remains visible as an internal varix, producing an opaque streak in the adult, visible externally on the base, or if the surface is dulled, it may be seen by holding the shell up to the light.

Height 7 mm., diameter 14.5 mm.; 5½ whorls.

Height 7 mm., diameter 13.3 mm.; 5½ whorls.

NEW MEXICO: West slope of the Mogollon Mountains, in Cave Spring Canyon (about two miles north of, and running parallel to, Little White-water Creek; south of the south fork of Whitewater Creek, at about 7000 feet; Range 19 West on the parallel of 30° 20', U. S. G. S. Topographic Map,



Fig. 539. Upper row, *Ashmunella danielsi*. Lower row, *A. danielsi dispar*. ($\times 1\frac{1}{2}$.)

Mogollon Quadrangle), (Ferriss & Daniels), Type 111952 A.N.S.P. Also taken about two miles farther up, at about 8,000 feet.

This species is remarkable for retaining large lip-teeth while the parietal tooth has totally disappeared, showing that these teeth are not connected in inheritance, though from the diminution of all together in *A. tetrodon mutator* a connection would be supposed to exist. The large series taken at Stations 57, 58, 59, at successively higher elevations in the same canyon, shows very little variation. As in *A. tetrodon*, the basal teeth are yoked together by a callus shaped like the letter U.

Ashmunella danielsi dispar Pilsbry & Ferriss

Fig. 539, lower.

Ashmunella danielsi dispar Pilsbry & Ferriss, 1915, *Nautilus*, 29: 41, pl. 2, fig. 2.

Smaller than typical *A. danielsi*, composed of five whorls, and like that in having no trace of a parietal tooth. The long tooth in the outer lip is strongly developed. The two basal teeth are closer together and more or less completely united, or sometimes conerescent into one. The umbilicus enlarges but little at the last whorl.

Height 5.8 mm., diameter 11.2 mm. Largest adult: diameter 11.25 mm.; smallest: 9.8 mm.

NEW MEXICO: West slope of the Mogollon Mountains in Little White-water Creek,¹ elevation about 7500 feet (Ferriss & Daniels), Type 111955 A.N.S.P.

Ashmunella mogollonensis (Pilsbry)

Figs. 540; 541: 10.

Ashmunella chircahuana (Dall), Pilsbry, 1900, *Nautilus*, 14: 93. (Not of Dall).

Ashmunella chircahuana mogollonensis Pilsbry, 1905, *Proc. Acad. Nat. Sci. Phila.*, p. 252, pl. 16, fig. 102.

Ashmunella mogollonensis Pilsbry & Ferriss, 1915, *Nautilus*, 29: 42. 1917, *Proc. Acad. Nat. Sci. Phila.*, p. 93, pl. 7, fig. 10 (shell), pl. 10, fig. 3 (genitalia).—Pilsbry & Ferriss, 1918, *Proc. Acad. Nat. Sci. Phila.*, p. 319.

¹ This place is about 6 miles east of Glenwood, Socorro County, New Mexico.

The depressed shell is umbilicate, the umbilicus contained about four and one-half to five times in the diameter; cinnamon-buff or paler, usually with a dark-edged buff growth-rest streak on the last whorl. The five and one-half to six whorls are convex, the last broadly rounded at the periphery, descending slightly to strongly in front, contracted behind the peristome. The surface is slightly glossy, with sculpture of low, irregular wrinkles of growth and distinct incised spiral lines throughout the last whorl, weaker or obsolete on the spire. The aperture is broadly lunate, toothless. Peristome white or pale brown, reflected throughout, the edge recurved. Parietal callus thin and transparent.

Height 9 mm., diameter 17.7 mm. Type.

Height 10.2 mm., diameter 19.5 mm. Silver Creek, Mogollons.

Height 7 mm., diameter 15.5 mm. Silver Creek.

Height 11.7 mm., diameter 23 mm. Blue Mountains, Arizona.

Height 8.5 mm., diameter 18.3 mm. Blue Mountains, Arizona

The genitalia (Fig. 524: 3-3c), show relationship with *A. chiricahuana*. The lower, enlarged part of the penis is short, the longer upper part being as slender as the epiphallus, its end indicated at e. There is a strong, short retractor. The talon has low, unequal tubercles (fig. 3d). Length of penis 6 mm., epiphallus 38 mm., spermatheca 40 mm. The penis is less swollen than in *A. chiricahuana*, with simpler internal plication, and the epiphallus is much shorter than in that species in shells of about the same size.

NEW MEXICO: Mogollon Mountains, from Mineral Creek to Dry Creek, 5500 to 9000 feet (Ferriss & Daniels). Whitewater Creek about 1½ miles due east of Mogollon Peak, 9000 feet (E. O. Wooton), Type 79530 A.N.S.P.

ARIZONA: Blue Mountains, below the San Francisco River, Greenlee County, 5500 to 12,000 feet (Ferriss).

This species differs from *A. chiricahuana* by the more tumid last whorl, more broadly rounded periphery, and the engraved spiral lines.

The largest specimens are from the rim of the Blue Mountains in Arizona. They are deeply engraved spirally (Fig. 540 b). In some of the shells from Dry Creek, in the western Mogollons, the spirals are very weak or almost obsolete. At the head of Mineral Creek albino shells are found with others of the usual brown color.

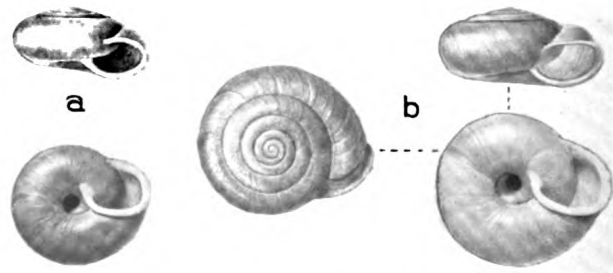


Fig. 540. *Ashmunella mogollonensis*; a, type; b, Eagle Creek, rim of Blue Mountains, Arizona. (Nat. size.)

Ashmunella binneyi Pilsbry & Ferriss

Fig. 541:8.

Ashmunella binneyi Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 91, pl. 7, fig. 8 (shell), pl. 10, fig. 5 (genitalia).

The shell is depressed, with low but convex spire and angular periphery, the angle disappearing on the latter part of the last whorl. Isabella color above, paler below. Sculpture of very minute, interrupted, somewhat anastomosing striae along growth-lines; some weak traces of spiral lines on the base. Whorls slowly widening, convex, the last angular or subangular in front, descending a little to the aperture. Umbilicus widening rapidly in the last whorl, one-fifth the total diameter. Aperture toothless, rounded, lunate, the peristome white, evenly and rather narrowly reflected throughout.

Height 7 mm. diameter 15.5 mm.; 5 whorls. Type.

Diameter 13.5 to 16.7 mm.

Genitalia (Fig. 525: 8-8c). The upper part of the penis is almost as wide as the lower. Penial retractor weak or sometimes wanting (?). The talon is conspicuously tuberculate (fig. 8a). Length of penis and epiphallus 32 mm., spermatheca 24 mm.; in four others, 38 and 28 mm., 42 and 25 mm., 35 and 22 mm., and 42 and 35 mm. The lung is maculate.

NEW MEXICO: Black Range, on Silver Creek above the "box", at about 8500 feet (Pilsbry & Ferriss), Type 115751 A.N.S.P. Also head of Bull Top Creek, and Spring Creek, a tributary of Iron Creek.

This species differs from *A. mendax* by the angularity and the microscopic sculpture of the last whorl. Also by the weaker penial retractor muscle attached to the diaphragm and the conspicuously nodulose talon. It is far smoother than any form of *A. cockerelli*, and not carinate, though distinctly angular in front.

It is certainly far less widely spread than *A. mendax*. We found it only in an area of a couple of miles along the western flank of the range, from upper Silver Creek to upper Spring Creek, well within the heavily forested zone. No doubt it will be found over a somewhat wider area; yet its absence in our many stations both north and south indicates that it is a relatively local species.

It is rather similar to *A. tetradon inermis*, but it has one whorl less and the umbilicus is wider.

(Named in honor of William G. Binney.)

Ashmunella mendax Pilsbry & Ferriss

Fig. 541: 6, 6a, 6b.

Ashmunella mendax Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 92, pl. 7, figs. 6-6b (shell), pl. 10, fig. 1 (genitalia).

The shell resembles *A. mogollonensis*, but is less robust, with different microscopic sculpture, lighter colored, being between tawny-olive and saccardo umber, often with a lighter streak from a former resting period. The third and fourth whorls have minute growth-wrinkles interrupted to form oblong granules in places, and an excessively minute spiral striation. On the last whorl the growth-wrinkles are low, unequal and continuous, and

there are many weakly impressed spiral lines. Last whorl descends slightly in front. The aperture is small, toothless; lip white, narrowly reflected. The umbilicus is cylindrical within, but in the last whorl opens out to more than twice its former diameter.

Height 9.3 mm., diameter 20 mm.; width of umbilicus 5.2 mm.; $5\frac{1}{2}$ whorls.

Genitalia (Fig. 524: 4-4d), with upper sac of the penis about as wide as the lower, as in *A. binneyi*; epiphallus or vas deferens not looped over the spermatheca, penial retractor very short. Talon cylindrical with conic, weakly rugose end (fig. 4d). Length of penis and epiphallus 56 mm., spermatheca 40 mm.; in two others, 54 and 63 mm., and 61 and 42 mm. The spermatheca is abnormally short and broad in fig. 4, a Gallina Canyon example. Lung sparsely strewn with small black spots.

NEW MEXICO: Black Range, from Gallina Canyon and Sawyer Peak north to Black Canyon (Pilsbry & Ferriss), Type 115754 A.N.S.P.

The shell, while superficially very like *A. mogollonensis*, may be distinguished typically by the somewhat granose intermediate whorls and less deeply engraved last whorl. In *A. mogollonensis* there is no granulation, and the last whorl is typically deeply and closely engraved spirally (Fig. 541: 10). In the genitalia, the presence of an enlarged upper sac of the penis distinguishes *mendax* from *mogollonensis*, in which the upper sac is as slender as the epiphallus.

This snail has a remarkable range, from about 5500 to over 9000 feet. The lowest colonies on both sides are far below the forest, especially on the west side, where it was found in great numbers in the arid Gallina Canyon. The examples here are rather small, the diameter varying from 16 to 17.3 mm. On the east side of the range we took it under wood and rubbish in a garden of Kingston, where it was common. Most of the other localities are along the crest of the range, in the humid forest zone. The type locality is on the south side of Iron Creek some distance above the mouth of Spring Creek, at the entrance of a ravine from the south, where there has been rather extensive mine prospecting.

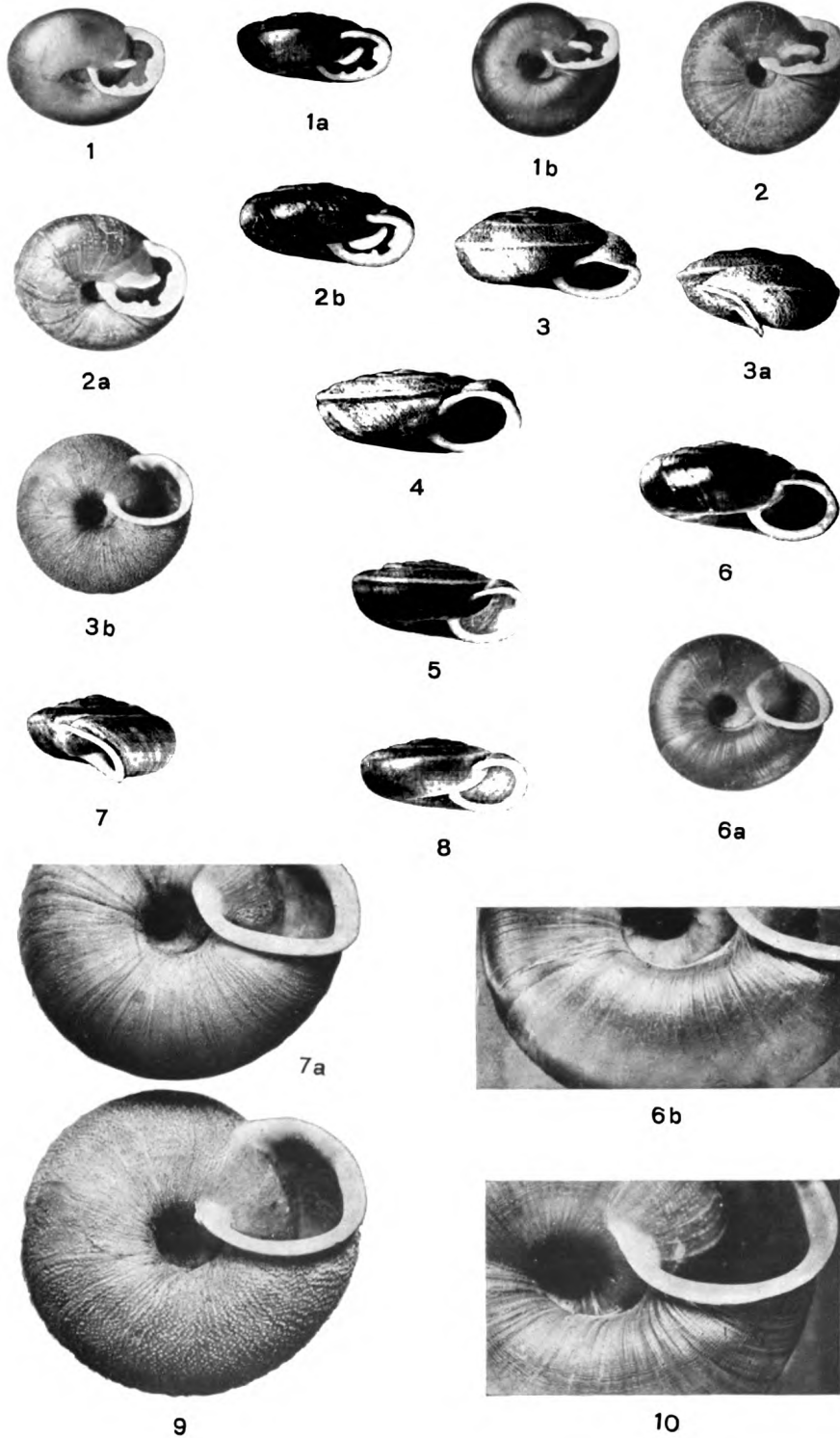
Ashmunella cockerelli Pilsbry & Ferriss

Fig. 541: 3, 3a, 3b, 4, 9.

Ashmunella cockerelli Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 90, pl. 7, figs. 3-3b, 4, 9; pl. 10, fig. 2 (genitalia).

The shell is umbilicate (umbilicus between one-fifth and one-sixth the total diameter, enlarging in the last half whorl, rather tubular further in); depressed; carinate at the periphery; the shape recalling *Triodopsis carolinensis* and *obstricta*; wood-brown above, usually somewhat paler at the base, having a buff streak indicating a former resting stage about the middle of the last whorl. Surface lusterless except the earliest whorls. Sculpture

Fig. 541: 1, 1a, 1b, *Ashmunella tetradon fragilis*, type and paratypes. 2, 2a, 2b, *A. tetradon animorum*, type and paratypes. 3, 3a, 3b, 4, 9, *A. cockerelli*. 5, *A. cockerelli argenticola*, type. 6, 6a, 6b, *A. mendax*, type and paratype. 7, 7a, *A. cockerelli perobtusata*, type. 8, *A. binneyi*, type. 9, *A. cockerelli*. 10, *A. mogollonensis*. (Lower four figures \times nearly 3, the rest $\times 1\frac{1}{2}$.) Figure on p. 947.



of close-set, irregular pebble-like granules on the last whorl, finer on the whorl preceding, before which it is finely striate and slightly punctate, the first one and one-half whorls smooth and glossy. The inner whorls are convex, the penult whorl flattened, the last somewhat convex above, but excavated on both sides of the strong peripheral keel. It is rather swollen below the keel, particularly in the last half. It descends shortly in front, and is guttered behind the outer and basal margins of the lip. The aperture is very oblique, subcircular and toothless. Lip is reflected and somewhat thickened within.

Height 3.2 mm., diameter 16.4 mm.; 5½ whorls. Type. (Fig. 541: 3, 9.)
Height 7.2 mm., diameter 17.8 mm.

Genitalia as in *A. binneyi*, the penis with large upper sac; penial retractor short and strong. Length penis and epiphallus 45 mm., spermatheca 35 mm. In a specimen of the race *perobtusa* these organs measure 40 and 23 mm.

NEW MEXICO: Black Range, south of Sawyer's Peak, on slopes of the ravine at Grand Central Mine, and in the next two ravines on the trail to the peak, Type 115748 A.N.S.P. Also farther north a short distance above Spade's cabin (Ferriss & Pilsbry).

This species is remarkable for its strong carina and roughly pebbly sculpture, which is coarsest on the latter part of the whorl. The upper surface is usually convex, but often nearly flat. The periphery of the penult whorl frequently projects a little above the suture in the individuals with flattened spire.

***Ashmunella cockerelli perobtusa* Pilsbry & Ferriss**

Fig. 541: 7, 7a.

Ashmunella cockerelli perobtusa Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 91, pl. 7, figs. 7, 7a; pl. 10, fig. 4 (genitalia).

The shell is sharply angular in the young, and on the front of the last whorl, but becomes rounded and rather swollen in the last third. The granulation is minute, as in the following race, and in places the granules are linked into spiral lines.

Height 7.8 mm., diameter 16 mm.; 5½ whorls.

NEW MEXICO: Black Range, in a ravine about two miles to the left of the trail (going down) from the camp site on Sawyer Peak to the Grand Central Mine, and at a somewhat higher level than the mine (Pilsbry & Ferriss), Type 115750 A.N.S.P.

***Ashmunella cockerelli argenticola* Pilsbry & Ferriss**

Fig. 541: 5.

Ashmunella cockerelli argenticola Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 91, pl. 7, fig. 5.

This form differs from *A. cockerelli* by the far smoother surface; the granulation being very fine, and on the base the granules are connected into spiral threads, closely placed, and not visible over the whole base. The keel is strong, and continues to the lip, thereby differing from *A. c. perobtusa*.

Height 7.4 mm., diameter 16 mm.

NEW MEXICO: Black Range, in upper Silver Creek and its branches, above 7500 feet, to the northern flank of Sawyer Peak, about 500 feet below the summit; Type 115749 A.N.S.P. From Silver Creek just below the Box, where the trail makes a detour on the steep northern slope. This is probably between 8000 and 8500 feet (Ferriss & Pilsbry).

In the type locality the diameter is 15 to 16 mm., and the keel projects but little or not at all above the suture. Some lots vary more. At Station 11 the diameter is from 13.7 to 16 mm., and the keel of the penult whorl often projects. In some lots there are coarse, conspicuous wrinkles of growth. The spire varies in convexity in all lots, and is often almost flat.

4. SPECIES OF THE CHIRICAHUA MOUNTAINS

A study of the genitalia of Chiricahuan *Ashmunellae* leads to the conclusion that all the species of that range are of common ancestry, and more closely related *inter se* than any are to Huachucan species. In both Chiricahuan and Huachucan species the penis is bipartite, consisting of an upper and a lower portion separated by a submedian constriction. In the

Huachucan series the upper segment is enlarged like the lower as in Figure 524: 2. In Chiricahuan forms the upper segment of the penis is narrower, often hardly larger than the epiphallus, but its distal end usually contracts abruptly where it passes into the epiphallus as in Figure 542. The penial retractor is extremely short in Chiricahuan species, longer in Huachucan. The vagina in the Chiricahuan series is swollen and muscular in its upper part, smaller with thinner walls below. In other respects the organs are alike in the two series.

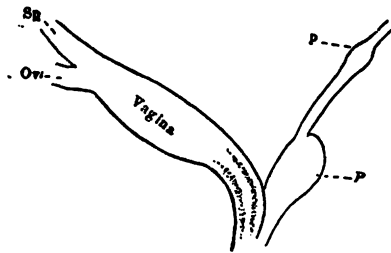


Fig. 542. Terminal ducts of genitalia of *Ashmunella proxima albicauda*, Station 4, White Tail Canyon. Sp, base of spermathecal duct; Ovi, base of oviduct; P, lower, swollen portion of penis; p, upper end of penis (diagrammatic).

These considerations lead to the conclu-

sion that the whole Chiricahuan series of *Ashmunella* constitutes one phyletic line, the Huachucan series another; their evolution on the two parallel mountain ranges has been independent. Both of these series are represented also in the Mogollon and Black Ranges of New Mexico.

Some species in the Blue and Mogollon Ranges, such as *A. mogollonensis* and *A. pilsbryana*, are closely related to Chiricahuan species. Though the two mountain ranges are now separated by many miles of plains and low mountains not inhabited by snails, the faunal separation here seems to have been a relatively recent climatic event, possibly as late as early Pleistocene.

Key to Chiricahuan Species

1. Aperture toothless or with small vestiges of teeth only2
Aperture having three or four strong teeth3
2. Shell chestnut brown, glossy, the lip narrow, without trace of teeth.
A. chiricahuana
Shell light brown with little luster; usually with a callous ledge within the outer lip or other weak vestiges of teeth*A. esuritor*
3. Very acutely carinate, the keel projecting more or less above the suture; whorls flat; outer basal tooth as near or nearer to the outer lip-tooth than to the inner basal tooth*A. ferrissi*
Carina or angle, when present, not projecting at suture4
4. Outer basal tooth strongly compressed, well separated from inner basal, and nearer to the short tooth of the outer lip*A. angulata*
Outer basal tooth not conspicuously compressed, and as near or nearer to inner basal than to the long tooth of the outer lip5
5. Periphery strongly carinate, the last whorl impressed above the keel; surface dull, somewhat papillose or scaly*A. lepiderma*
Strongly to weakly angular; not papillose or scaly; basal teeth varying from well separated to united*A. proxima*

***Ashmunella chiricahuana* (Dall)**

Fig. 543.

Polygyra chiricahuana Dall, 1895, Proc. U. S. Nat. Mus., 18: 2; 19: 341 (in part).*Ashmunella chiricahuana* Dall, Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 250, pl. 16, figs. 96-100; pl. 21, fig. 29; pl. 22, fig. 10; pl. 23, fig. 13 (anatomy).—Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 110, fig. 23; pl. 10, figs. 1, 4 (genitalia).

The shell is depressed, translucent buckthorn-brown, often with one or more opaque buff streaks. Umbilicus contained 5 to 6 times in the diameter. Whorls moderately convex, rather slowly increasing, the last rounded at periphery, shortly descending in front and a little constricted behind the lip. The surface is very glossy and smooth, marked with weak growth-wrinkles and engraved spirals, which are distinct in some, almost obsolete in other specimens. Under the compound microscope spiral striae are seen to cover the surface between the spiral lines. The aperture is without teeth.

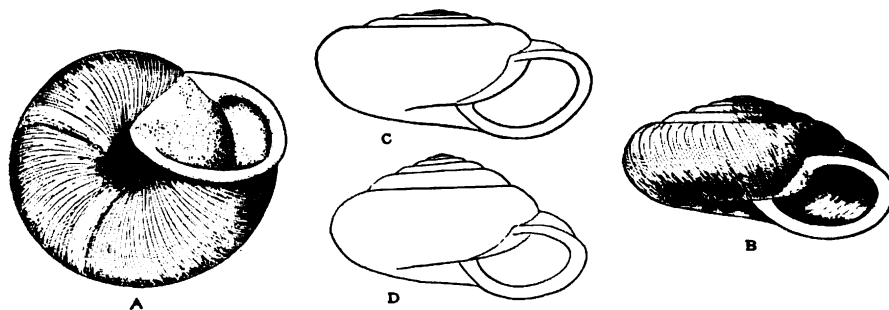


Fig. 543. *A. chiricahuana*. A, B, Cave Creek Canyon; c, d, amphitheatre of Cave Creek. (X 2.)

The lip is narrow, reflexed, at the base recurved, white, or brownish above and at the edge, without trace of teeth.

Height 8.5 mm., diameter 16 mm.; $5\frac{1}{2}$ whorls. Flys Park.

Height 9 mm., diameter 18 mm.; $5\frac{1}{2}$ whorls. Flys Park.

Height 10 mm., diameter 21 mm.; $5\frac{1}{2}$ whorls. Reed's Mt., Cave Creek.

Height 6.7 mm., diameter 13.5 mm.; $5\frac{1}{2}$ whorls. Cave Creek Falls.

The genitalia of a Cave Creek example is represented in Figures 524 1-1c. Penis with short, strongly swollen lower sac and slender upper portion; penial retractor short. Spermatheca is very long. Both spermatheca and epiphallus adhere to the uterus throughout most of their length, the epiphallus looped under the spermatheca. Talon formed of several rounded tubercles. Length of penis with epiphallus in two examples 72 and 73 mm., of spermatheca 42 and 56 mm. Diameter of shells 19 and 19.5 mm. In very small specimens of 13.5 to 16 mm. diameter, the ducts are shorter.

ARIZONA: Chiricahua Mountains in Flys Park 10,000 feet (A. K. Fisher), Type 129325 U.S.N.M. Cave Creek, on moderately humid north slopes where there is rock shelter (Ferriss & Pilsbry). Long Park, 8000 feet (Ferriss).

This fine snail is abundant in the spacious Cave Creek valley and the "parks" above its head. It was at one time confused with the Huachuacan *A. varicifera* and with *A. ashmuni robusta* of the Jemez Mountains, New Mexico; but *A. varicifera* proves to be practically identical with *A. levettei* in the soft anatomy, and abundantly distinct from *A. chiricahuana* by the large upper sac of the penis and the proportions of other organs, the spermatheca and epiphallus being far longer in *chiricahuana*, as I have satisfied myself by the dissection of many specimens, four of which have been figured.

The color varies from sayal brown to light buff. The surface is very glossy. Young specimens form a strong wide white rib within the lip at resting stages; this persists as a yellow blotch or stripe in the adult stage.

The chief variation, aside from tint, is in the elevation of the spire. Two examples, extremes of a continuous series, are figured to illustrate this (Fig. 543 c, d). This variation is not peculiar to any special colonies, though greater in some lots than in others.

Ashmunella esuritor Pilsbry

Fig. 544.

Ashmunella esuritor Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 249, pl. 13, figs. 23-26, pl. 21, figs. 25, 30 (anatomy).—Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 112, pl. 9, figs. 1-8; pl. 10, figs. 2, 5 (genitalia).

Ashmunella metamorphosa Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 252, pl. 16, figs. 114, 115; pl. 21, figs. 27; pl. 22, fig. 8; pl. 23, figs. 16; Idem, 1910, p. 114, pl. 9, fig. 9.

The shell is rather solid, light brown, biconvex, angular at the periphery. The cylindric umbilicus is dilated in the last whorl. The surface is irregularly marked with slight growth-wrinkles, and on the last whorl there are

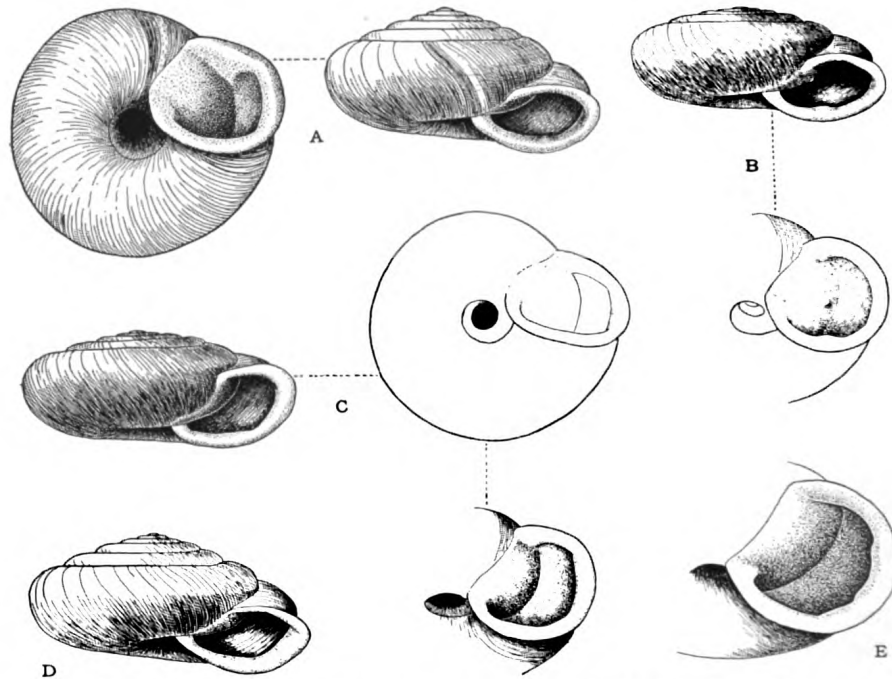


Fig. 544. *Ashmunella esuritor*. A, B, C, in or near Barfoot Park; D, Pine Canyon; E, aperture of type of "*A. metamorphosa*," Barfoot Park. (\times about $2\frac{1}{2}$.)

impressed spiral lines, more or less irregularly developed and sometimes almost obsolete. Some intermediate whorls are indistinctly punctulate. Spire low-conic. Whorls six and one-third to six and one-half slowly increasing. The first three whorls are convex, the rest more or less flattened. The last whorl is distinctly but not acutely angular in front, but becomes rounded in its later half. The suture descends a little to the aperture, and the whorl is rather deeply guttered behind the lip. The aperture is very oblique, roundly lunate. The peristome is white, thickened within, and equably reflexed. In the middle of the basal margin there is a low, indistinct prominence, and there is a very weak flange within the outer lip, but in many specimens these peristomial thickenings are hardly or not discernible; in a few examples a minute parietal tooth is seen (fig. B). The parietal callus is thin except in old specimens, when it is thickened at the edge, forming a cord across the whorl.

Height 7.7 mm., diameter 15 mm.

Genitalia as in other Chiricahuan species, the lower half of the penis swollen, upper half slender. Lengths of penis with epiphallus and of spermatheca in three specimens are: 58 and 35 mm., 48 and 42 mm., 50 and 42 mm.

ARIZONA: Chiricahua Mountains in and near Barfoot Park, and about a mile along the road to Paradise; head of Pine Canyon, from about 7500 to 8500 feet (Ferriss & Pilsbry), Type 87023 A.N.S.P.

It is smaller and decidedly more depressed than *A. chiricahuana*, with a relatively wider lip and an angular periphery; and it differs especially by being deeply guttered behind the lip, *A. chiricahuana* having only a shallow contraction there.

At first glance this appears to be a small subangular race of *A. chiricahuana*; but upon closer study it seems far more likely that it is a terminal member of the *A. angulata* group, in which the teeth have degenerated. The slight flattening of the whorls, the shape of the mouth, and a faint punctation observable near the end of the third whorl in the freshest specimens, all indicate this relationship.

Most of the fully adult and old individuals seen have lost much or all of the cuticle, and are dull flesh-tinted. The spiral engraved lines vary a good deal in different specimens, and when slightly corroded neither spirals nor granulation are visible, even in living shells.

In some lots the peripheral angulation is noticeable only above the termination of the last whorl, the latter becoming rounded.

The type locality is not in Barfoot Park proper, but in a small park of yellow pine on the road from Paradise, about a mile before it crosses the ridge or divide going to Barfoot. This is the first grove of yellow pine on the road up. The type lot came from a small conical pile of earth and rocks about ten feet to the left of the road. It was covered with snow at the time of our visit late in November, but we dug out a small series of living specimens (92205 A.N.S.P.). About a mile below this place, toward Paradise, where a few yellow pines first appear among the oak scrub, we found a few examples. It probably occurs in many other suitable places in this vicinity, reached by the road from Paradise to Barfoot Park. Our work here was impeded by a heavy snowfall, which lay knee-deep among the pines.

In topotypes the diameter varies from 14 to 16 mm., whorls 6 to 6½. The degree of elevation of the spire is quite variable, as in all the related species. Two are figured, Figure 544 A, C. Rarely there is the minute vestige of a parietal tooth (fig. B).

The description of *Ashmunella metamorphosa* Pilsbry was due to a misconception of the characters of the genitalia, as explained in *Nautilus* vol. 49, p. 67. The type specimen, 88885 A.N.S.P. (Fig. 544 e), has somewhat stronger lip calluses than other *esuritor* seen, but these vary individually among different specimens of *esuritor*.

***Ashmunella proxima* Pilsbry**

Fig. 545: 1-1b.

Ashmunella levettei proxima Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 242, pl. 14, figs. 65, 66, 70, 71; p. 224, pl. 21, fig. 24 (genitalia).

Ashmunella proxima Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 100, fig. 17.

The shell is depressed, biconvex, strongly angular at the periphery, pale corneous-brown, the umbilicus contained about 4.7 times in the diameter. Whorls six to six and one-half, convex, closely coiled, the last descending shortly in front, deeply guttered behind the outer and basal margins of peristome. Surface of first one and one-half whorls smooth except for striae below the suture, the rest finely and lightly, irregularly striate, the base smoother; some low wrinkles behind the peristome. Aperture four-toothed; within the outer lip a long, concave-topped, slightly receding tooth, basal lip with two blunt teeth, the outer one slightly larger and a little compressed; these teeth dividing the lower border of the aperture into three nearly equal bays, or the outer bay may be a little larger. Parietal tooth somewhat sinuous, its axial end curving towards the columella; a very indistinct ridge or none between distal end of parietal tooth and insertion of outer lip. Outer and basal margins of peristome rather thick, reflected.

Height 5.3 mm., diameter 12 mm. Type.

Height 5.7 mm., diameter 12.8 mm.

Genitalia of the usual Chiricahuan type. Length of penis with epiphallus 37 mm., spermatheca 27 mm. For other races the lengths are: *duplicidens*, 31 and 19.5 mm., 45 and 18 mm.; *albicauda*, 34 and 24 mm.; *emigrans*, 38 and 24 mm. It is not likely that these differences have any racial significance.

ARIZONA: Chiricahua Mountains at "Quartzite Hill" near Old Fort Bowie, about 6000 feet (Pilsbry & Ferriss); head of Pine Canyon, Barfoot Park, 8500 feet (Ferriss), Type 86498 A.N.S.P.

Besides the sculpture described above there is a close, microscopic spiral and radial striation visible in places, giving the surface a textile appearance. This varies from distinct to subobsolete in different individuals of the several races, and in any lot may be effaced by wear. In perfectly fresh young shells a delicate pattern of minute low, oblong pustules may sometimes be seen on intermediate whorls. They are in part cuticular, and often not developed. These features are common to all the races, but variable in all.

Young shells sometimes form a weak callous rib within the lip at growth rests.

A. proxima and its races inhabit the Chiricahuas mainly above 6,000 feet for about 35 miles along the range. The colonies are widely separated in the northern part, more numerous in the better watered central and southern parts. There are many local races and subraces. The two localities given for the typical *proxima* are widely separated. I have myself collected it only at the northern limit of *Ashmunella* in the Chiricahuas, on a hill locally called Quartzite Peak, about a mile south of the ruins of Old Fort Bowie.¹

¹ This little peak is shown on the topographic map, San Simon Quadrangle, southwest of Bear Spring and northeast from Bowie Mt.

When the first few specimens of this series were studied in 1905 they seemed readily divisible into the three species *proxima*, *fissidens* and *duplicidens*. Subsequently hundreds of these snails from many places were taken by Ferriss and myself, Witmer Stone and Cyril Harvey. They show that the degree of angulation and the proportions and spacing of the basal teeth are individually variable in all large lots, breaking down the supposed specific distinctions; but it may be well to recognize the local diversity by the use of subspecific names.

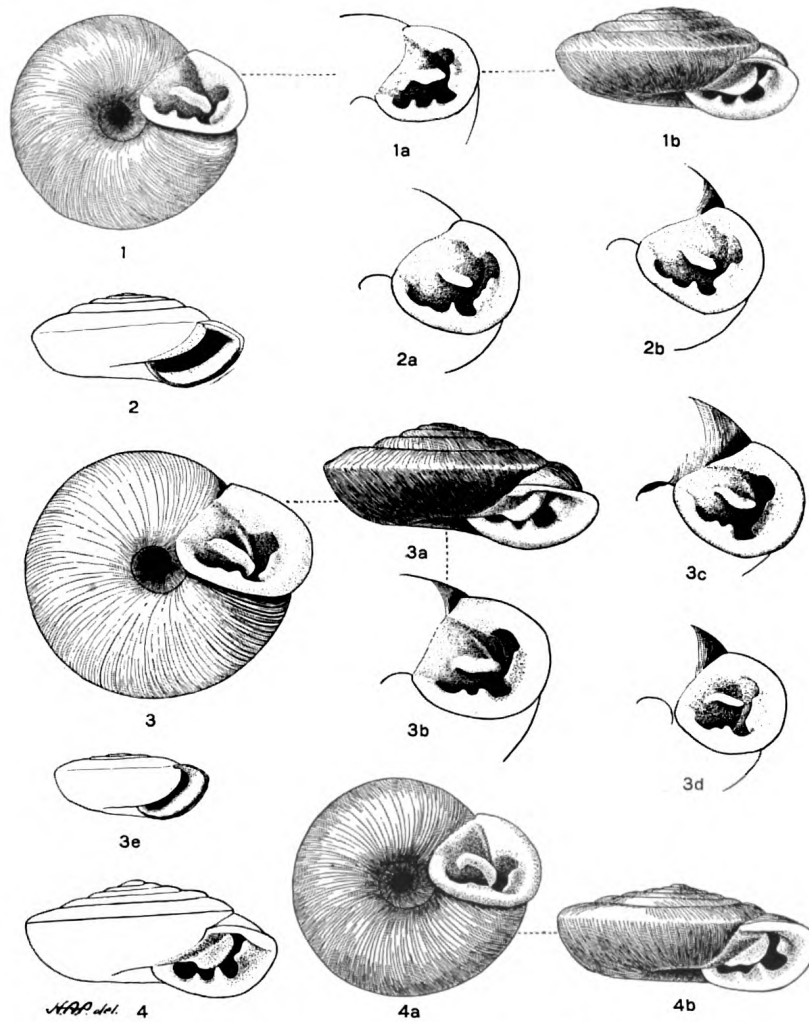


Fig. 545: 1, 1a, 1b, *Ashmunella proxima*, Quartzite Peak. 2, 2a, 2b, *A. proxima albicauda (emigrans)*, Emigrant Canyon. 3-3e, *A. proxima albicauda*, Whitetail Canyon. 4, 4a, 4b, *A. proxima albicauda (pomeroyi)*, Hands Pass. ($\times 2\frac{1}{2}$.)

Ashmunella proxima albicauda Pilsbry & Ferriss

Fig. 545: 3-3e.

Ashmunella fissidens albicauda Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 103, fig. 19 a-f; p. 95, fig. 16 (genitalia).

Ashmunella proxima emigrans Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 102, fig. 18 a-c.

Ashmunella fissidens pomeroi Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 105, fig. 20 a-c.

The upper end of the parietal wall stands more or less free and the lip, near its upper insertion, runs forward in an angle; the posterior angle of the aperture is heavily calloused, and the parietal tooth is usually V-shaped by development of a weak upper branch. The young shells form a very thick and heavy callus within the lip at resting stages (Fig. 345 e). Adult shells are invariably acutely angular in front, the angle weakening and almost disappearing on the latter part of the whorl. Behind the aperture the striation is stronger and sometimes amounts to an irregular costulation. There is an angular gutter behind the basal lip, and the reddish-brown color gives place there to a wide buff stripe which borders the lip. The whole base has a sculpture of minute spiral lines in fresh examples; and under the microscope the usual microscopic spiral lineolation is seen between these spiral lines, which are readily visible with a hand lens. The upper surface also shows very faint spiral lines in places, and there is often some interruption of the growth striae, giving a slight appearance of punctation. Seven specimens from Station 14 measure:

Height	5	5.5	4.8	4.7	5.2	4.8	5	mm.
Diameter	12.5	12.5	12	11.5	11.5	11.3	11.3	mm.
Whorls	5½	5½	5½	5½	5½	5½	5½	

ARIZONA: Chiricahua Mountains, southern side of Whitetail Canyon and across the ridge in Pinery Canyon, from about 5500 to 7000 feet (Pilsbry & Ferriss), Type 99618 A.N.S.P.

At all stations in White Tail Canyon where many shells were taken, there is variation in height of spire. Otherwise there is variation in the size of the outer lip-tooth and especially in that of the inner tubercle of the basal tooth. The parietal tooth may be either straight at its axial end or abruptly curved inward, and, when turned inward, a low ridge usually runs to the outer end of the lip, making the parietal tooth V-shaped. Spiral striation on the base is better developed than in other races of *A. proxima*.

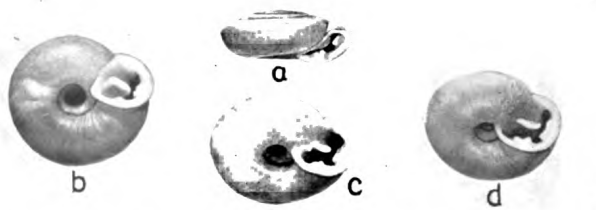


Fig. 546. a, b, c, *Ashmunella proxima albicauda*, Pinery. d, *A. p. fissidens*, Type. ($\times 1\frac{1}{2}$.)

In Pinery Creek a short distance up the north fork at about 6,000 feet, Witmer Stone collected a rather peculiar form. It is strongly depressed, the periphery conspicuously angular or even carinate, and the umbilicus often much wider than in any other race, contained from 3.75 to 5 times in the diameter, thus rather variable in width. The spiral striation on the base is well developed; the teeth are about as in typical *A. proxima duplicidens*; the size is 5.3 mm. in height and 12.3 mm. in diameter to 4.7 mm. high and 10.8 mm. in diameter. The immature stage often forms a strong lip-rib at growth-rests (Fig. 546 a-c).

Ashmunella fissidens pomeroi Pilsbry & Ferriss (Fig. 545: 4-4b), does not seem sufficiently distinct from *albicauda* to require a name, as it can be matched in some lots of the latter. It was found in Hand's Pass, head of Jhus Canyon,¹ the shells are similar to those of White Tail Canyon in general appearance, but differ in certain particulars, constituting a minor race. They are in the average smaller, diameter $8\frac{1}{2}$ to $11\frac{1}{2}$ mm., rarely 13 mm., with five and one-half whorls; the umbilicus is noticeably wider, contained about 4.5 times in the diameter; the lip is heavy and wide. The basal teeth vary from completely united to distinctly bifid, as in White Tail *fissidens*, or rarely they are almost separated. In most examples these teeth are more united than in White Tail specimens. The shape of the parietal tooth varies from V-shaped to simple. All of the shells are more angular and more depressed than *A. duplicidens*. Type 99607 A.N.S.P., Figures 545: 4a, b.

Ashmunella proxima emigrans Pilsbry & Ferriss (Figs. 545: 2-2b), now seems to me indistinguishable from some *albicauda*. I do not doubt that geographically intermediate colonies exist. It came from Rough Mountain,² Emigrant Canyon, at from 6000 to 7000 feet (Pilsbry). It was thus described:

"The shell is somewhat larger than *proxima*, more robust, with slightly less than 6 whorls. The two basal teeth are less separated, somewhat united by a callus at their bases, and the inner one is generally smaller, frequently very small. There is often the weak trace of an upper branch, making the parietal tooth V-shaped. Fine spirals may often be seen on the base of the shell. The young shell (Fig. 545: 3e), diameter 11 mm., forms a very strong callous rib within the lip at growth rests, as in *A. proxima albicauda*. The umbilicus is narrow, contained five times in the diameter of the shell.

"Alt. 5.8, diam. 13.2 mm.

"Genitalia not materially differing from *A. p. albicauda*. The swollen basal portion of the penis is less than half the total length. The penial retractor is less than one millimeter long."

¹ This is the locality given by Ferriss; on the topographic map, Chiricahua Quadrangle, Hands Pass is about two miles northwest of the head of Jhus Canyon.

² Called "Big Emigrant Mt." in our paper of 1910, p. 121.

This shell is like *A. fissidens* except in the single character of having the basal teeth more widely separated. As in that species, the inner of the two basal teeth is quite variable in size. It is a race intermediate in character between *fissidens* and *proxima*.

Ashmunella proxima fissidens Pilsbry

Fig. 546 d.

Ashmunella fissidens Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 243, pl. 14, figs. 67-69; 1910, p. 103.

Similar to *A. proxima* in shape and sculpture, spiral striation being scarcely or not discernible. The two basal teeth are unequal, contiguous and somewhat united basally, closer together than in *A. proxima* but less closely united than in *A. p. duplicidens*. No ridge running from inner end of parietal tooth towards upper angle of aperture.

Height 5.2 mm., diameter 11.7 mm.; 6 whorls.

ARIZONA: Chiricahua Mountains: Cave Creek Canyon (Ferriss), Type 87022 A.N.S.P. Branch near head of Whitetail Canyon (Pilsbry). Bonito Canyon (Ferriss).

The type is figured. Only a very thin lip-rib is formed at growth rests. This race has not been found in Cave Creek by later collectors, and possibly Ferriss picked it up around the head of Whitetail Canyon, where I found a small form 10-11 mm. in diameter. In 1908, Ferriss found it in Bonito Canyon, over the ridge westward.

Ashmunella proxima duplicidens Pilsbry

Fig. 547.

Ashmunella duplicidens Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 244, pl. 16, figs. 103-107; p. 224, pl. 21, fig. 23 (genitalia).—Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 106, pl. 8, figs. 1-8.

The pale brown shell is typically less depressed than *A. proxima*, the periphery obtusely angular in front, becoming rounded in the latter part. Umbilicus contained 6.6 times in diameter. The five and two-thirds to six and one-half whorls are moderately convex. After the first one and one-half whorls the next four whorls more or less appear minutely punctate in the best preserved examples, though in most only an indistinctly interrupted condition of the striae can be made out. Under the compound microscope some very fine close spiral striation is seen on the base. Aperture with a long, bilobed tooth within the outer lip as in allied races; within the basal lip a smaller, bifid tooth, or sometimes simple by suppression of its inner cusp. Parietal tooth either nearly straight, or incurved at its columellar end. Immature shells form only a thin narrow rib within the lip at resting stages, and have a wider, somewhat less angular aperture than *A. proxima fissidens*.

Height 6.3 mm., diameter 13 mm. Type.

ARIZONA: Chiricahua Mountains, 6000 to 9500 feet. Barfoot Park (type locality, Ferriss & Pilsbry), Type, 87024 A.N.S.P. High in Cave Creek. Southward to the head of Rucker Canyon (Ferriss).

Typically the periphery is much more obtuse than in *A. proxima fissidens*, and the basal teeth are more closely united into a single bifid tooth;

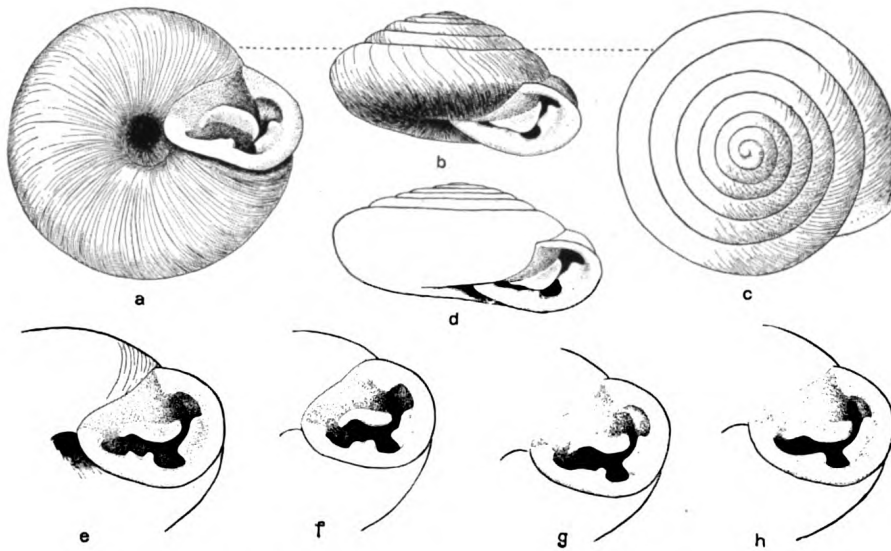


Fig. 547. *Ashmunella proxima duplidentis*, type (a-c) and topotypes.

but in a large series from the type locality there is much variation in the degree of depression, some individuals having a periphery as angular as *A. proxima* or *fissidens*. The mantle within the last whorl is cream-colored with sparse black maculation. Earlier whorls have copious black pigmentation along the top of the whorls.

In the first branch west of the Falls branch of Cave Creek very large specimens were found, 7 mm. in height and 14.2 mm. in diameter, typical in shape and teeth.

***Ashmunella proxima harveyi* new subspecies**

Fig. 548.

Similar to *A. proxima* except that the umbilicus is conspicuously smaller,



Fig. 548. *Ashmunella proxima harveyi* type (second fig. from left) and paratypes. ($\times 1\frac{1}{2}$.)

its width contained about eight times in diameter; pale brown; peripheral angle acute. Lip thick, brown tinted. Lip-rib of immature shells thin when present.

Height 5 mm., diameter 10.3 mm.; barely 6 whorls.

ARIZONA: Rucker Canyon at upper camping ground, about 6000 feet, among pines, oak, alligator juniper, etc., on steep, stony slope, abundant (Cyril Harvey and H. A. Pilsbry), Type 166252 A.N.S.P.; Shake Gulch (Ferriss).

It differs from *A. angulata* by the less compressed outer basal tooth and by having the bay between basal teeth smaller than that between outer basal and outer lip tooth.

At the head of "Rasberry Gulch," a branch of upper Rucker, Ferriss collected a slightly larger form, 11-12 mm. high, with less acute periphery and six and one-third whorls, the umbilicus contained nine times in diameter.

(Named for a good companion and efficient snail hunter of the trip of 1935.)

Ashmunella lepiderma Pilsbry & Ferriss

Fig. 549.

Ashmunella lepiderma Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 98, pl. 7, figs. 1-7.

Shell umbilicate, the umbilicus about one-fifth the diameter, much depressed, biconvex, acutely carinate peripherally, thin, corneous-brown. The surface is lusterless, sculptured with fine, unequal wrinkle-striae, and covered with cuticular scales or processes (readily removed by cleaning). There are five and three-fourth whorls, the first one and one-half corneous and glossy, the first three convex; subsequent whorls convex, but flattened above the lower suture; last whorl is distinctly impressed above the projecting peripheral keel, the base convex; in front it descends slightly to the aperture, and is narrowly, rather deeply, guttered close behind the outer and basal margins of the lip. The aperture is lunate, contracted by four teeth: a wide flat or concave-topped one within the outer lip, two contiguous tubercles in the basal lip, and an oblique straight parietal tooth, sometimes shortly curved at the columellar end. Parietal callus thin and transparent.

Height 5 mm., diameter 11 mm.; 5 $\frac{3}{4}$ whorls. Type.

Height 4.3 mm., diameter 11.3 mm. Topotype, fig. f.

Height 5.8 mm., diameter 12.5 mm.; 6 whorls. Topotype, fig. d.

Height 4.1 mm., diameter 9.5 mm. Smallest topotype.

Genitalia as in *A. proxima*. Length of penis with epiphallus, and of spermatheca, in three examples: 30 and 17 mm., 32 and 21 mm., 28 and 23 mm.

ARIZONA: Chiricahua Mountains, east side of Whitetail Canyon and Indian Creek, from the base of the slope below confluence, 5500 feet (type locality), to and beyond the summit of Maverick Peak ridge, 7200 feet, in slides of angular rhyolite (Ferriss & Pilsbry), Type 97948 A.N.S.P. Also "Hands Pass, Jhus Canyon," (Ferriss).

The strong peripheral carina, the whorl being more or less impressed above it, and the development of papillae and cuticular processes, distinguish this species from *A. proxima albicauda*, which inhabits the opposite (lime-stone) side of Whitetail Canyon.

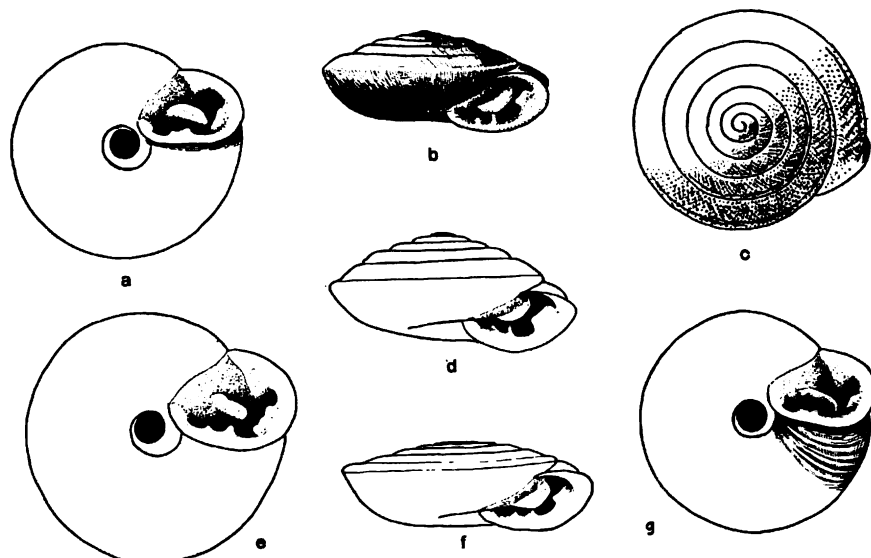


Fig. 549. *Ashmunella lepiderma*, type (b) and paratypes.

The cuticular scales or hairs, for they vary in form, are more copiously developed in some colonies than others, and they may be almost lacking in some individuals. They are easily lost by natural wear or by brushing, unless cleaned with a very soft brush. In immature stages only a weak lip-rib is formed at growth rests, not a heavy one as in *A. proxima albicauda*.

According to specimens collected by Ferriss, this species reappears at Hand's Pass, at the head of Jhus Canyon. The surface is regularly very minutely pustulate, some perfectly fresh shells having minute cuticular appendages on the pustules in places. There are also some cuticular spiral hair-lines on the base. These measure 5 mm. in height, 12 mm. in diameter and have six whorls. This colony is separated from the type locality by the whole southern slope of Whitetail Canyon, where *lepiderma* certainly does not occur.

***Ashmunella angulata* Pilsbry**

Fig. 550.

Ashmunella angulata Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 244, pl. 11, fig. 11; pl. 14, figs. 55-61, 63, 64; pl. 21, fig. 26 (genitalia).—Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 108, pl. 10, fig. 6 (genitalia).

The shell is lens-shaped, angular peripherally, rather narrowly umbilicate, glossy, reddish-chestnut when unworn, paler and more corneous around the umbilicus and in the middle portion of the upper surface, but frequently dull throughout by slight wear of the surface. Sculpture of very fine and irregular growth-lines, and for a short space behind the lip there are fine, sharp striae. The embryonic whorl is glossy, with fine radial striae on the outer side of the suture; some part or parts of the third or fourth

whorls are sculptured with very minute raised points in quincuncial order. The spire is low conic-convex, very obtuse above, the first two whorls being almost in a plane. Whorls six and one-half to six and three-quarters, very narrow, and very slowly increasing; the first three are convex, those following being decidedly flattened, only slightly convex. The last whorl is acutely angular at the periphery, the angle more obtuse on its last third; it is guttered behind the outer lip. The aperture is very oblique, narrow and

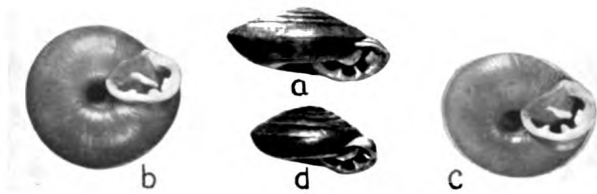


Fig. 550. *Ashmunella angulata*, type b, c, and paratypes. ($\times 1\frac{1}{2}$.)

lunate, obstructed by four teeth: a more or less sinuous, oblique parietal lamella, two compressed, entering teeth on the basal lip, of which the outer one is higher and more compressed, and an oblique, square-topped tooth within the outer lip. The sinus or bay between the two basal teeth is slightly wider than that between the outer basal and the outer lip-tooth. The umbilicus is about one-sixth the diameter of the shell.

Height 13.3, diameter 6.3 mm.; other specimens of the type lot measure 13 to 14.3 mm. in diameter.

Genitalia about as in *A. proxima*.

ARIZONA: Chiricahua Mountains, in the South Fork of Cave Creek, at the base of the mountain, Type 87019, A.N.S.P. Generally spread in Cave Creek; head of Turkey Creek; mountain southeast of Paradise; Barfoot Park; Horseshoe Canyon at the "Red Box", 10 miles up; upper branches of Rucker Canyon (Ferriss, Daniels & Pilsbry).

The young shells show the characteristic punctuation better than adults.



Fig. 551. *A. angulata*, young, diameter 8 mm.

At resting periods in the neanic stage of growth a callous rib is formed within the lip. When this occurs early (as in the specimen figured, Figure 551, 8 mm. diameter) the rib is much thicker in the middle. When it occurs in the last whorl it is more equally thickened.

This species is closely similar in shell characters, but not in its soft anatomy, to *A. levettei angigyra* of the Huachuca range, agreeing with that form in the close convolution of the whorls, the angular periphery and the general arrangement of the teeth. But all fresh

specimens of *A. angulata* show a quincuncial punctation of some part of the neanic whorls, not present in the Huachuca form, and the two especially differ in the shape of the whorls, the upper surface of which is flattened in *angulata*, convex in *angigyra*. Moreover, the genitalia of *angigyra* and *angulata* differ in important respects. The compressed outer basal tooth which is nearer to the outer lip tooth than to the inner basal tooth, and the somewhat less convex whorls readily separate *A. angulata* from *A. proxima*.

The size varies in different colonies, those from high elevations usually being smaller; thus at the falls of Cave Creek specimens measure from 5×11 mm. to 4.4×9.8 mm. The peripheral angle is blunter in shells from Barfoot Park.

Ashmunella ferrissi Pilsbry

Fig. 552.

Ashmunella ferrissi Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 247, pl. 16, figs. 108-110, 113.—Pilsbry, 1912, Nautilus, 26, pl. 1, figs. 11, 12.—Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 109, fig. 22, pl. 10, fig. 7 (genitalia).

The shell is biconvex and acutely carinate, umbilicate, brown. The initial half whorl is smooth and glossy; then growth-striae begin below the suture, gradually extending over the whole width of the whorl. The third and fourth whorls are very minutely indistinctly marked with subregularly arranged points, as though hairy in the immature stage, though none taken retain any hairs. The rest of the whorls are finely striate. The base also

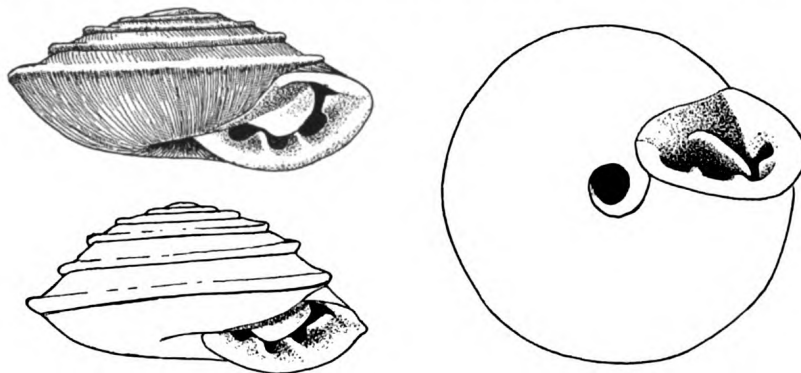


Fig. 552. *Ashmunella ferrissi*, Cave Creek, Station 11, topotypes. (\times about 4.)

is marked with very fine, unequal growth-striae, and under a strong lens shows faint, extremely fine and close spiral striae. These are also faintly visible in places on the upper surface. The spire is convex, of six and one-half very closely coiled and slowly widening whorls, the earliest two convex, the rest flat, with a narrow keel projecting upward and outward above the suture. The last whorl is concave above and below the keel, and descends very shortly to the aperture. The aperture is very oblique and obstructed by four white teeth: a wide one slightly notched at the summit, just below the peripheral angle; two compressed teeth on the basal margin, connected by a low flange on the face of the peristome; these three teeth stand about

equidistant. There is also a low prominence on the lip at the position of the keel. On the parietal wall there is a straight lamella, very obliquely placed and shortly curved towards columella at the end.

Height 5.5, diameter 11.3 mm. Type.

Height 5.2, diameter 11 mm.

Genitalia as usual in the group. Basal half of the penis is swollen, the upper half slender. As in *A. angulata*, the retractor muscle of the penis is longer than in *A. duplicidens*, *proxima*, etc. The mantle within the last whorl is white.

ARIZONA: Cave Creek Canyon, Chiricahua Mountains (Ferriss & Pilsbry), Type 89232 A.N.S.P.

The type and only known locality is in the talus at the foot of Reed's Mountain, south side of the creek, at our Station 11, about a half mile below Reed's house, where it is found with *A. chiricahuana*, *Sonorella virilis*, etc.

This remarkable snail is at once distinguished from all others by the projecting keel above the suture of the spire. The carina first appears above the suture at the end of the second whorl in some examples, in others at the end of the third. In the most depressed shells it projects very little. There is considerable variation in size and degree of elevation. Three of the specimens taken in 1906 at the type locality measure: 6.2×12.5 mm., 5.2×11.8 mm., 5.6×10.6 mm.

The punctuation of the early neanic whorls shows that *A. ferrissi* is related to *A. angulata*, a much more widely spread species.

5. SPECIES OF THE HUACHUCA RANGE, ARIZONA

These mountains in southwestern Cochise County reaching to the Mexican border, are well watered and wooded, with peaks up to about 10,000 feet. The *Ashmunellae* appear most nearly related to the New Mexican and Chihuahuan group of *A. mearnsi*. Living under conditions favorable for snail life, they are more robust and darker colored than their allies in arid mountains. While there is great diversity among them, the Huachucan forms all belong to a single intimately related group. All may have descended from an ancestral stock similar to *A. levettei angigyra*, which is the most widely distributed form, and the one showing most similarity to dentate species of other ranges. The common ancestry of the whole Huachucan series is demonstrated by the intermediate stages found in the shells, and by the genitalia, which are so much alike that it would be impossible to tell the species apart, yet differ characteristically from species of the Chiricahuas by the shape of the penis, in which the upper sac is almost as large as the lower (Fig. 524: 2, *A. varicifera*).

The species and races merge into a beautiful form-chain, almost completely connecting those having the most fully developed apertural processes with the toothless forms, thus: *bifurca*—*levettei*—*ursina*—*heterodonta*—*microdonta*—*varicifera*. Evolution seems to have proceeded from shells with fully toothed apertures to toothless species; it has been retrograde, marked by degeneration of complex structures.

Key to Huachucan Species and Races of Ashmunella

1. Aperture with four strongly developed teeth2
 Several weak or subobsolete teeth present *A. levettei heterodonta*
 No teeth, or a minute, tubercular parietal only5
2. Periphery somewhat angular; diameter 9-15 mm.3
 Periphery rounded; diameter 16-18 mm.4
3. Parietal tooth v-shaped *A. levettei bifurca*
 Parietal tooth with outer branch extremely weak or wanting *A. levettei angigyra*
4. Parietal tooth sinuous, with weak outer branch *A. levettei*
 Parietal tooth straight, smaller, without outer branch *A. levettei ursina*
5. No teeth; umbilicus contained about four and one-half times in diameter.

A. varicifera

A minute parietal tooth or vestige of it; umbilicus contained less than four times in diameter *A. varicifera microdonta*

Ashmunella levettei (Bland)

Fig. 553.

Triodopsis levettei Bland, 1882, Ann. N. Y. Acad. Sci., 2: 115, figs.—Binney, 1882, Man. Amer. Land Sh., p. 385, fig. 419; 1883, Suppl. Terr. Mollusks, Bull. Mus. Comp. Zool., 11: 154, pl. 1, fig. E; 1886, 2d Suppl., Idem, 13: 36, pl. 1, fig. 15.
Ashmunella levettei (Bland.), Ancy, 1901, Journ. Malacol., 8: 74.—Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 508, fig. 8.

The shell is umbilicate, umbilicus contained six times in diameter; depressed, with more or less convex spire of closely coiled whorls, the last rounded peripherally, narrowly constricted behind the lip. Color dilute snuff brown, often with one or more buff radial streaks. The glossy surface is marked with fine growth-wrinkles, and on the last whorl very fine and very faint spiral lines. The parietal callus is distinct, but thin at the edge. The parietal tooth is long, high, straight, but at the axial end it becomes low and curves strongly towards the columella. From the distal end of the tooth

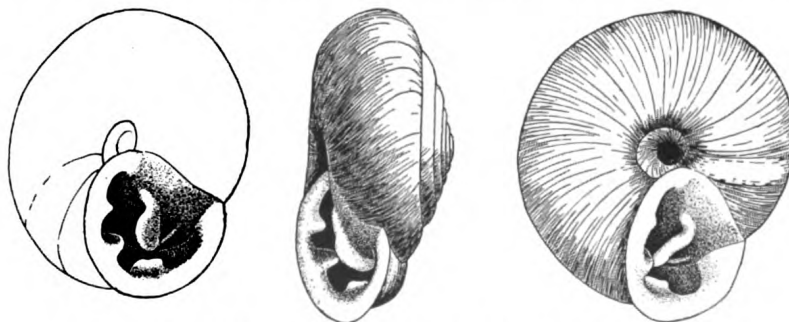


Fig. 553. *Ashmunella levettei* (Bland). Type. (× 2½.)

a very low but distinct branch runs towards the outer termination of the lip. This branch is brownish, like the callus it rests upon, hence might easily be overlooked. The outer lip-tooth is slightly emarginate at the top, and curves inward. The outer basal tooth is compressed and larger than the inner one, which is also somewhat compressed.

Height 8 mm., diameter 16 mm.; diameter of aperture 7.9 mm.; $6\frac{1}{2}$ whorls. Type.

ARIZONA: Huachuca Mountains, Type 1274 Binney & Bland Collection, Amer. Mus. Nat. Hist., collected by Dr. G. M. Levette. Miller Canyon is selected as type locality.

A. levettei was originally described as from near Santa Fé, New Mexico. No *Ashmunella* of this group has been found in that region, but shells indistinguishable from the type occur in Miller Canyon, in the Huachuca.

At resting stages during growth the lip becomes thickened within, the callus visible through the shell as a buff streak. In all races of the species the height of the spire varies individually from convex to low conoidal. The abrupt bend of the parietal tooth towards the columella is rather inconstant in forms possessing it.

It is a variable species, nearly every large canyon having its own special race. Though weakly characterized, these local races are moderately homogeneous in their areas, with the exception of *A. levettei heterodonta*.

***Ashmunella levettei ursina* Pilsbry & Ferriss**

Fig. 554

Ashmunella levettei Pilsbry & Ferriss, 1905, Proc. Acad. Nat. Sci. Phila., p. 238, pl. 15, figs. 72-78.

Ashmunella levettei ursina Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 504, 508, fig. 7; pl. 20, figs. 1, 4 (genitalia).

The shell is like *A. levettei*, capacious and glossy. The aperture is less obstructed by the teeth. The parietal tooth is smaller, straight, not curving inward at the axial end, or almost imperceptibly so, and without an outer branch running towards the upper insertion of the lip.

Height 9, diameter 18, diameter; aperture 8.5 mm.; fully $6\frac{1}{2}$ whorls.
Height 7.2, diameter 16 mm.; $6\frac{1}{2}$ whorls.



Fig. 554. *Ashmunella levettei ursina*. Type.

ARIZONA: Huachuca Mountains; head of Bear Canyon, about 7500 feet elevation, type 87089 A.N.S.P. Also in the head of Miller Canyon.

In Bear Canyon there are many albino specimens, occurring with others of the normal brown color. The range of *ursina* lies westward from that of *heterodonta*.

This race was formerly referred to typical *A. levettei*.

Ashmunella levettei bifurca Pilsbry & Ferriss

Fig. 555.

Ashmunella levettei bifurca Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 510, fig. 9.

In Tanner Canyon the shells resemble those of Carr Canyon. They are glossy, dark chestnut colored, depressed, the last whorl angular in front. The aperture is small, the lip-ends connected by a distinct, often heavy parietal cord. The outer lip-tooth is pushed farther back into the mouth. The parietal tooth curves inward at its axial end, and usually gives off a distinct branch from the distal end, though this may be weak or wanting in some examples. The umbilicus is usually wider than in other forms of *levettei*, about three and six-tenths times in diam. The whorls coil closely.

Height 6.6 mm., diameter 15 mm.; fully $6\frac{1}{2}$ whorls.

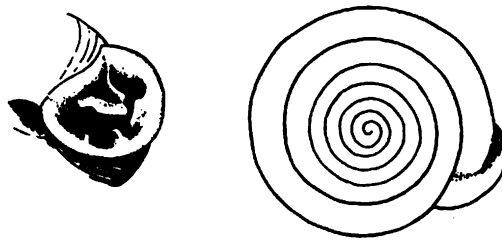


Fig. 555. *Ashmunella levettei bifurca*. Type.

ARIZONA: Tanner Canyon, Type 99262 A.N.S.P.

Ashmunella levettei angigyra Pilsbry

Fig. 556.

Ashmunella levettei angigyra Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 240, pl. 14, figs. 47-54; pl. 21, fig. 28 (genitalia); pl. 22, fig. 12 (teeth); pl. 23, fig. 14 (jaw).—Pilsbry & Ferriss, 1909 Proc. Acad. Nat. Sci. Phila., p. 510, fig. 10; pl. 20, fig. 2 (genitalia).

Smaller, more depressed than *levettei*, bluntly angular or subangular at periphery; teeth contracting the aperture more, the upper branch of parietal obsolete or nearly so; space between basal teeth wider than that between outer basal and tooth of outer lip.

Height 6.5 mm., diameter 13.6 mm.; 7 whorls (type) or smaller.

The type, 83269 A.N.S.P., was from Ramsey Canyon. Those from northwestward and along the warm dry slopes of the ridge are more typical of the race, being smaller and more angular. It occurs along the north-eastern side of the range from northwest to southeast as follows: Babokomari Creek; Fort Huachuca; Tanner Canyon, over the range, west fork,

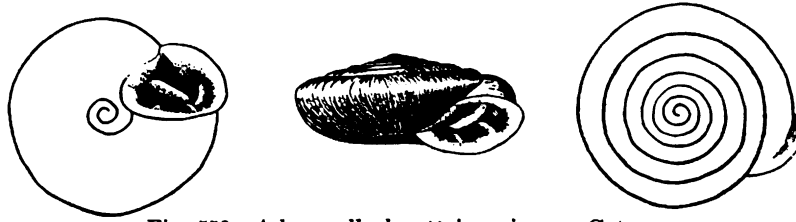


Fig. 556. *Ashmunella levettei angigyra*. Cotype.

and along cliffs south of the canyon; Brown's Canyon; Limestone Mountain, 9000 feet; Ramsey Canyon; also over the range on the foothills of Bear Canyon at about 5000 feet, where it is very widely separated from other known localities, and very small, the diameter 9.5 to 11 mm., and with $5\frac{1}{2}$ to $6\frac{1}{2}$ whorls.

The race from Carr Canyon is intermediate between *angigyra* and *levettei* in size and shape of the last whorl. The examples from Limestone Mountain and Salvation Ridge approach those of Carr Canyon in size and apertural teeth, and would probably be grouped with that race rather than with typical *angigyra*, if the two be separable.

A. levettei angigyra is the common and widely distributed *Ashmunella* of the Huachuclas. The other forms are very local.

***Ashmunella levettei heterodonta* Pilsbry**

Figs. 557, 558.

Ashmunella levettei heterodonta Pilsbry, 1905, Proc. Acad. Nat. Sci. Phila., p. 241, pl. 15, figs. 81-91.—Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 507, fig. 6.

Similar to *levettei* in size, shape and color. Typically it has a low, straight-topped tooth within the outer lip, a small tubercular tooth at junction of outer and basal margins, and a faint prominence in the position of an inner basal tooth. The parietal tooth is minute or wanting. A few individuals (Fig. 558 a) have teeth nearly as well developed as *A. levettei*; others show progressively smaller teeth (Fig. 558: b-g), the last differing



Fig. 557. *Ashmunella levettei heterodonta*, ($\times 2$). Cotype, Ida Canyon. Diameter 16.3 mm.

but slightly if at all from *A. varicifera*. There are barely over six whorls, which therefore are a little wider than in *A. levettei*.

Diameter of type 16.3 mm.; most shells measure from 15 to 18 mm., but there is one pygmy of 12 mm.

We have elsewhere noted the extreme variability of the teeth in *heterodonta*. They may be much more developed than described above, or so degenerate that only faint traces of teeth are discernible. The shells can be arranged in a form-chain connecting *levettei* and *varicifera*, as in Figure 558.

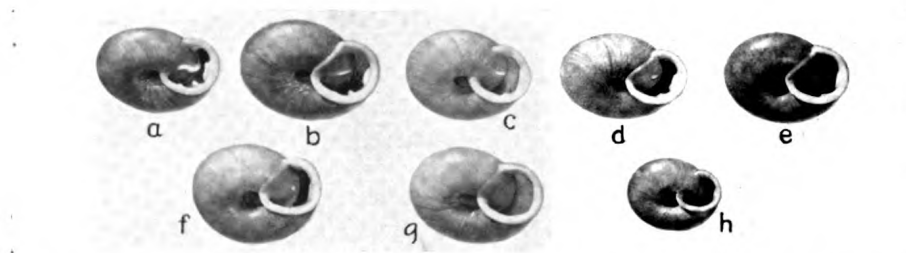


Fig. 558. *Ashmunella levettei heterodonta*, series from Ida Canyon. (Actual size.)

This form occurs in the head of Ida and Cave Canyons in the Huachuca range. In one place *heterodonta* goes over the divide two or three hundred feet, but in no other case do these species cross to the other side of the range. *A. levettei* or *heterodonta* are not found in *varicifera* territory.

As the *heterodonta* area lies between that of *levettei* and *ursina* on the north and northwest and the area of *varicifera* on the southeast, there seems good reason for believing that a hybrid population of these species has spread over the upper basin and branches of Ida and Cave Canyons. In that case it might be more correct to call this lawless snail *A. levettei* × *varicifera*.

***Ashmunella varicifera* (Ancey)**

Figs. 559, 560.

Polygyra chiricahuana Dall, 1897, Proc. U. S. Nat. Mus., 19: 341, pl. 32, figs. 9, 10, 12. (In part, specimens from Tucson, Cox, no. 124481).

Ashmunella chiricahuana var. *varicifera* Ancey, 1901, Journ. Malacol., 8: 77.

Ashmunella varicifera Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., 61: 505, fig. 4; pl. 20, figs. 3, 5, 6 (genitalia).

Mesodon kiowaensis Simpson, Binney, 1890, Bull. Mus. Comp. Zoöl., 19: 199 (figures only; cf. Rehder, 1932, Nautilus, 45: 141).

The shell is depressed, the spire low, varying from convex to low-conoidal, the periphery of the last whorl situated above the middle, obtusely subangular in front. Color cinnamon to cinamon-buff and opaque; or paler and somewhat transparent (sometimes pure white). Surface rather glossy, lightly marked with growth-lines and faint traces of incised spiral lines. Umbilicus rather narrow but open, contained five times in diameter. Aperture oblique, at about 45° with the axis. Peristome rather narrow, reflexed,



Fig. 559. *Ashmunella varicifera* Ancy, Miller Canyon. Diameter 18 mm.

recurved at the edge, having a low, indistinct thickening of the inner rim of the outer lip, and sometimes excessively weak indications of one or two vestigial teeth in the basal lip.

At resting stages young shells form a callous thickening within the lip, which shows through as an opaque, buff radial streak in some adult shells.

Height 8 mm., diameter 16.5 to 17 mm.; $5\frac{1}{2}$ whorls.

Height 10.5 mm., diameter 18.5 mm.; 6 whorls.

Height 8 mm., diameter 17.7 mm.; $5\frac{1}{2}$ whorls

Height 8 mm., diameter 16.9 mm.; $5\frac{1}{2}$ whorls } Cotypes.

The genitalia, *A. varicifera* (Fig. 524: 2-2c), are as in other members of the *levettei* group. The penis with epiphallus and the spermatheca in 4 individuals measure respectively: 47 and 41 mm., 44 and 27 mm., 37 and 25 mm., 26 and 32 mm. Talon is cylindric with a small tubercle. In fig. 2a the atrium and part of penis are seen protruded.

ARIZONA: Southeastern end of the Huachuca Mountains in Miller Canyon near head; Miller Peak, about 9800 feet; mountain on south side of mouth of Ash Canyon; Montezuma Canyon; east fork of Cave Canyon (Ferriss). Types in Bryant Walker Collection, Museum of Zoology, University of Michigan.

The growth-rest "varices" to which the name is due are only occasionally present in adult shells. They are also seen in *A. chiricahuana*, which is so similar that formerly the Chiricahuan and Huachucan snails were supposed to belong to one species. The soft anatomy shows at once that we have to do with two species.

In his field notes Ferriss stated that "On the Cave Creek side we found *A. varicifera* larger than the lot from Wickersham's Rock on the (Miller) peak, and generally albino. Out of one hole containing 29, only two were dark colored. On the other side of the east fork of Cave Creek they were larger but all dark. On the south side of the range there is a strong tendency to albinism in the *Ashmunellas*, *Sonorellas* and *Oreohelix*."

In more than two hundred specimens which have been examined, none has any trace of a parietal tooth. In some colonies in Montezuma Canyon the shells are all small, the diameter varying from 14.5 to 15 mm.

Ancy's type lot of two specimens (Fig. 560 a, b) now in the Bryant Walker Collection (Museum of Zoology, University of Michigan), is labelled

"Tucson, Arizona, ex C. T. Simpson", evidently obtained in exchange from the National Museum, as in his publication Ancey credits them to the same collector, Cox. The larger shell shows one, the smaller two buff growth-rest streaks on the base. Both have extremely weak callous thickenings within the lip, in the places of outer and basal teeth, such as are seen in some of the Miller Canyon shells. For this reason Miller Canyon is selected as type locality. This is also the canyon where typical *A. levettei* occurs. Probably both were collected there by Cox.¹

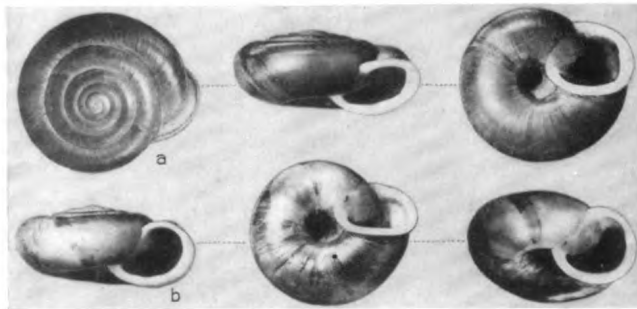


Fig. 560. *Ashmunella varicifera* Ancey. Cotypes. (About $\times 1\frac{1}{2}$.)

These cotypes are not the most typical expression of the Miller Canyon *varicifera*, as in a majority of the shells seen the lip is less calloused within, showing no trace of teeth, as in Figure 559.

I have seen the specimen, 12760 M.C.Z., inadvertently figured by W. G. Binney for *Mesodon kiowaensis*, as noted by Rehder.

***Ashmunella varicifera microdonta* Pilsbry & Ferriss**

Fig. 561.

Ashmunella microdonta Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., p. 506, fig. 5; pl. 20, fig. 7 (genitalia).

The shell resembles *A. varicifera* in general appearance, but differs by having the last whorl a little wider viewed from above; umbilicus wider, exposing more of the penultimate whorl, contained four to four and four-tenths times in diameter. The lip is toothless except for a very low vestige in the basal margin in some specimens; but there is a minute tubercular parietal tooth in over half of those examined, and it is perceptible as a faint thickening in all. The shell is chestnut colored, usually with one or two varix-streaks on the base; lip white or with its upper half reddish-brown.

Height 9.5 mm., diameter 20 mm.; $5\frac{1}{2}$ whorls, or smaller.

Height 8.8 mm., diameter 18.7 mm.; $5\frac{1}{2}$ whorls.

ARIZONA: Head of Cave Canyon, Huachuca Mountains, for about one-eighth of a mile. Type 94347 A.N.S.P.

¹ I have been unable to obtain any information about the Cox who collected these shells.

Ashmunella mearnsi (Dall)

Fig. 563.

Polygyra mearnsii Dall, 1895, Proc. U. S. Nat. Mus., 18: 2; 1897, Idem, 19: 343, pl. 32, figs. 7, 8, 11.

Ashmunella mearnsii (Dall), Pilsbry, Proc. Acad. Nat. Sci. Phila., 1905, p. 248; 1915, Idem, p. 329, fig. 3 (genitalia); pl. 5, figs. 1-1f.

The shell is depressed, with nearly flat or slightly raised spire, and narrowly rounded periphery near the plane of the upper surface; umbilicate, the umbilicus rapidly enlarging in the last whorl, contained about four and three-fourths times in the diameter. Surface rather glossy, pale cinnamon-buff, the first one and one-half whorls polished, the rest weakly marked with striae of growth. The whorls are rather closely coiled, the last abruptly descending in front and strongly constricted behind the lip. The aperture is strongly oblique; peristome reflected except near the upper insertion of lip, pale brown tinted, the terminations connected by an appressed or slightly raised callus. Parietal wall with a curved or angularly bent oblique tooth, and a shorter, lower one diverging towards the upper lip-insertion, from near its inner end, with which it is usually connected weakly. Outer margin thickened, with a flat-topped tooth; in the basal margin two compressed teeth. The interdental intervals are about equal.

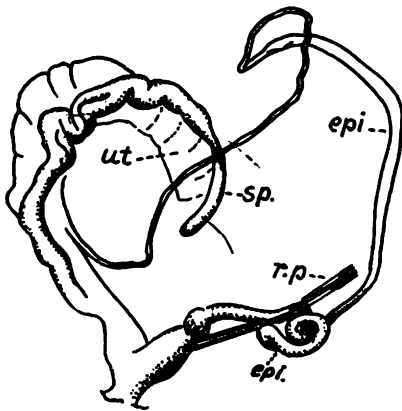


Fig. 562. Genitalia of *A. mearnsi*. *epi.*, epiphallus; *r.p.*, retractor of the penis; *sp.*, spermatheca; *ut.*, uterus.

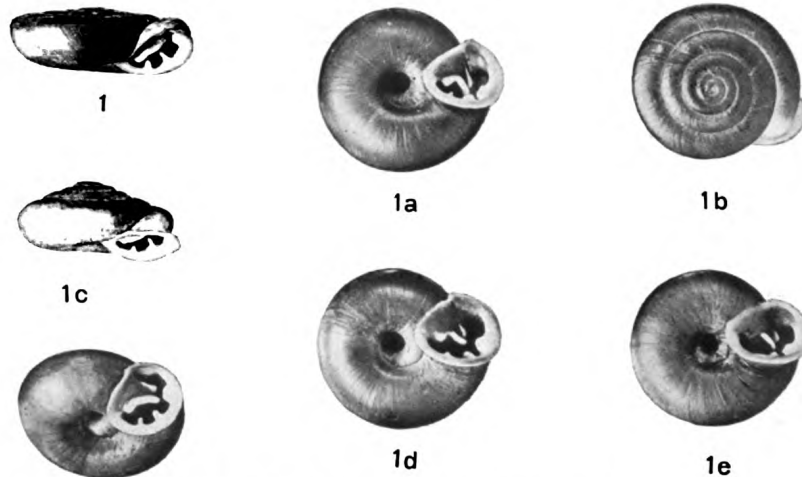
Height 5.5 mm., diameter 13 mm.; 5 whorls.

The penis is stout, bipartite. The epiphallus is strongly convoluted just beyond the insertion of the retractor muscle. It is very long. No flagellum seen. The spermatheca is largest in the middle, thin-walled. Length of penis 4.5 mm.; epiphallus 30 mm.; vagina 4 mm.; spermatheca and duct 19 mm. (Fig. 562).

NEW MEXICO: Big Hatchet Mountains, on the peaks around the heads of Thompson Canyon, from Daniels Peak to the summit of Big Hatchet Peak; from about 6500 to 8366 feet (Pilsbry and Daniels). Type 130012 U.S.N.M. (Dr. E. A. Mearns).¹

A. mearnsi lives in the earth under stones, like *A. walkeri* in the Floridas, both being burrowing species. It is closely related to *A. kochii* Clapp and *A. walkeri* Ferriss, but quite distinct from both. *A. levettei bifurca* in the Huachucas resembles *mearnsi* in teeth, but it is a less depressed shell with more whorls.

¹ "*Polygyra*" *mearnsii* was reported by Cockerell (1897, Nautilus, 11: 69) from high up in Filmore Canyon, Organ Mountains, New Mexico, found by Prof. J. D. Tinsley. This specimen can not now be traced; it is not in the Philadelphia or Washington collections. The identification is thought to be erroneous.

Fig. 563. *Ashmunella mearnsi*. ($\times 2$.)

We found it in great profusion on the northeast side of Daniels Mountain, near the summit (6829 feet, according to the topographic sheet). Also various places on the east and northeast slopes of Hacheta Grande. In the former place, which is selected as type locality, the parietal callus is usually raised from the surface as a thin, straight lamina, and in almost all of them its edge is more definite than in shells from other stations. The axial end of the parietal lamella is abruptly bent towards the columella and is more or less tubercular. Rarely the tubercle is almost free from the lamella. The spire is occasionally almost flat. The diameter varies from 11.5 to 14.5 mm.

In specimens from the summit of Hacheta Grande the parietal lamellae are a little shorter; the axial end of the longer branch is often straight, but more frequently is bent, or the bend is represented by a tubercle connected with, or almost free from the lamella. The edge of the parietal callus is appressed to the surface, and is often arcuate.

***Ashmunella hebaridi* Pilsbry & Vanatta**

Fig. 564.

Ashmunella hebaridi Pilsbry & Vanatta, 1923, *Nautilus*, 36: 119.

Shell of about the size and color of *A. mearnsi*, but differing (1) by the presence of an acute peripheral keel near the top of the whorl, the upper surface of the last three whorls nearly flat, the last whorl impressed above the keel; the base strongly convex, (2) the straight parietal callus is much more strongly raised, (3) the surface is distinctly though finely striate, the striae partially interrupted forming long granules. The teeth are substantially as in *A. mearnsi*. Umbilicus contained nearly four times in the diameter.

Height 5 mm., diameter 14.7 mm.; $5\frac{1}{2}$ whorls.



Fig. 564. *Ashmunella hebari*, type and paratypes. ($\times 1\frac{1}{2}$.)

NEW MEXICO: Northwestern slope of Big Hatchet Peak at about 7600 feet, in a broad canyon (Morgan Hebard), Type 131409 A.N.S.P.

By its acute keel and minutely roughened surface this form resembles *A. walkeri* Ferriss of the Florida Range; but that is a smaller species with weaker sculpture, an appressed parietal callus and a simple parietal lamella. *A. kochi* Clapp of the San Andreas range is larger, smoother, not so acutely carinate, and has not a raised parietal callus.

All of the specimens are dead shells more or less bleached. The amount of granulation visible on these "bones" is variable, especially on the base. Doubtless living shells would show it more strongly, and possibly with cuticular scales. The surface is dull, not glossy as in living *A. mearnsi*. In one example some fine incised spiral lines can be made out on the base.

The locality of this shell is reached by way of a road running east from Chainey's ranch, mapped on the Big Hatchet Peak Quadrangle of the Topographic survey.

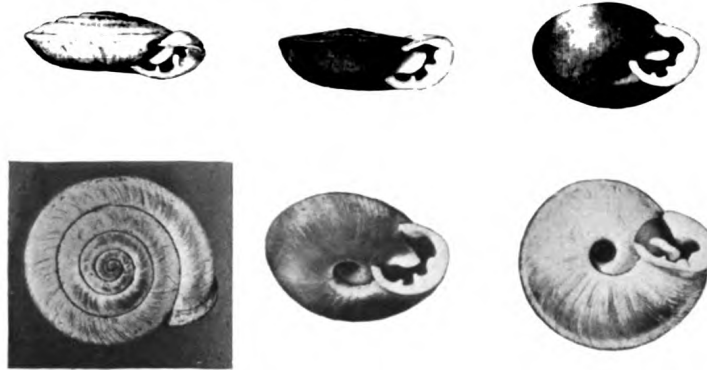
***Ashmunella walkeri* Ferriss**

Fig. 565.

Ashmunella walkeri Ferriss, 1904, Nautilus, 18: 53. Pilsbry, Proc. Acad. Nat. Sci. Phila., 1905, p. 247, pl. 16, figs. 111, 112, 117; 1915, *ibid.*, p. 348, fig. 7 (genitalia), pl. 5, figs. 2-2e.

The shell is much depressed, lens-shaped, acutely carinate peripherally, rather thin and very light colored, pale ochraceous salmon or pale brown or entirely white. Old ones are dull, but the best-preserved adults have a little lustre. The umbilicus, narrow within, enlarges rapidly at the last whorl, and is contained four times in the diameter. Surface lightly marked with growth-lines, but showing no trace of spiral striae or lines. The upper surface is but slightly convex. The apex is sculptured like that of *A. levettei*. Whorls four and one-half, slightly convex, the last very shortly descending in front. Base more convex than the upper surface. The aperture is small and very oblique, the lip well reflected, white, with an obtuse, squarish tooth in the outer margin and two compressed teeth in the basal margin, the inner one smaller; these three being nearly equally spaced, or the outer two may be nearer together. There is a rather short, straight, obliquely set parietal tooth, and in old shells a very low diverging ridge between it and the outer insertion of the lip.

Height 4.5 mm., diameter 13.3 mm.; $4\frac{1}{2}$ whorls.

Fig. 565. *Ashmunella walkeri*. ($\times 2$.)

The genitalia have no peculiar features, being about as in *A. mearnsi*. The ducts are rather short. Length of penis 3 mm.; epiphallus 14 mm.; vagina 2.5 mm.; spermatheca 10 mm. The atrium is well developed and the flagellum distinct, though short as usual in the genus.

NEW MEXICO: Florida Mountains, Luna County, in a rock talus near the middle of the west side, at an elevation of 6000-6500 feet (Ferriss & Pilsbry), Type 87101 A.N.S.P.; Paratypes in Ferriss Collection.

While related to *A. hebardei* and to *A. mearnsi* by the structure of the aperture, this species is flatter than either, and differs especially in the small number of whorls—fewer than in any other *Ashmunella*.

This species was originally described from a few dead shells. We found it living in abundance by digging in the soil among the rocks in the shade of bushes. It lives in families or "pockets." The snails are very hard to pull, few coming out entire.

(Named for Dr. Bryant Walker.)

***Ashmunella kochi* Clapp**

Fig. 566 a-c.

Ashmunella kochii G. H. Clapp, 1908, *Nautilus*, 22: 77, pl. 8, figs. 1-3.

The shell is much depressed with flat spire and strongly angular periphery about in the plane of the upper surface. Umbilicus contained about three and one-half times in the diameter, very rapidly widening in the last whorl. Surface somewhat glossy, very pale brown or white in the dead specimens known, with very fine growth-lines after the polished initial one and one half whorls. The whorls are weakly convex, the last angular with convex base, abruptly descending in front and somewhat constricted behind the lip. Aperture very oblique. Peristome white, rather broadly expanded above, narrowly reflected at the basal margin. Parietal wall with an oblique, slightly sinuous tooth, its outer end abruptly bent towards the columella; from near its inner end a very weak, shorter, straight tooth diverges towards the insertion of outer lip. Within the outer lip is an obliquely set, blunt-topped tooth; in the basal margin two compressed

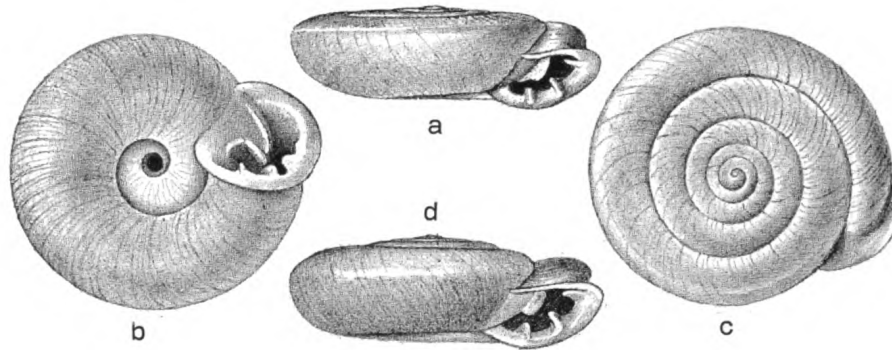


Fig. 566. a-c, *Ashmunella kochi*, cotype; d, *A. kochi amblyia*, type. ($\times 2$.)

teeth, their proximal ends united by a U-shaped ridge on the lip. Within the last whorl there is a lamella 3 or 4 mm. long on the columellar slope of the cavity, 3 or 4 mm. behind the columellar lip.

Height 6.75 mm., diameter 20.5 mm.; $5\frac{1}{2}$ whorls. Type.

Height 7 mm., diameter 21 mm.; $5\frac{1}{2}$ whorls. Paratype.

Height 6.3 mm., diameter 19.6 mm.; $5\frac{1}{2}$ whorls. Paratype.

NEW MEXICO: Black Mountain, at the south end of the San Andreas Range, Dona Ana County, at about 6800 feet (Walter E. Koch), Type 5765 Clapp Collection; Paratypes 97640 A.N.S.P.

A. kochii is related to *A. mearnsi*, but it is much larger with an acutely angular periphery and far wider umbilicus. It differs further by the deep-seated lamella behind the columella, which is wanting in *mearnsii*.

***Ashmunella kochi amblyia* new subspecies**

Fig. 566 d.

Less depressed than *A. kochi*, the whorls more convex, last one only bluntly angular. Pale, translucent brown; peristome brownish; parietal tooth short and straight.

Height 7.5 mm., diameter 21.3 mm.; $5\frac{1}{2}$ whorls.

Height 6.4 mm., diameter 16.5 mm.; $5\frac{1}{4}$ whorls. Smallest topotype.

The genitalia, (Figs. 525: 6-6b), resemble those of *A. mearnsi*, the upper sac of the penis being short, not distinctly demarked from the lower. Length of penis with epiphallus 28 mm., spermatheca 25 mm. These ducts are short for so large a snail.

NEW MEXICO: Guadalupe Mountains, east and southeast of Orange, New Mexico, from Pine Spring Canyon above Walter Glover's house (Pilsbry & Ferriss, Nov. 2-11, 1922). Type 164659 A.N.S.P.

This race was taken in large numbers, but living ones were hard to find as they were hibernating. It is strange that practically the same form occurred at Ropes' Spring, western foothills of the San Andreas range about 30 miles north of Las Cruces. Here they are all small, with five and one-half whorls, and the diameter varying from 14.7 to 17 mm.

The lamella within the last whorl varies from sharp to very low and blunt.

Ashmunella carlsbadensis Pilsbry

Fig. 567.

Ashmunella carlsbadensis Pilsbry, 1932, Nautilus, 46: 19.

The shell is umbilicate, the umbilicus contained about five times in diameter of shell; lens shaped, acutely carinate; cinnamon buff, with little gloss above, the base paler, glossy, subtransparent. Initial one and one-half whorls smooth, third whorl with a few weak traces of long granules on the weak striae, last whorl with weak wrinkles of growth and some very weak spiral lines. The fully five whorls are moderately convex, the last descending in front. The umbilicus enlarges suddenly in the last whorl, the inner,

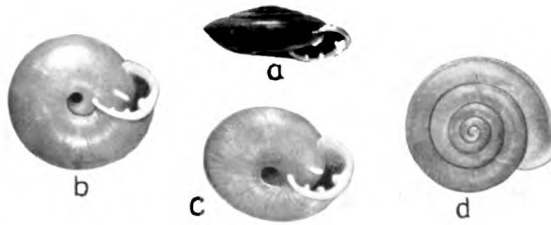


Fig. 567. *Ashmunella carlsbadensis*, a, type, b-d, paratypes. ($\times 1\frac{1}{2}$.)

well-like cavity being much less than half of the final width. The very strongly oblique aperture is irregularly trapezoidal, the white lip reflected, with one tapering, round-topped tooth within the outer margin, two smaller teeth in the basal margin, and a short, straight, oblique tooth on the parietal wall.

Height 5.5 mm., diameter 13 mm.

NEW MEXICO: A cave in Dark Canyon, southwest of Carlsbad, from the surface to a depth of two feet (E. B. Howard), Type 158815 A.N.S.P.

This species is related to *A. walkeri* Ferriss, of the Florida Mountains, but it differs by the much narrower peristome, with a narrower, tapering tooth in the outer lip, farther from the outer basal tooth; a much smaller parietal tooth, a thinner parietal callus, and there is a fraction of a whorl more. Like *A. walkeri* it appears to be a burrowing snail, and will doubtless be found outside of the shallow cave where the type lot was collected.

Family VI. SAGDIDAE

Telephalla Pilsbry, 1892, Proc. Acad. Nat. Sci. Phila., p. 396 (for *Sagda* and "*Cysticopsis*" = *Zaphysema*).

Sagdinae Pilsbry, 1895, Man. Conch., 9, Index to the Helices, p. 124.

Sagdidae Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 77, 106.

Helices of moderate or small size, in shape varying from discoidal to conic, of plain, uniform color. Aperture lunate or oval, sometimes with internal laminae or submarginal teeth. The peristome is simple and sharp.

Typically the penis is continued in an epiphallus and flagellum, and has a branch bearing a long appendix; but in many genera the appendix is lacking, and in some small forms all appendages as well as the retractor muscle are absent.

The kidney varies in length. Secondary ureter either closed or open.

The jaw is usually thin, composed of many flat plaits, but these are wholly united into a smooth jaw in *Sagda*. The radula is of Polygyrid type.

This is a tropical and subtropical Middle American family of about 13 genera, copiously developed on the mainland and in the West Indies, especially in Jamaica. A few of the genera extend to the northern border of South America and to the southern borders of the United States. One genus, *Microphysula*, is notable for its range, being a characteristic snail of the Canadian and the upper Transition zones of the Rocky Mountain region, also in the San Juan Islands and Vancouver Island, but not yet known in California or Nevada.

The Sagdidae have no known relatives in the Eastern Hemisphere, and apparently arose in America from a primitive helicid stock which may also have given birth to the exclusively American family Polygyridae.

Von Martens, 1860, associated *Sagda*, *Hyalosagda*, *Proserpinula* and *Odontosagda* in the genus *Sagda*, but the other genera of the family had been rather widely scattered among the helices until brought under the subfamily Sagdinae in 1895 and 1926.

The characters of the male genitalia vary so widely that although the family appears to be a natural group, it can only be loosely defined. The thin, unexpanded peristome of the shell is common to all of the genera.

Paleontology.—MICROPHYSULA OXYAENAE (Ckll.), described as *Thysanophora oxyaenae*, Cockerell, 1914, Bull. Amer. Mus. Nat. Hist., 33: 325, fig. 5, and compared with *M. ingersolli*, is from 5 miles southeast of mouth of Pat O'Hara Creek, Clark's Fork Basin, Wyoming, thought to be at the base of the Wasatch formation (Eocene). Also found in the Sand Coulee Eocene, Park County, Wyoming. Russell has referred *Vitrea sinoparum* Ckll. to *Microphysula*, with some doubt. It is from the same localities.

Key to Genera of Sagdidae

1. Penis provided with a long appendix; (SAGDINAE)*Lacteoluna*
 Penis without appendix; (THYSANOPHORINAE)2
2. Penis vestigeal, without epiphallus or retractor ...*Thysanophora* subgenus *Lyroconus*
 Penis developed, with epiphallus and retractor3
3. A flagellum present; marginal teeth having entocones*Hojeda*
 No flagellum; side teeth without entocones4
4. Epiphallus terminal on penis, slender, apparently being an enlarged part of the vas deferens*Thysanophora*
 Epiphallus glandular, inserted laterally on penis*Microphysula*

The reproductive system of *L. selenina* (Gld.), (Fig. 568 c), from Bermuda, is much like that of *Sagda* and *Hyalosagda*. The penis has a terminal vas deferens and flagellum, the latter rather broad and flattened. The long, slender retractor muscle has its insertion about midway, widening into a sort of thin sheath. Close to the base arises an appendicular branch, terminating in a very long appendix, at first contracting to a small duct, then enlarging and folded lengthwise, bringing the end back near the base. It was found folded about the same in a second individual opened. The spermathecal duct is very long, and inserted low on the oviduct. The upper part of the oviduct or "uterus" is filled with embryos in the specimens figured. Binney noted that the species is viviparous.

The lung (Fig. 568 d) is long and narrow, with no macroscopic venation except the pulmonary vein. The narrow kidney is about three times the length of the pericardium. The secondary uterus appears as a whitish band with a thread-like ridge near the intestine, and seems to be open throughout.¹ The mantle is very light colored.

The radula has short, square central teeth with the mesocone nearly as long as the basal plate, ectocones well developed. Laterals similar but without entocone. In the marginal teeth an entocone is developed by splitting of the mesocone and the original ectocone is bifid or split into three cusps. There are 9.10.1.10.9 teeth (Fig. 568 A).

The jaw is very thin, composed of numerous flat narrow plates, denticulating the edges (Fig. 568 B).

The Jamaican genus *Hyalosagda* differs from *Lacteoluna* by its nearly smooth, transparent shell, the simple, slender flagellum, the black mantle and the absence of distinct entocones, the marginal teeth being bicuspid.

***Lacteoluna selenina* (Gould)**

Fig. 569.

Helix vortex Pfeiffer, 1839, Archiv f. Naturg., 2: 351; Monogr. Hel. Viv., 1: 95. Not of Linnaeus, 1758.

Microphysa vortex Pfr., W. G. Binney, 1878, Terr. Moll., 5: 171, pl. 48, fig. 2.

Helix selenina Gould, 1848, Proc. Boston Soc. Nat. Hist., 3: 38; Terr. Moll., 2: 240, pl. 48, fig. 2.

Thysanophora selenina (Gld.), Pilsbry, 1905, Nautilus, 19: 38 and of subsequent authors

Lacteoluna selenina (Gld.) Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 108 (anatomy); 1930, ibid., 82: 244, 249.

The small shell is thin, strongly depressed, of a milky-bluish tint, umbilicate, the umbilicus contained $5\frac{1}{2}$ to nearly 6 times in the diameter. The spire is low, of strongly convex, slowly increasing whorls, the last having the periphery well above the middle, the base convex. Surface with somewhat silky luster, not polished, the initial whorl smooth, the next microscopically striate spirally, the last whorl delicately marked with weak fine growth wrinkles. The narrow aperture is crescentic with blunt ends. Peristome thin, dilated at the columellar insertion.

Height 2.8 mm., diameter 5.3 mm.; 4 $\frac{1}{2}$ whorls. Paratype.

Height 2.7 mm., diameter 5 mm. Fikahatchee Key.

¹ However, I did not section it; the whitish band may be a thin-walled duct.

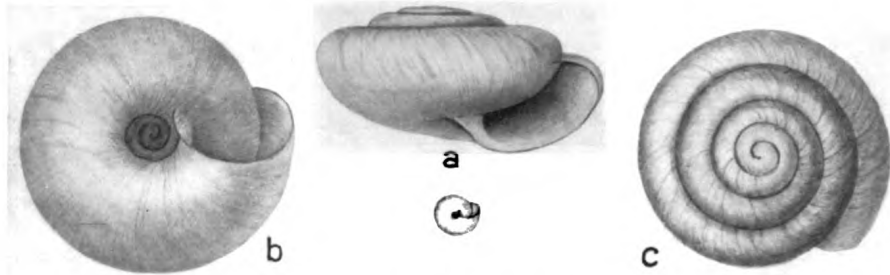


Fig. 569. *Lacteoluna selenina* a, paratype; b, c, Lossman's Key. (Enlarged and actual size.)

FLORIDA: Throughout the keys; north to Key Marco on the west coast, Palm Beach on the east; Lakeland, Polk Co.; type locality Miami. Under stones and rubbish.

WEST INDIES: Bahamas south to Barbados; Swan Island, Old Providence and St. Andrews, in the western Caribbean.

BERMUDA.

This is an abundant snail throughout southern Florida on calcareous soils. The depressed shape and the somewhat dull, or at least not polished, surface of the very thin shell are qualities possessed by only one other species of the region, *Hojeda inaguensis*, which is much smaller and more openly umbilicate. The locality Lakeland is rather detached.

(*Selenina*, moon like.)

Subfamily THYSANOPHORINAE Pilsbry

Thysanophorinae Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 107.—H. B. Baker, 1927, *ibid.*, 79: 235.

HOJEDA H. B. Baker

Hojeda H. Burrington Baker, 1926, Occ. Pap. Mus. Zool. Univ. Mich., no. 167, p. 15, type *Thysanophora vanattai* H. B. B.—Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 118.

? *Microphysa* von Martens, 1860, Die Heliceen, p. 82, t.o.d. *Helix boothiana* Pfr. Not *Microphysa* Westwood, 1834.

The shell is depressed, shaped as in *Thysanophora*, thin, whitish or pale brown; faintly striate, without periostracal threads or hairs, the embryonic whorl smooth.

The penis is continued in a short epiphallus with terminal vas deferens, retractor muscle and flagellum, the latter large, fusiform and conspicuously glandular. Spermathecal duct of medium length (Fig. 570). Kidney triangular, about three times the length of pericardium. An entocone is present on the marginal teeth.¹ Reproduction by relatively large, ellipsoidal eggs with fairly thick and firm chalky-white shell.

H. inaguensis from Stock Island, under rocks, was dissected by Dr. Baker, who states that the anatomy is very similar to that of *H. vanattai*,

¹ For a fuller account of anatomy see H. B. Baker's paper cited above, p. 13, under the heading *Thysanophora canalis*.

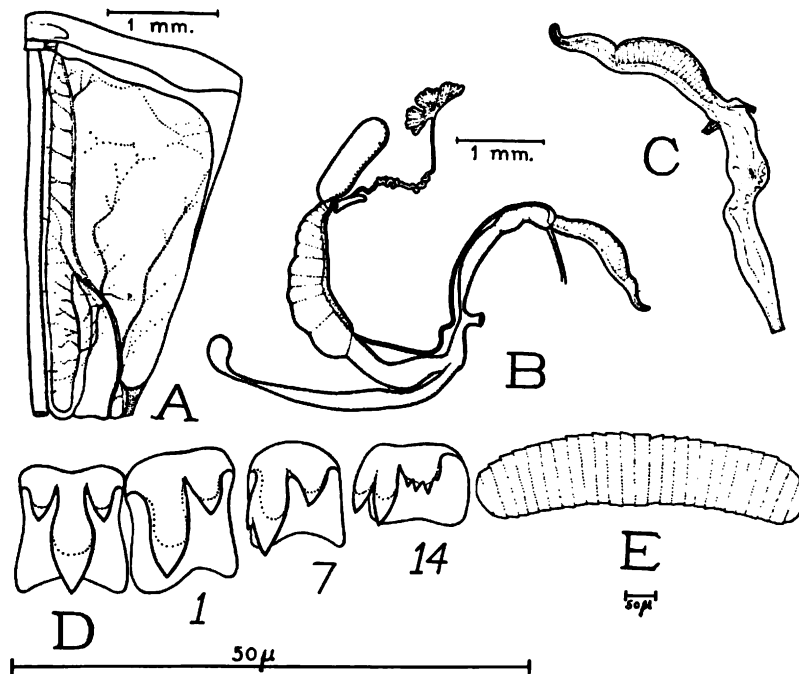


Fig. 570. *Hojeda vanattai*, Curacao. A, pallial complex. B, genitalia. C, penis, epiphallus and flagellum slightly flattened under coverglass and viewed by transmitted light to show lumen, semidiagrammatic. D, teeth. E, jaw. (After H. B. Baker.)

"but shows some approach to that of *Hyalosagda*, sg. *Lacteoluna* (sect. *Strialuna*, *Microsagda*, *Aerotrochus* and s.s.). The unbranched penis proper shows a short, ovoid caecum beyond the epiphallar opening (like in *Aerotrochus* but bigger) and is encircled near its middle by a muscular band (as in *Aerotrochus*). The spermathecal retractor [cf. 1935, Naut., 48: 135] inserts around the tapered apex of the secondary spermatheca and parallels the spermathecal duct for a short distance (like in *Microsagda*). The penial retractor inserts near the vas deferens (as in *Strialuna*). The later shell whorls of *Hojeda* have fine rib striae (like in *Strialuna*) and accumulate dirt more or less evenly (i.e., not forming costae or points along coarser growth-wrinkles as in *Aerotrochus* and *Lacteoluna* s.s.)."

The limits of the genus are somewhat uncertain, but the known range is from the Bahamas and southern Florida to Curaçao.

***Hojeda inaguensis* (Weinland)**

Fig. 571.

Helix inaguensis Weinland, 1880, Jahrb. deutsch. Malak. Ges., 7: 369, pl. 12, fig. 22.

Hojeda inaguensis (Weinl.) Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 120. H. B. Baker, 1936, Nautilus, 50: 70 (anatomy).

Thysanophora incrustata Poey, Vanatta, 1912, Nautilus, 26: 18-21.

"Shell perspectively umbilicate, depressed, thin, whitish, irregularly striatulate, the spire a little convex. The $4\frac{1}{2}$ flattened [planulati] whorls increase slowly, the last one being convex at base, not descending. Aperture



Fig. 571. *Hojeda inaguensis*, Boca Chica Key. (Enlarged and actual size.)

is oblique, depressed-lunate; peristome unexpanded, simple, acute, the margins approaching, the columellar margin a little reflected below. Greater diameter 3.5 mm., lesser 3 mm., diameter umbilicus 0.5 mm." (Weinland.)

BAHAMAS: Little Inagua (Bland), type locality.

FLORIDA: Key West, Stock Island, Boca Chica Key, Sugarloaf Key, Summerland Key, Big and Little Pine Keys, Noname Key, Long Key, Lignumvitae Key, Key Largo, Pumpkin Key.

A Florida (Boca Chica Key) specimen measures height 2.1 mm., diameter 3.3 mm., $4\frac{1}{3}$ whorls. The umbilicus is contained about 4 times in the diameter. The color of fresh shells is a very pale brown tint; Weinland states that his were dead. The striation is very fine, partly obsolete, the surface being rather dull, as in *L. selenina*. Weinland's description applies well to these shells except for his phrase "anfr. planulati $4\frac{1}{2}$." The whorls in our shell are strongly convex, as in *T. horni*, and this is the case also in Little Inagua specimens examined by John B. Henderson; by "planulati" Weinland apparently meant the spire, or whorls taken together.

THYSANOPHORA Strebel & Pfeffer

Thysanophora Strebel & Pfeffer, 1880, Beitrag zur Kenntnis der Fauna Mexikanischer Land- und Süßwasser-Conchylien, 4: 30.—Tryon, 1887, Man. Conch., 3: 16, *Helix impura* Pfr., designated type.—Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 113.—H. B. Baker, 1927, *ibid.*, 79: 240.

The shell is small, thin, lusterless, umbilicate, with depressed or conic spire and usually with sculpture of periostracal laminae more retractively oblique than the growth striae, or sometimes with delicate scattered hairs. Often dirty or with an earthy incrustation. The aperture is broadly oval, but little modified by the short parietal wall. Peristome thin and simple, slightly expanded at the columellar insertion.

The anatomy of *T. impura* (Pfr.), the genotype, is not known. In a specimen of *Thysanophora horni* from Chiricahua Mountains, Arizona (Fig. 572), the foot is gray, weakly granular, without an impressed line on the top of the tail or other peculiar features. The moderately long lung is plain under ordinary magnification except for the principal vein. The kidney is triangular, its length about twice the greatest width, and about twice as long as the heart; it is thin-walled, its lumen is large, the glandular bodies small, mainly transverse. The secondary ureter is closed near the base, but its greater part appears to be open, bounded by a thread-like ridge.

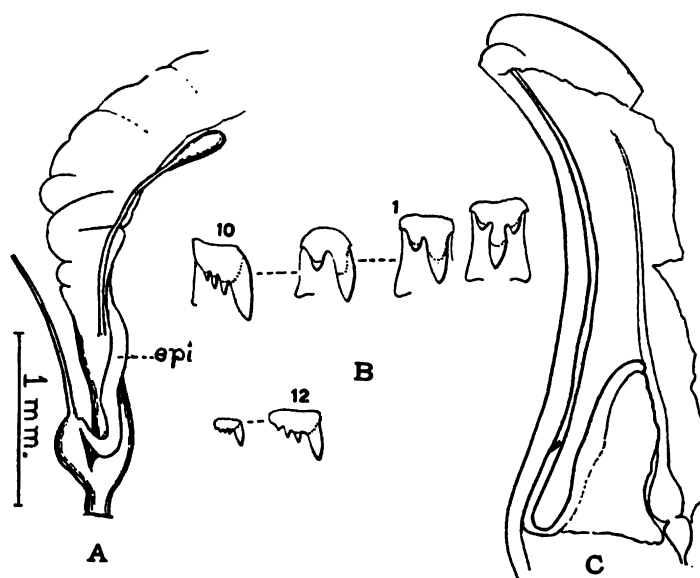


Fig. 572. *Thysanophora horni*. A, genitalia; B, teeth; C, pallial tract; epi, epiphallus.

The right ocular retractor passes between penis and vagina. The penis is very short, about 0.4 mm., with terminal retractor muscle and epiphallus, the latter at least $2\frac{1}{2}$ times as long as the penis. The penial retractor is quite long and inserted on the diaphragm. The vagina is rather large and quite long, double the length of the penis. Spermathecal duct of medium length, slender.

The radula has 8.8.1.8.8 teeth. The centrals are tricuspid, laterals bicuspid. The marginals have a long, simple inner cusp (mesocone) and three to four ectocones. In the absence of entocones on both lateral and marginal teeth, this radula resembles that of *Microphysula*, and differs from *Hojeda* and *Lacteoluna*.

The typical group of *Thysanophora* is characterized by a sculpture of oblique threads more strongly retractive than growth lines. They appear about midway of the first whorl, or slightly earlier, and are well developed and closer on the last embryonic whorl (Fig. 573). On the following neanic whorl or two they are often indistinct, but on the last whorl they occupy the greater part of the surface. Dirt often adheres firmly to the shell, concealing the sculpture, a peculiarity which suggested the names of some of the species.

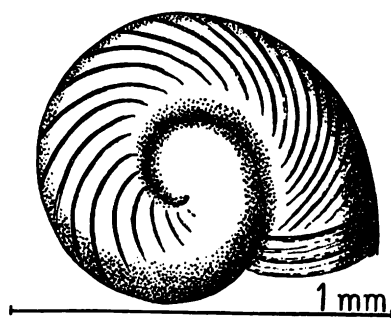


Fig. 573. Embryonic whorls of *Thysanophora impura*, Merida, Yucatan. ($\times 50$.)

Distribution.—Mainly continental, Arizona to Venezuela, but the group is also sparsely represented in the West Indies by *T. incrustata* (Poey), which apparently belongs in this subgenus near *T. impura*, and by members of the *T. plagiptycha* group.

Subgenus THYSANOPHORA *s. str.*

Depressed shells with the spire convex but more or less flattened.

This subgenus is used to include the subgenus *Setidiscus* H. B. Baker, (1927, Proc. Acad. Nat. Sci. Phila., 79: 235, 238, type *T. horni*), as it is not known that *T. horni* differs from *T. impura* anatomically; the shells are about alike in shape, and the difference in sculpture does not seem to be readily definable.

Thysanophora horni (Gabb)

Fig. 574 a.

Helix hornii Gabb, 1866, Amer. Journ. Conch., 2: 330, pl. 21, fig. 5.

Patula horni Gabb, W. G. Binney, 1878, Terr. Moll., 5: 167, fig. 78; 1885, Man. Amer. L. Sh., p. 169.

Thysanophora hornii Gabb, Pilsbry, 1898, Nautilus, 11: 105; 1900, Nautilus, 13: 98; 1903, Proc. Acad. Nat. Sci. Phila., p. 763 (Mexico); 1906, *ibid.*, p. 126; 1910, *ibid.*, p. 115.—Dall 1896, Proc. U. S. Nat. Mus., 19: 336.—Hinkley, 1907, Nautilus, 21: 172 (Tampico).—Hanna, 1923, Proc. Cal. Acad. Sci., (4), 12: 505. (Lower California records.)

Patula (Microphysa) incrustata Poey, Pilsbry, 1889, Nautilus, 3: 63.

The small shell is umbilicate, the umbilicus contained about 4 times in diameter, thin, buckthorn brown; depressed, with convex spire of strongly convex whorls joined by a deep suture, the last half turn descending to about the middle of the preceding whorl. Surface matt, the embryonic $1\frac{1}{2}$ whorls with rather close wrinkles more strongly retractive than growth lines, the last whorl with rather close periostracal threads which are more oblique than growth lines and somewhat irregular. The aperture is not very oblique, shortly oval; peristome thin, a little expanded in the basal margin, the columellar margin dilated.

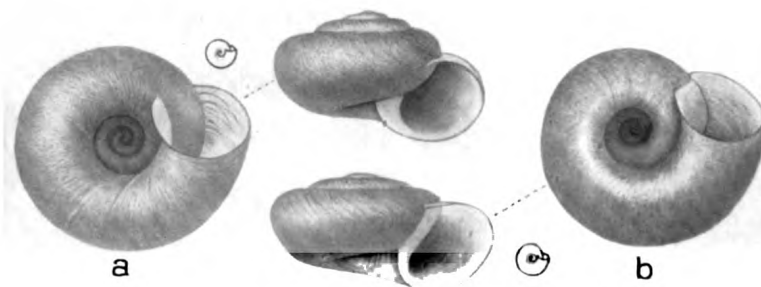


Fig. 574. a, *Thysanophora horni*, type. b, *Thysanophora incrustata*, Cuba. (Enlarged and actual size.)

Height 2.4 mm., diameter 3.8 mm.; $4\frac{1}{2}$ whorls. Cotype.

Height 3.1 mm., diameter 4.7 mm.; $4\frac{1}{2}$ whorls. Tucson Range.

TEXAS: From Brownsville and New Braunfels, Comal Co., west to the Pecos River region, Val Verde Co. Seen from Cameron, Hidalgo, Maverick, Live Oak, Webb, Medina, Comal, Frio and Val Verde counties.

NEW MEXICO: Cuchillo Mts., Sierra Co., Mogollon Mts., Florida Mts. and Big Hatchet Mts. (Ferriss & Pilsbry).

ARIZONA: Abundant in mountains of southeastern part of the state, Cochise, Pima, Graham and Pinal counties (Ferriss & Pilsbry). Type 10945 A.N.S.P. from old Fort Grant, at junction of Aravaipa and San Pedro Rivers, Pinal Co. (Geo. H. Horn). Maricopa Co. (Pilsbry & Ferriss). Yavapai Co. (Ashmun). Shinumo Creek, Coconino Co., north of the Colorado R. (Ferriss & Pilsbry).

MEXICO: In the states of Tamaulipas, Nuevo Leon, San Luis Potosi, Jalisco, Chihuahua, Sonora and Sinaloa (Pilsbry and others). Lower California in Agua Verde Bay, Carmen I. and Montserrat I. (Hanna).

This small xerophile occurs on both calcareous and volcanic soils. They are usually found under stones, but sometimes under dead cacti or among grass roots. They are common shells in the drift debris of rivers and arroyos. In Arizona and New Mexico it is mainly a shell of low treeless mountains and foothills, not ascending to the humid, forested levels. Thus in the Santa Catalina Range the highest station noted was 4500 feet. However, in the arid mountains of western Chihuahua, I have taken it at 7000 feet (Sierra de la Brena, near Pearson, Chih.). The records from near sea level at Brownsville, Texas, and San Blas, Sinaloa, are river debris examples; they probably drifted from somewhat higher stations. It is generally spread in suitable country.

It shows little variation except in the degree of development of the periostracal sculpture. On perfectly preserved young shells the periostracal threads bear a few hairs, but I have never seen them in adults. The threads are weaker and closer than in the Mexican *T. conspurcatella* (Morel.), but of the same character. The surface is often coated with dirt, especially in the deep suture.

(Named for the coleopterist George H. Horn.)

***Thysanophora incrustata* (Poey)**

Fig. 574 b.

Helix incrustata Poey, 1854?, *Memorias Hist. Nat. Cuba*, 1: 208, 212, pl. 12, figs. 11-16.

Helix saxicola Gould, 1851, *Terr. Moll.*, 2: 174, pl. 29a, fig. 4. Not of Pfeiffer, 1840.

Microphysa incrustata Poey, Binney, 1878, *Terr. Moll.*, 5: 170, pl. iii, fig. s (teeth).

"Shell umbilicated, depressed, smooth, horn-colored, usually incrustated with dirt, with crowded striae; spire slightly elevated, composed of 4 or 5 well-rounded whorls separated by a deeply impressed suture; beneath with a broad umbilicus, one third the diameter of the shell, exhibiting all the whorls within; aperture circular, being but slightly impinged upon by the penult whorl, its extremities joined by a slightly appressed scale of enamel,

rendering the peristome continuous; peristome slightly reflexed, so as to render the aperture somewhat campanulate. Greater diameter $4\frac{3}{4}$, lesser 4 mm.; height, 2 mm." (W. G. Binney.)

TEXAS: Galveston (Bartlett). Corpus Christi (Binney).

CUBA: Puentes Grandes (Poey).

The periphery is situated above the middle, the whorl being strongly convex in the upper part, somewhat flattened in the lower, the base convex. In some places a few indistinct threads may be seen, more strongly retractive than the faint lines of growth, but they are not so distinct as in many *T. horni*. The umbilicus is decidedly more widely open, contained $3\frac{1}{2}$ times in diameter; the last whorl descends less, and the aperture is more ample than in *T. horni*.

It is a common west Cuban species, found in the neighborhood of Havana. As I have not seen Texan specimens, Binney's description is copied. The figures represent a Cuban specimen received from Poey, height 2.2 mm., diameter 3.9 mm., barely 4 whorls. The Texas records have not been confirmed by any modern collectors.

Subgenus LYROCONUS H. B. Baker

Lyroconus H. Burrington Baker, 1927, Proc. Acad. Nat. Sci. Phila., 79: 235, type *T. plagioptycha* (Shuttl.).

Shell with elevated, conoidal spire the surface with oblique, strongly retractive periostracal threads. Penis vestigial, without retractor or epiphallus (Fig. 575).

The species are arboreal.

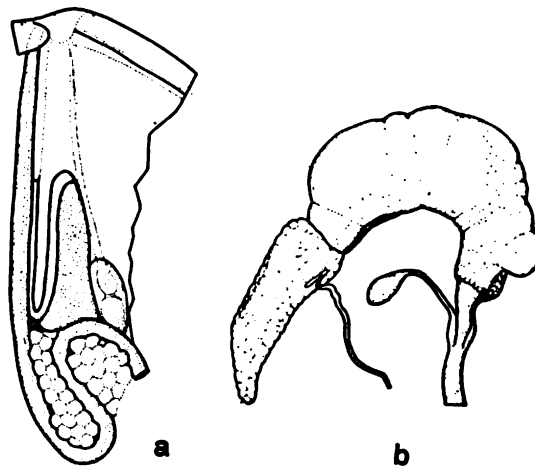


Fig. 575. *Thysanophora (Lyroconus) plagioptycha*, b, right view of genitalia, ovotestis omitted; a, inner view of pallial complex and s-loops of hindgut. (After H. B. Baker.)

Thysanophora plagiptycha (Shuttleworth)

Fig. 576.

Helix plagiptycha Shuttleworth, 1854, Mittheil. Naturforsch. Ges. Bern, p. 37 (Porto Rico and Vièque I.).

Thysanophora plagiptycha (Shuttl.) Pilsbry, 1905, Nautilus, 19: 38; 1912, Nautilus, 26: 12; 1919, 33: 93, 94, figs. 2, 3.—Vanatta, 1908, Nautilus, 21: 102, 104; 1912, 26: 17-21, 33, 34; 1915, 29: 82, 143; 1919, 33: 18; 1921, 34: 94.—Clapp, 1922, Nautilus, 34: 108.—Hinkley, 1921, Nautilus, 34: 39, 48 (Guatemala).—H. B. Baker, 1927, Proc. Acad. Nat. Sci. Phila., 79: 240, pl. 19, figs. 45, 46 (anatomy).

Helix ierensis Guppy, 1869, Proc. Sci. Asso. Trinidad, p. 242; 1871, Amer. Journ. Conch., 6: 307, pl. 17, fig. 4.

Acanthinula granum Strebel, 1878, Beitrag Kenntn. Mex. Land- u. Süßw.-Conch., 3: 31, pl. 4, fig. 13 (Mirador, V. C.).

The shell is umbilicate, the umbilicus contained $7\frac{1}{2}$ to 8 times in diameter, conoidal, thin, the whorls strongly convex; of dilute, semi-transparent brown color. Surface slightly glossy, with weak growth lines and very obliquely

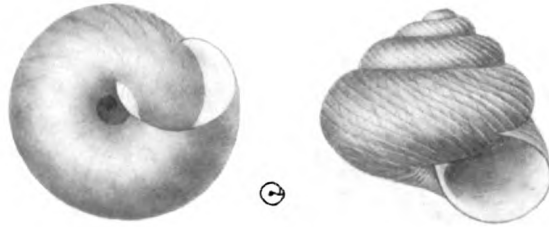


Fig. 576. *Thysanophora plagiptycha*, Lossman's Key, Florida. (Enlarged and actual size.)

retractive periostracal threads which may be more or less interrupted. Aperture rotund-lunate. The peristome is thin, simple, rather broadly dilated at the columellar insertion.

Height 3 mm., diameter 3 mm.; $4\frac{2}{3}$ whorls. Lossman Key.

Height 2.25 mm., diameter 2.5 mm., umbilicus 0.23 mm.; $4\frac{1}{2}$ whorls. Humacao, Porto Rico.

FLORIDA: Captiva Island, Lee Co. Osprey, Manatee Co. Dismal Key, Little Marco, Mound Key, Demorey Key and Horr's I., Lee Co. Russell's Key, Chatham River and Lossman Key, Monroe Co. Middle Cape Sable. Key West, Boca Chica Key, Summerland Key, Big and Little Pine Keys, Bahia Honda Key, Noname Key, Duck Key, Long Key, Key Largo, Pumpkin Key. Coconut Grove. Miami.

TEXAS: Brownsville.

Trinidad to Colombia, Guatemala and eastern Mexico; West Indies generally; type locality Humacao, Porto Rico.

This wide spread tropical snail is easily recognized by the conic shape and the strongly oblique threads of the surface. Specimens have been seen from all of the localities mentioned. Living on the leaves of plants, it is readily transported from place to place.

MICROPHYSULA Cockerell & Pilsbry

Microphysula (Cockerell in litt.) Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 117, type *Helix ingersolli* Bld.

The umbilicate shell is clear, smooth, glossy, discoidal with flat or very low spire of closely coiled whorls. Aperture narrow, crescentic.

The integument of the foot seems to be nearly smooth. The kidney, (Fig. 517 A), is short, the length about twice the greatest width. Its apex is recurved towards the anterior end of the pericardium, the capacious ureter curving quite around the anterior end of the kidney. The external orifice

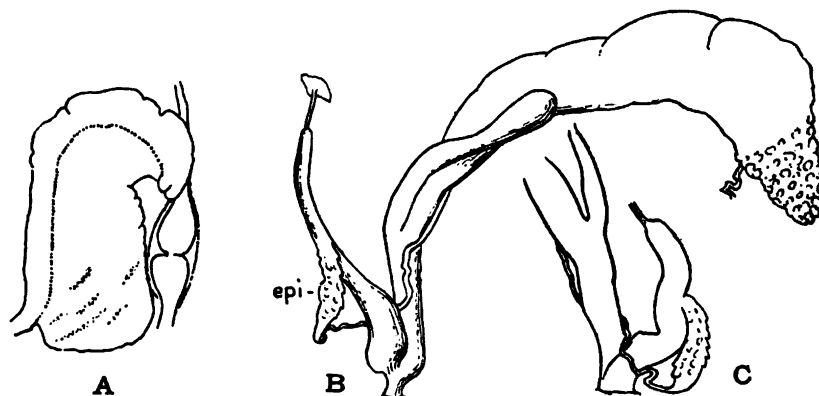


Fig. 577. *Microphysula ingersolli*. A, kidney and heart. B, genitalia. C, lower ducts of another individual. epi, epiphallus.

of the reproductive apparatus is below the right tentacle. The rather long penis appears to extend well beyond the insertion of the epiphallus. Its very short retractor muscle is terminal and attaches to the diaphragm. The epiphallus is a lanceolate, thin-walled, glandular sac, tapering to the vas deferens. The vagina is long. Spermathecal duct rather large, of medium length (Fig. 577 B).

The jaw is described by W. G. Binney as composed of 22 broad flat ribs. It is apparently of the same type as that of *Hojeda* and *Lacteoluna*. The 16.1.16 teeth, as figured by Binney, resemble those of *Thysanophora horni*. No endocones on any of the side teeth.

The type of this genus was naturally thought to be a "*Zonites*," but on examining the jaw and teeth, Binney considered it a *Microphysa*, which was perfectly right as generic limits were then understood. Some years ago Professor T. D. A. Cockerell, influenced by its very different zonal distribution, thought that *ingersolli* might be found to differ generically from the West Indian *Microphysae*, and in a letter suggested the name *Microphysula* for it. On finding valid anatomical characters, the genus was defined in my revision of the thysanophorine genera in 1926. The name is a diminutive of *Microphysa*, little bubble.

Distribution.—Rocky Mountain region and as far south as the Mexican boundary, at considerable elevations and in humid stations; west to eastern Oregon, San Juan Islands, Washington, and Vancouver Island.

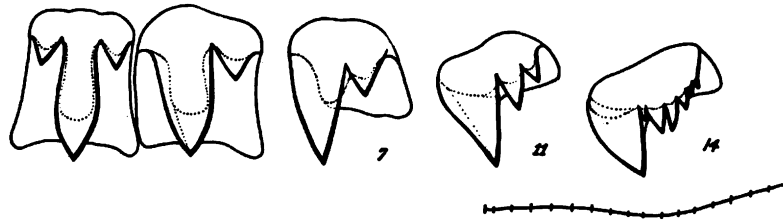


Fig. 578. *Microphysula cookei*, teeth. (After H. B. Baker.)

Dr. H. B. Baker has described the jaw and teeth of *M. cookei* thus:

“Jaw: very similar to that of *Hojeda vanattai* [Fig. 570 E], consisting of 31 narrow plates. Radular formula (Fig. 578): 8-8-1-16; about 90 transverse rows, which are almost straight in lateral but slope slightly anterior in marginal fields. Teeth: central tricuspid; laterals without entocone and with only one ectocone; 9th to 16th teeth shorter, with large mesocone and a varying number of ectocones.”

***Microphysula ingersolli* (Bland)**

Fig. 579 A, B, C.

Helix ingersolli Bland, 1874, Ann. Lyc. Nat. Hist. N. Y., 11: 151, figs.

Microphysa ingersolli Bld., Ingersoll, 1877, Proc. Davenport Acad. Sci., 2: 130.—W. G. Binney, 1878; Terr. Moll., 5: 173, fig. 82, pl. iii, fig. v (teeth); 1883, 1st Suppl., Bull. Mus. Comp. Zool., 11: 148; 1886, 2nd Suppl., Bull. Mus. Comp. Zool., 13: 35, pl. 3, fig. 5; 1890, 3rd Suppl., p. 215, figs.—Cockerell, 1889, Journ. Conch., 6: 62-65.

Thysanophora ingersolli Bld., Dall, Proc. U.S. Nat. Mus., 19: 366.—Pilsbry, 1898, Nautilus, 11: 105, 1910, Proc. Acad. Nat. Sci. Phila., p. 116, fig. 24 a-c.—J. Henderson, Univ. Colo. Studies, 4: 169; 1924, 13: 129; 1929, 17: 90, fig. 46.—Henderson & Daniels, 1916, Proc. Acad. Nat. Sci. Phila., 68: 327, 335; *ibid.*, 69: 54, 62-65.

Microphysula ingersolli (Bld.), Pilsbry, 1926, Proc. Acad. Nat. Sci. Phila., 78: 118, fig. 34.—H. B. Baker, 1927, *ibid.*, 79: 235; 1929, *ibid.*, 81: 251; 1930, Nautilus, 43: 126; 1932, Nautilus, 45: 84.—Chamberlin & Jones, 1929, Bull. Univ. Utah, 19: 74, fig. 24.—Chamberlin & Berry, 1930, *ibid.*, 21: 4; 1929, Nautilus, 42: 124.—E. G. Berry, 1931, Nautilus, 44: 114.—J. Henderson, 1936, Univ. Colo. Studies, 23: 101.

Microphysa ingersolli var. *convexior* Ancey, 1887, Conch. Exch., 2: 64 (Logan Canyon, Utah).

Thysanophora ingersolli convexior Anc., Pilsbry, 1910, Proc. Acad. Nat. Sci. Phila., p. 117.—S. S. Berry, 1916, Nautilus, 29: 127.

“Shell umbilicated, discoidal, thin, translucent, nearly smooth, white; spire flat, summit subimmersed; suture impressed; whorls $5\frac{1}{2}$ rather convex, slowly increasing, the last not descending, more convex below the periphery; breadth of umbilicus nearly 1 mill.; aperture subvertical, higher than broad, lunate; perist. simple, acute, margins remote, columellar margin slightly reflexed, basal margin subsinuate. Diameter maj. 4; min. $3\frac{2}{3}$; alt. $2\frac{1}{2}$ mill.” (Bland.)

BRITISH COLUMBIA: Field (Stew. Brown).

WASHINGTON: 15 mi. east of Walla Walla (Henderson).

OREGON: Walla Walla valley above Milton, and 10 mi. above Weston, Umatilla Co. (H. B. Baker). Weston (Hemphill). Head of Wallowa Lake and west of Enterprise, Wallowa Co. (H. B. Baker).

IDAHO: Old Mission (Hemphill). Southeast of Coeur d'Alene, and north side Baldy Mountain, Cataldo; Cedar Creek valley near Summit; east of Harrison; Fernan Lake, all in Kootenai Co.; Hope and between Sand Point and Coburn, Bonner Co.; Coeur d'Alene River above Larson and around Avery; northeast of Steven's Peak and between Dorsey and Twin Lake, Shoshone Co.; below St. Joe, and above St. Marie's, Benewah Co.; south of Stites; west of Riggins; south of Harpster, and in John Day Creek, Idaho Co.; Mission Creek, 7-8 mi. above Jaques Spur, Nez Perce Co.; along Oro Fino Creek, Clearwater Co. (H. B. Baker). Goodenough Canyon and Harkness Canyon, near McCammon (Henderson & Daniels).

MONTANA: Glacier National Park, and Swimming Woman Creek Canyon, Big Snowy Mountains (S. S. Berry). 16 mi. east of St. Regis (Henderson). Camas Creek Canyon; Lost Horse Canyon, Bitter Root Mountains (Daniels). Around Thompson Falls, Sanders Co., and Rock Creek, northeast of Garrison, Powell Co. (H. B. Baker).

WYOMING: Cliff Creek Canyon, near Jackson (W. O. Gregg).

UTAH: Box Elder Co. (Hemphill). Wasatch Mountains in Logan and Ogden Canyons (Henderson and Daniels); Mount Nebo (Ingersoll) and elsewhere. City Creek Canyon, Salt Lake City; Fillmore; Provo; Beaver, etc.; Kamas, La Sal Mountains (Chamberlin and Jones). Near Willow Springs, Henry Mountains (Chamberlin and Berry). North Creek Gulch, west of Monticello (Henderson).

COLORADO: Generally spread in mountains of the western half of the state. "More common at high altitudes (up to 10,000-11,000 feet), but also at about 5500 feet at Boulder." Howardsville, Baker's Park, 9300 feet above the sea, abundant in wet places in the mountains; not uncommon at Cunningham Gulch, near the former locality, clinging to the almost vertical face of a trachyte cliff at about 11,000 feet; found also on the southern slope of the Saguache Mountains, in the Las Animas (type locality) and La Plata valleys, all in southwestern Colorado (Ingersoll).

KANSAS: Lawrence, on the banks of Kaw River (E. Ingersoll, according to W. G. Binney).

NEW MEXICO: Bland, Sandoval Co. (Ashmun). Capello Canyon, 8000 feet, near Beulah, San Miguel Co. (Cockerell). James Canyon, Clouderoft, Sacramento Mountains (Rehn & Viereck). Cuchillo Mountains, Sierra Co. (Ferriss). Heads of Mineral and Willow Creeks; Whitewater Creek; and Silver Creek above Mogollon, Mogollon Mountains (Ferriss & Daniels). Black Range (Pilsbry).

ARIZONA: Kaibab Plateau and Kaibab Saddle, Grand Canyon; Bill Williams Mountain (Ferriss & Pilsbry). Summit of Mount Mingus, near Jerome (Ashmun). Casper's Pasture, Blue Range, 11,000 feet; Black River, Graham Co. to 10,000 feet; Reservation Creek, Apache Co. (Ferriss). Trail from Weber Canyon to Mt. Lemmon, Santa Catalina Mountains (Ferriss).

Under very high magnification some spiral striae are visible on the intermediate and last whorls but not on the first whorl. The narrowly lunate aperture is characteristic. The spire is weakly convex generally, but there is some variation, even in the same lot, from practically level to distinctly convex.

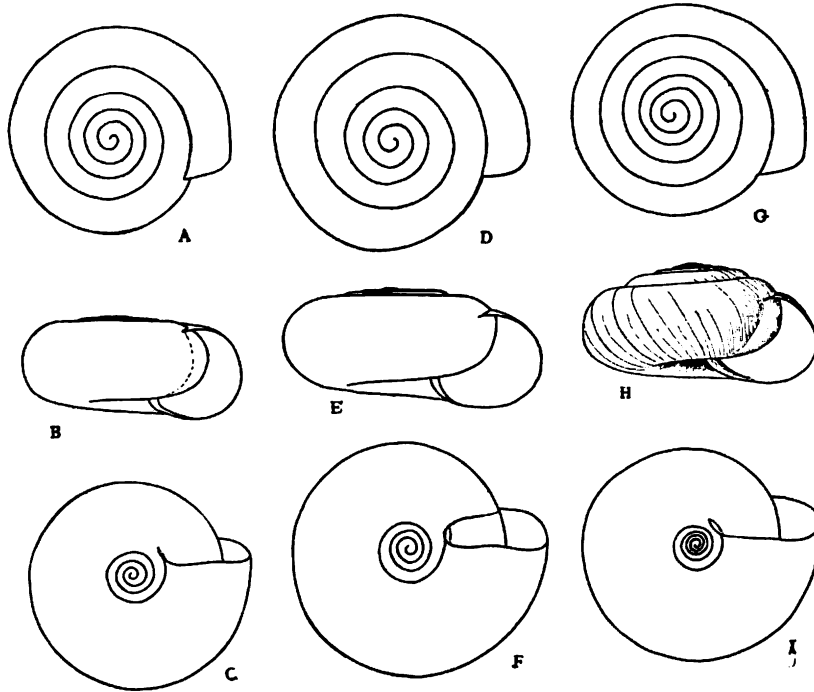


Fig. 579. A, B, C, *Microphysula ingersolli* Mt. Mingus, near Jerome, Ariz.; D, E, F, *M. i. meridionalis* Long Park, Chiricahua Mountains, Ariz.; G, H, I, *M. ingersolli*, Weston, Oregon.

In specimens collected by Hemphill at Weston, Oregon (Fig. 579 G, H, I), the spire is distinctly convex, the aperture perceptibly wider and the umbilicus rather small. Figured specimen measures: height 2.5 mm., diameter 4.8 mm., width of umbilicus 1 mm., $5\frac{1}{2}$ whorls. In good sets from the same region taken by H. B. Baker, 1931, the aperture is narrow, as in the Colorado *ingersolli*, but the spire is distinctly convex.

The var. *convexior* of Ancey was thus defined: "Shell a little smaller; spire scarcely planulate, the apex not subimmersed, distinctly convex; whorls 5, not $5\frac{1}{2}$, regularly but less slowly increasing, umbilicus smaller." (Ancey.) It was from Logan Canyon, Wasatch Mountains, Utah. Henderson and Daniels fully discussed this supposed variety (Proc. Acad. Nat. Sci. Phila., 1917, p. 63), showing that Ancey was misled by the original figures and attached too much importance to the shape of the spire. Many specimens collected by them in Logan Canyon, part of which I have seen, are not distinguishable from ordinary *ingersolli*.

***Microphysula ingersolli meridionalis* (Pilsbry & Ferriss)**

Fig. 579 D, E, F.

Thysanophora ingersolli meridionalis Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., p. 116, fig. 24 d-f.

Shell with a wider aperture than *T. ingersolli*; whorls not quite as closely coiled, scarcely 5 in a shell of over 5 mm. diameter; umbilicus about one-fourth the total diameter; spire nearly flat.

Height 2.3, diameter 5.2, width of umbilicus 1.3 mm.; 4½ whorls.

Height 2.2, diameter 5.4, umbilicus 1.4 mm.; 5 whorls.

ARIZONA: Chiricahua Mts. in Long Park, Type 97366 A.N.S.P.; Bear Park, head of Cave Creek and Rucker Canyon. Huachuca Mts. on Miller Peak. Northern Arizona on Navajo Mt., Laguna Canyon and War God Spring (Ferriss).

UTAH: Blue Mts. and 10 mi. southeast of Monticello, San Juan Co. (Ferriss).

NEW MEXICO: Las Huastus Canyon, Sandia Mts. (Maud Ellis).

The distribution is peculiar. It occurs at high elevations in southeastern Arizona, and also at the northern boundary of the state and the adjacent part of Utah, and eastward in the Sandia Mountains, New Mexico.

***Microphysula cookei* (Pilsbry)**

Fig. 58o.

Zonitoides cookei Pilsbry, 1922, *Nautilus*, 36: 38, fig. 1.

Microphysula cookei (Pilsbry), H. B. Baker, 1929, *Proc. Acad. Nat. Sci. Phila.*, 81: 251, pl. 8, fig. 1 (teeth).—S. S. Berry, 1930, *Nautilus*, 43: 142.

The shell is discoidal, the spire very slightly convex, umbilicus regularly diminishing inward, very near one-fourth the diameter of the shell; whitish, glossy, smoothish, under the microscope showing faint growth lines and on

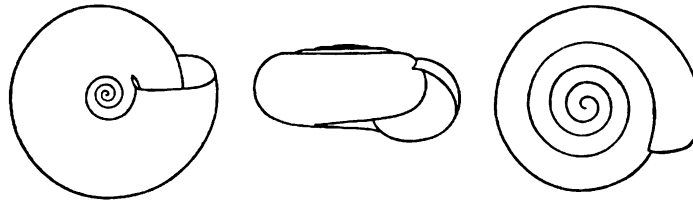


Fig. 58o. *Microphysula cookei*, Cameron Lake.

the upper surface an excessively minute, close and shallow spiral striation on the last 2 or 3 whorls. The whorls increase slowly and are rather convex, the suture rather deeply impressed, last whorl rounded peripherally. The aperture is rather narrow, crescentic.

Height 1.7 diameter 3.6 mm.; 4½ whorls. Cameron Lake.

Height 2.2 mm., diameter 4.4 mm., umbilicus 1.1 mm.; 5 whorls. Near Duncan.

BRITISH COLUMBIA, Vancouver Island: Cameron Lake (C. Montague Cooke). Type 130623 A.N.S.P. Quamisham District near Duncan (A. W. Hanham).

WASHINGTON: English Camp, San Juan Island (E. J. Newcomer).

It is related to *M. ingersolli* and especially to *M. i. meridionalis*, but the whorls are not so closely coiled and the aperture is narrower than in *meridionalis*.

(Named for a life-long Hawaiian friend and collaborator.)

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