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## ON BIFIDARIA PENTODON AND ITS ALLIES.

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The group of *B. pentodon* has been for many years the subject of much perplexity to conchologists, on account of the great variability of the shells in size, shape, and dentition of the aperture. It is easy to select forms which seem perfectly distinct species, but when large series are examined, there is always a residuum of intermediate specimens which can as well be placed in one as another of the selected groups. The difficulty is increased by the fact that practically all of the forms occur over the whole area of the group, though one or another of them may predominate in any given locality. This led Dr. Gould to the conclusion that *P. curvidens* and *tappaniana* are forms of *pentodon* (Boston Journal N. H. IV, 1844, p. 35), an opinion adopted by Binney, and commonly prevalent until recent years, when Dr. Sterki revived *curvidens*. It is the purpose of this article to ascertain the exact forms which have been described, and to show by figures the various modifications of form.

In all the forms the shell is of a white-corneous color and the teeth within the lip stand upon a white callus, in this respect differing from *B. pilsbryana* of the Southwest.

The following names have been applied to the group:

1. *Vertigo pentodon* Say, 1821.
2. *Pupa curvidens* Gld., 1841.
3. *Pupa tappaniana* Ward, C. B. Adams, 1842.
4. *Pupa tappiana* Ward, Pfr., 1842.
5. *Pupa cincinnatiensis* Judge, 1878.
6. *Pupilla floridana* Dall, 1885.

7. *Pupa montanella* Ckll., 1889.

8. *Pupa curvidens* var. *gracilis* Sterki, 1890.

9. *Pupa pentodon* for f. *curta* Sterki, 1894.

The original descriptions of these forms are given below, most of them in full, while of others (nos. 4-6) only the important parts are quoted.

Having examined many hundreds of specimens from all parts of the range of the species in question, it appears that there is intergradation throughout the series in a small proportion of specimens; but the vast majority of specimens fall into two groups which may be given the nominal rank of species, the proposed classification standing as follows:

*B. pentodon* (Say). Synonyms, *cincinnatiensis*, *curta*, *montanella*. "Form" *curvidens*, including *floridana*.

Var. *gracilis* St.

*B. tappaniana* (C. B. Ad.). Synonyms, *tappiana* Pfr., *pentodon* auct.

NOTE.—The figures are all drawn to one scale ( $\times 13.8$ ), and any may be accurately measured by plotting on paper a scale with the lines 13.8 mm. apart; each space then representing 1 mm. Thus fig. 1 is 1.8 mm. long.

BIFIDARIA PENTODON (Say). Figures 1 to 41. Fig. 1 is typical.

The shell is small, varying from conic to subcylindric in shape. Teeth typically 5, of which the parietal, columellar and lower palatal are larger and compressed, the lower palatal entering a little more deeply than its fellows in the outer margin; but often subcolumellar, basal, and interpalatal denticles are developed. Figs. 1 to 8 are from Maine specimens, showing the ordinary variations. The development of a crest behind the lip varies a good deal, from weak to very strong, with all intergrades. *P. cincinnatiensis* (fig. 35, a cotype) is a small form of *pentodon*.

The increase in number of accessory denticles or teeth culminates in the form named *curvidens*, represented in figs. 9 to 15, also 3, 6, 32 and perhaps some others, as there is absolutely no line to be drawn between *pentodon* and *curvidens*. The number of teeth varies from 5 to 9 in perfectly adult shells of the same gathering from one spot. The development of an infraparietal denticle is also extremely variable in many lots, as in that from Buckfield, Me., figs. 1 to 4, 8. *P. floridana* (fig. 9, a cotype from the author) is absolutely identical with *curvidens*.

It may be stated as proven that some colonies consist of "pentodon" and intermediate forms; some of "pentodon," intermediate and "curvidens" forms; and some of the intermediate and "curvidens" forms. We have found no large gathering of wholly typical *pentodon* or entirely *curvidens*. Either form may be found with a low or high crest—this being usually more constant in any one colony than the number of teeth or the size and shape of the shell. The only theory upon which *curvidens* could be retained as a species or subspecies would be to assume that two species are living in a state of hybridism—an assumption which seems to us baseless.

*Bifidaria pentodon gracilis* Sterki. Figs. 16 to 27.

This is usually larger, more cylindric, with 5 teeth, though perfectly mature shells may have as few as 3 (figs. 19, 26,) or as many as 6 or 7 (figs. 16, 18, 21). It was originally described from New Philadelphia, Ohio, but those figured are from Alabama; figs. 16, 17, 21 to 27 from around Wetumpka, 18, 19, from Woodville, 20 from Big Wills Valley, coll. by H. H. Smith and H. E. Sargent. None of them has an infraparietal denticle.

While this race seems to be tangibly differentiated in the hill region of Alabama, specimens may be selected from other lots of *pentodon* which could not possibly be distinguished if mixed with the Ala. shells; for instance fig. 31, Henry Co., Ind., and fig. 33, Des Moines, Ia., both taken from lots varying in shape from long and cylindric to shorter and more conic.

The original descriptions of forms referred to *pentodon* here follow.

"*V. pentodon*. *Shell* dextral, subovate, whitish horn-color; *apex* obtuse; *whorls* five, glabrous, convex; *suture* not very deeply impressed; *aperture* semioval; *labium* two-toothed, of which a single very prominent one is on the middle of the transverse portion or true labium, and the other is remote, much smaller and placed in the basal angle of the columella; *labrum* regularly arcuated, tridentate, tooth nearest the base very small and placed near the smaller tooth of the columella, the two others larger, subequal; umbilicus distinct. Length less than one-tenth of an inch.

"*Animal*. Tentacula two, rather long and thick, cylindrical-ob-conic, retractile, with a rounded oculiferous extremity; two hardly elevated truncated tubercles instead of the anterior tentacula; *foot* white; *head* and neck, as far as the mantle, black.

"Inhabits Pennsylvania. The lower tooth of the labrum is sometimes obsolete." (Say, Journ. Acad. Nat. Sciences Phila., vol. 2, 1821, p. 376.)

NOTE.—*This is not the comparatively large and conic multidentate form commonly known in recent years as pentodon; but a five- or six-toothed form which has hitherto been referred to curvidens.*

"*Pupa curvidens*. Shell minute, ovate, but much elongated, of a spermaceti-white color; whorls five, convex, smooth, gradually diminishing to an obtuse apex; suture deeply impressed, aperture subtriangular, with the front and outer angles rounded, and the outer lip curved inwards, so as almost to make the aperture heart-shaped; the transverse margin is straight, and slightly oblique; the inner lip is also nearly straight, so that these two form a rightangle at their junction; lip widely reflected, flattened, white; throat armed with nine teeth; the longest, somewhat curved to the left, compressed and pointed, is situated on the middle of the transverse lip, and has a small one seated at its left side; at the front, nearly opposite the large tooth, almost as large and inclined to the left also, is a quadrangular, blunt tooth, more slightly curved; on the left margin are three teeth, of which the upper one is larger, and about the size of the basal tooth, of a blunt quadrangular figure; the other two are minute; on the outer lip are also three teeth, of which the two upper are very small and pyramidal; umbilicus open. Length  $\frac{1}{15}$  inch, breadth  $\frac{1}{40}$  inch.

"This minute species I first found under a loose stone on the ledges at Phillips Point, Lynn, near the Ocean House. \* \* \* \* Four of the teeth are very small, and would scarcely be discerned without being highly magnified, and they seem to be seated farther within the aperture; the small one on the transverse lip, the basal one, and the upper one on the right lip are liable to be wanting. So far as I can ascertain, it has not been previously described, unless several of the teeth have been overlooked. It is nearest allied to *P. pentodon*" (Gould, Report on the Invertebrata of Massachusetts, 1841, p. 189, f. 120).

"*Pupa cincinnatiensis* Judge. \* \* \* peristome simple, heavily thickened near the margin, the callus extending over the parietal wall; aperture contracted by five prominent denticles, seated on the callus, one prominent on the parietal wall, two on the columella, the

lower being the smaller of the two, and two on the outer portion of the peristome, more deeply seated in the throat, and occasionally one or two very minute rudiments on the peristome. Length 1.56, diam. 84 mm. This shell is found on both sides of the Ohio River, near Cincinnati." (Judge, The Quarterly Journ. of Conch., p. 343, 1878.)

"*Pupilla floridana* Dall. \* \* \* subcylindrical \* \* \* teeth about 9, of which there are generally 3 larger than the rest, their tips nearly meeting and their bases mutually nearly equidistant; one is on the pillar, one on the body-whorl, and one on the anterior margin; on either side of the latter are two generally subequal, much smaller denticles. Lon. 1.6, lat. .75 mm. Archer, Alachua Co., Fla." (Dall, Proc. U. S. Nat. Museum, Vol. 8, 1885, p. 261, pl. 17, f. 11.)

The figure seems to have two teeth on the parietal wall, two on the columella and five in the palatal region. This is practically identical with the arrangement described under *curvidens*.

"*Pupa montanella*. A minute *Leucochila* which I have found very sparingly at about 8400 feet in West Custer Co. (Colorado), to which I have given the name *P. montanella* sp. nov., but do not describe it pending further investigations." (Ckll., The Journ. of Conch., Leeds, Vol. vi, 1889, p. 63.)

"*P. montanella*, indicated on the same page as *P. coloradensis*, proves to be a form of *P. pentodon*." (Ckll., The Brit. Nat., 1891, p. 101.)

Since no definition of any kind has been published, this name becomes an absolute synonym of *B. pentodon*.

"*Pupa curvidens* var. *gracilis*. On a gravelly bank at New Philadelphia, Ohio, there is a peculiar form of our species; long, slender, nearly cylindrical, with only 5 typical lamellæ, no accessory ones. \* \* \* I thought it not out of place to name it var. *gracilis*." (Dr. V. Sterki, NAUTILUS, iii, 1890, p. 119.)

"*Pupa curvidens gracilis* Sterki. Scarce. New Philadelphia. A peculiar form intermediate in shape between the type and *Pupa holzingeri* Sterki. It has also been seen from Rhode Island, Tennessee and Alabama." (Sterki, The Land and Fresh-water Mollusca in the Vicinity of New Philadelphia. A contribution to the Nat. Hist. of Tuscarawas Co., Ohio, 1894.)

"*Pupa pentodon* f. *curta*. Examples from wet places are small

and short ovoid (f. *curta*).” (Sterki, Land and Fresh-water Mollusca in the Vicinity of New Philadelphia, etc., p. 5, 1894.)

*BIFIDARIA TAPPANIANA* (C. B. Adams). Figs. 42 to 53.

The shell is larger than *pentodon*, markedly conic though obtuse; only one tooth on the parietal wall, usually 6 on the columellar, basal and outer margins, those on the latter standing on a strong rib. Lower palatal tooth usually not so long and entering as in *B. pentodon*.

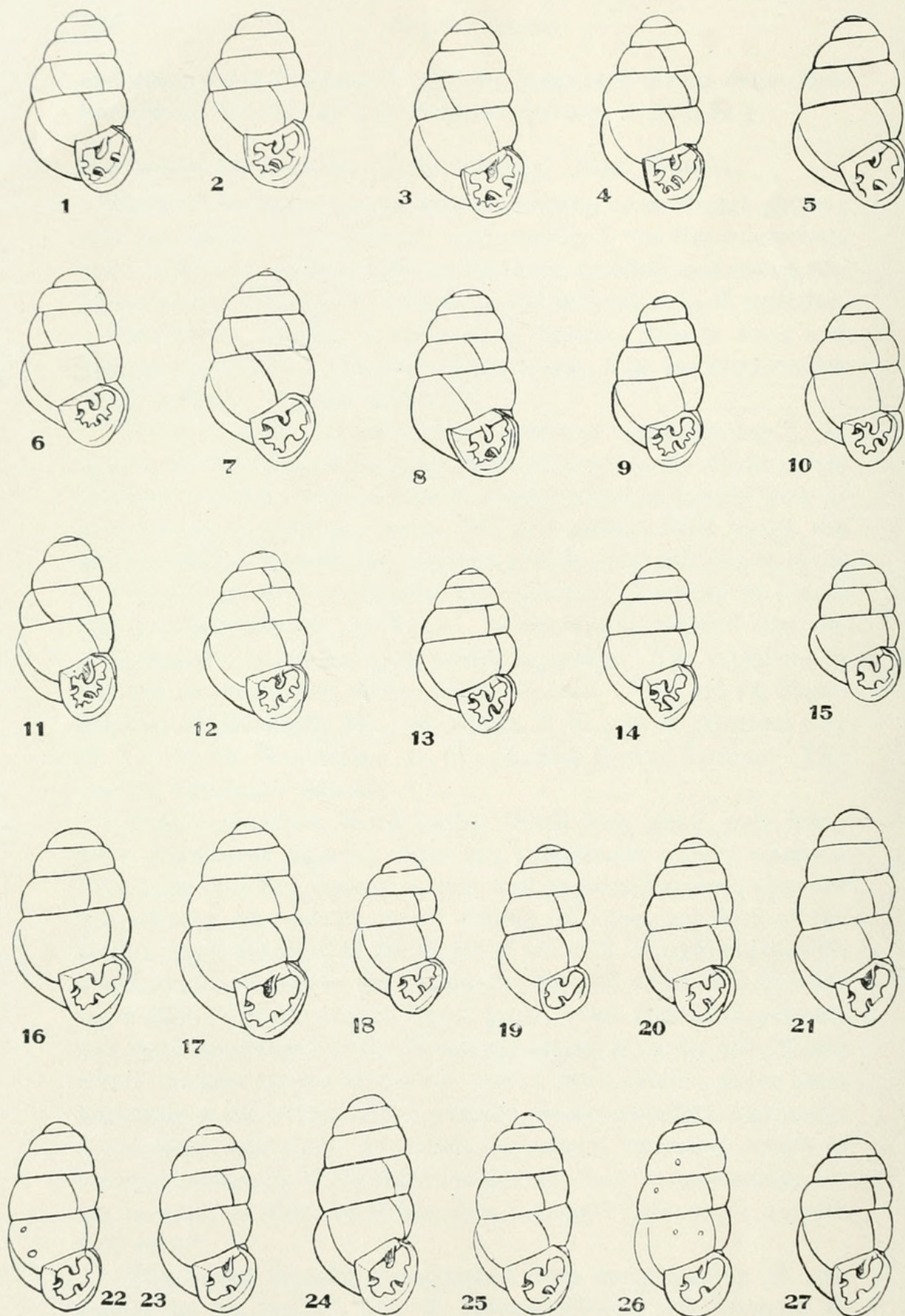
Distribution, Ontario to the Gulf of Mexico, west to Iowa and Kansas, southwest to Arizona, but not known from the southeastern Atlantic States, Virginia to Florida.

This is the form now everywhere known as “*pentodon* Say.” It is often a difficult question, upon which no two experts might agree, whether to refer a certain specimen to *tappaniana* or to some form of *pentodon*, since while the larger size and globose-conic shape are characteristic of *tappaniana*, yet intermediate sizes and shapes occur occasionally, so that we disclaim any intention of setting up a definite boundary between the forms. It can only be claimed that the great majority of lots are quite readily separable. The variations in size and shape are well shown in the figures. Figs. 42, 43, Philadelphia; 44, Buckfield, Me.; 45, Ithaca, N. Y.; 46–48, Dutchess Co., N. Y.; 49–52, Washington, D. C.; 53, Oak Creek, Arizona. The original description follows:

“*Pupa tappaniana* Ward, inedit. Shell very small, pale horn-color, translucent, tapering above the penultimate whorl; whorls a little more than five, convex, with a well-impressed suture; aperture sub-orbicular (the penult. whorl cutting off about one-third of the circle), about one-third of the length of the shell; margin sharp, with a narrow contraction in the submargin, beneath which is a thickening within, on which are the labial teeth; teeth eight, five primary and three secondary; of the former the largest is on the penultimate whorl, the next largest on the left side of the aperture; at the base, beginning at the left hand, is a primary, then a secondary, a primary, a secondary, a primary and another secondary, extending nearly to the upper extremity of the right margin; the last three primaries are not constant in size; umbilicus open. Length 0.08 inch; breadth 0.05 inch.

“This species is easily distinguished from the preceding (*P. contracta*) by its teeth.” (C. B. Adams, History of Vermont, Z. Thompson, 1842, p. 158.)





*Bijidaria pentodon*. 1-4, 8. Buckfield, Me.; 5. Woodland, Me.; 6. Fairfield, Me.; 7. Westbrook, Me.; 9. Alachua Co., Fla.; 10. Volusia Co., Fla.; 11. San Marcos, Tex.; 12. Comal Co., Tex.; 13, 16, 17. Wetumpka, Ala.; 14, 15, 20. Near Valley Head, Ala.; 18, 19. Woodville, Ala.; 21-27. Wetumpka, Ala.



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