Fig. 124. Dentition of *A. harpa*. (Binney.)**ACANTHINULA HARPA** (Say).Fig. 125.
A. harpa.
(Binney.) $\times 6$.

Shell subperforate, ovately conic, pellucid, very thin, irregular striate, light horn color; spire conical, rather obtuse; whorls four, convex, the upper ones smooth, the last two with prominent distant, thin, colorless ribs, the last whorl rounded, somewhat longer than the spire; aperture lunately oval; peristome simple, acute.

Alt. $3\frac{1}{2}$, greater diam. 2 mm.

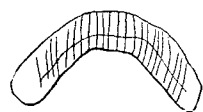
Helix harpa, Say, Long's Exped., II., 256, pl. XV., fig. 1, (1824).
Acanthinula harpa, W. G. Binney, Man. Am. Land Shells, 185, fig. 183, (1885).
Walker, Rev. Moll. Fauna Mich., 16, (1894).

A northern species. The Porcupine mountains, Ontonagon county, and Isle Royale, in the Upper Peninsula, and Charlevoix, Petoskey and Beulah, Benzie county, in the Grand Traverse region are the localities thus far reported. Easily distinguished by its elevated shape and prominent ribs.

Genus PUPOIDES Pfeiffer.

Shell rimate, cylindrically ovate, apex rather obtuse, rather smooth, shining, pellucid; whorls 6-7, rather convex, aperture semi-ovate, edentate; peristome thickened, reflected, its external margin decidedly arcuate.

Animal as in *Pupilla*.

Fig. 126. Jaw of *P. marginatus*.Fig. 127. Dentition of *P. marginatus*. (Binney.)**PUPOIDES MARGINATUS** (Say).Fig. 128.
P. marginatus.
(Binney.) $\times 4$.

Shell fusiform, regularly diminishing in size from the body-whorl to the apex, smooth; brownish horn-color; whorls 6 very convex, very lightly striate; suture well impressed; aperture lateral, rounded oval; peristome white, rather broadly reflected, strongly curved above; umbilicus perforated.

Alt. $5\frac{1}{2}$, diam. 2-2 $\frac{1}{2}$ mm.

Cyclostoma marginata, Say, Jour. A. N. S. P., II., 172, (1821).
Pupa fallax, W. G. Binney, Man. Am. Land Shells, 324, fig. 351, (1885).

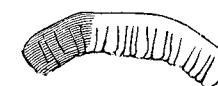
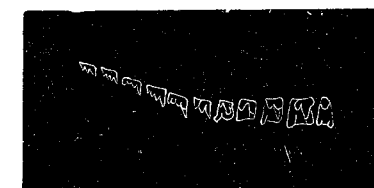
Bulimus marginatus, Miles, Rep. Geol. Surv. Mich., 236, (1861).
Pupa fallax, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Not a common species. Reported from Berrien, Kent, Genesee, Monroe, and Washtenaw counties.

Genus BIFIDARIA Sterki.

Shell small, umbilicus perforate, cylindrical, turriculate, conic or ovoid; surface smooth, polished or finely striate or, rarely, finely ribbed; aperture lateral, oval or sub-orbicular; contracted by one or more teeth on the parietal wall and inner margin of the lip and columella; peristome expanded or reflected; parietal lamella large and more or less distinctly complex, formed by the fusing of the parietal and supraparietal lamellæ; the columellar lamella also generally somewhat complex; the typical inferior and superior palatal lamellæ are generally present and as a rule deep seated, never reaching the margin.

Animal, jaw and dentition as in *Pupilla*.

Fig. 129. Animal of *B. tappaniana*. (Binney.)Fig. 130. Jaw of *B. tappaniana*. (Binney.)Fig. 131. Dentition of *B. tappaniana*. (Binney.)**KEY TO THE SECTIONS OF BIFIDARIA.***

- I. Parietal and angle lamellæ very short, small and tuberculiform; no palatal folds; shell cylindrical.....*Privatula*.
- II. Parietal and angle lamellæ elongate, more or less united, either by a callous ridge, or so extensively as to appear like a single sinuous, or emarginate lamella.....*Albinula*.
- III. Parietal lamella simple; no angle lamella; parietals normal or increased by accessory denticles, often standing on a callous ridge.. *Vertigopsis*.

KEY TO THE SPECIES OF BIFIDARIA.

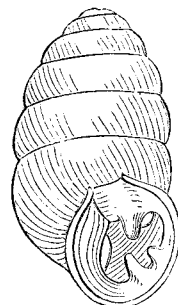
- I. Base of shell between umbilicus and margin compressed, forming a keel.
 - a. Shell cylindrical, apex obtuse, length more than $4\frac{3}{4}$ mm.....*armifera*.
 - aa. Shell sub-conical, length 3 mm.....*contracta*.
- II. Base of shell rounded.
 - a. Aperture multidentate, labial teeth on a ridge of callus, contracting the aperture.
 - b. Shell obtusely conical, last whorl widest, parietal and inferior palatal teeth straight.....*tappaniana*.

* Adapted from Pilsbry, Proc. A. N. S. P., 1900, 593.

- bb. Shell cylindrical, last whorl not wider than the penultimate, parietal and inferior palatal teeth curved.....*pentodon*.
 aa. Aperture not thickened within, no labial teeth.....*corticaria*.

Section **ALBINULA** Sterki.

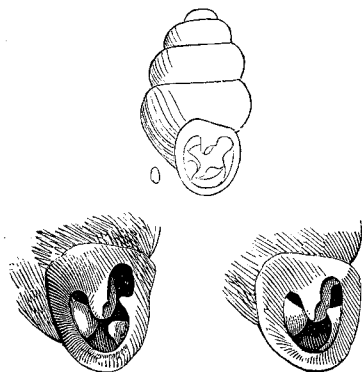
Throat nearly closed by teeth. Shell oblong or conic, rather wide; parietal and columellar lamellæ long and tortuous, the latter more or less vertical; palatal folds several, situated on a ridge.

BIFIDARIA ARMIFERA (Say).Fig. 132. *B. armifera*.
(Binney.) $\times 8.6$

Alt. $4\frac{2}{3}$, diam. $2\frac{2}{3}$ mm.

- Pupa armifera*, Say, Jour. A. N. S. P., II., 162, (1821).
 ———, W. G. Binney, Man. Am. Land Shells, 325, fig. 352, (1885).
 ———, Miles, Rep. Geol. Surv. Mich., 236, (1861).
Leucochilla ———, Currier, Shell-bearing Moll. Mich., 6, (1868).
 ———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).
Pupa ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Generally distributed in the southern part of the state. Easily distinguished from *B. contracta*, which is the only species resembling it in the form of the aperture, by its greater size and the arrangement of the apertural lamellæ.

BIFIDARIA CONTRACTA (Say).Fig. 133. *B. contracta*. (Binney.)

Shell subconical, white, whorls 5-6, very convex, diminishing regularly from the last whorl to the apex; suture well impressed; peristome white, somewhat reflected, its extremities connected by a raised testaceous fold making the margin of the aperture entire; aperture rather triangular, expanded above and diminishing regularly into a very narrow throat; lamellæ four; parietal, large, coarse and irregular, projecting into the aperture; superior palatal fold not large, tuberculous and placed near the margin of the peristome, the inferior palatal large, deeply seated near the base, the columellar lamella large and massive and deeply seated

in the throat; umbilicus minutely perforate; base of shell sharply keeled between the umbilicus and margin; last whorl impressed behind the peristome.

Alt. 3, diam. $1\frac{3}{4}$ mm.

- Pupa contracta*, Say, Jour. A. N. S. P., II., 374, (1822).
 ———, W. G. Binney, Man. Am. Land Shells, 327, fig. 353 $\frac{1}{2}$, (1885).
 ———, Miles, Rep. Geol. Surv. Mich., 236, (1881).
Leucochilla ———, Currier, Shell-bearing Moll. Mich., (1868).
 ———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).
Pupa ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

The most common species of the genus and of general distribution over the entire state.

Section **PRIVATULA** Sterki.

Parietal and angle lamellæ very small, short and tuberculiform; no palatal folds; shell cylindrical.

BIFIDARIA CORTICARIA (Say).Fig. 134.
B. corticaria.
(Binney.)

Shell whitish, shining, cylindrical, apex obtuse; whorls 5-6, convex; suture well impressed; aperture two-thirds as wide as the last whorl, sub-orbicular, with a single tooth (sometimes two) on the parietal wall, near the centre and a tooth-like enlargement near the umbilical termination of the peristome, which is white, reflected; umbilicus very minutely perforated.

Alt. $2\frac{1}{2}$, diam. 1 mm.

- Odostomia corticaria*, Say, Nich. Encycl. IV, pl. IV, fig. 5, (1817).
Pupa ———, W. G. Binney, Man. Am. Land Shells, 330, fig. 355, (1885).
Leucochilla ———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).
Pupa ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Apparently of general distribution over the entire state. Differs from all the other species of the genus in the lack of labial teeth.

Subgenus **VERTIGOPSIS** (Ckll.) Sterki.

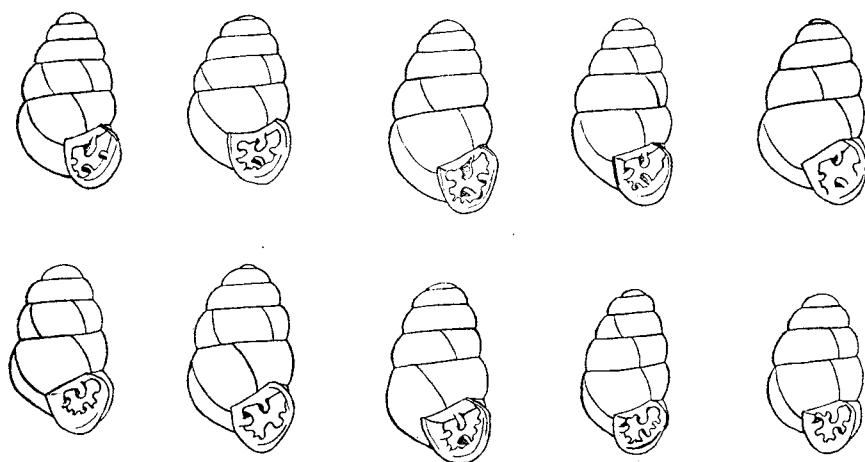
Parietal lamella simple; no angle lamella; palatals normal or increased by accessory denticles, often standing on a callous ridge.

BIFIDARIA PENTODON (Say).

Shell ovate, sub-cylindrical, much elongated; spermaceti white; whorls 5, convex, smooth, gradually diminishing to an obtuse apex; suture deeply impressed; aperture sub-triangular, the transverse margin straight and slightly oblique, columella nearly straight; peristome somewhat expanded, thickened within by a callus deposit bearing the lamellæ; lamellæ five to nine, the parietal and inferior palatal curved to the left; perforate.

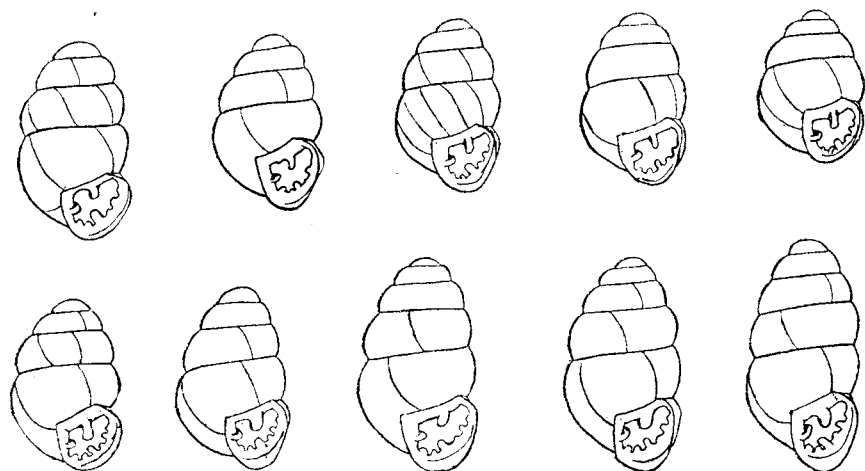
Alt. $1\frac{3}{8}$ diam., $\frac{5}{8}$ mm.

- Vertigo pentodon*, Say, Jour. A. N. S. P., II., 376, (1821).
Pupa curvidens, Gould, Invert. Mass., 189, fig. 120, (1841).
 ——— *pentodon*, W. G. Binney, Man. Am. Land Shells, 323, fig. 347, (1885).
 ——— *curvidens*, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Fig. 135. *B. pentodon*. (P. & V.) $\times 13.8$.

Not abundant, but apparently of general distribution through the state. Closely related to *B. tappaniana*, from which it is distinguished by its smaller size, more cylindrical outline, and curved parietal and inferior palatal folds. This species has been commonly known as *B. curvidens* Gld., But Dr. Pilsbry has recently shown that this is the *B. pentodon* of Say and not the species usually so called.

BIFIDARIA TAPPANIANA (C. B. Adams).

Fig. 136. *B. tappaniana*. (P. & V.) $\times 13.8$.

Shell sub-perforate, elongate, ovate, of a spermaceti or whitish horn-color; whorls 5, well rounded and separated by a deep suture; apex rather acute; aperture oblique, nearly semi-circular; peristome sharp and somewhat expanded, but not reflected; the inner margin thickened by a ridge of white callus, on which the palatals are situated; lamellæ 5 to 10, of which

the parietal is the largest, the columellar next and the inferior palatal third in size; parietal and inferior palatal straight.

Alt. 2, diam. 1 mm.

Pupa tappaniana, C. B. Adams, Thomp. Hist. of Vt., 158, (1842).
pentodon, W. G. Binney, Man. Am. Land Shells, 323, fig. 348, (1885).

—, Miles, Rep. Geol. Surv. Mich., 236, (1861).
Pupilla —, Currier, Shell-bearing Moll. Mich., 6, (1868).
 —, DeCamp, Shell-bearing Moll. Mich., 7, (1881).
Pupa —, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Distribution probably the same as that of *B. pentodon*. This species and *pentodon* are distinguished by the ridge of callus within the lip on which the lamellæ are situated. Heretofore usually known as *B. pentodon* Say. But Say's species is that commonly called *B. curvidens* Gld.

Genus PUPILLA Leach.

Shell deeply rimate or perforate, cylindrically shortened, apex extended into an obtuse cone, horn-colored, smooth; whorls 5-9; aperture rounded with few or no folds; peristome somewhat expanded.

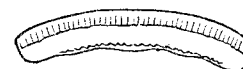
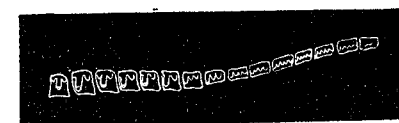


Fig. 137.
 Animal of *P. muscorum*.
 (Binney.)

Animal heliceform, small, short, blunt before, tapering behind; mantle posterior, thin, protected by a shell; respiratory and anal orifices on the right side of the mantle, under the peristome of the shell; generative orifice behind the right eye-peduncle; eye-peduncles long; tentacles stout, very short; no caudal mucus pore or locomotive disk.

Jaw slightly arched, concave edge waved.

Lingual band narrow, central teeth tricuspid, laterals bicuspid, uncini serrated.

Fig. 138. Jaw of *P. muscorum*. (Binney.)Fig. 139. Dentition of *P. muscorum*. (Binney.)

PUPILLA MUSCORUM (Linæus.)

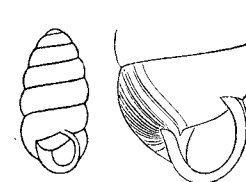


Fig. 140.
P. muscorum. (Morse.) $\times 5$.

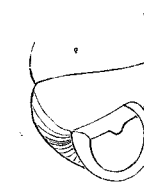


Fig. 141.
 Var. *unidentata*. (Morse.)



Fig. 142.
 Var. *bigranata*.

Shell perforate, sub-cylindrical, apex obtuse, dark chestnut color; whorls 6-7, rounded, finely striate; suture deep; aperture nearly circular, small, thickened internally, edentulous; peristome thin, sharp, with a thick, white exterior rib slightly behind it.

Alt. 4, diam. $1\frac{1}{2}$ mm.

Turbo muscorum, Linnæus, Syst. Nat., ed. X., I., 767, (1758).

Pupa ———, W. G. Binney, Man. Am. Land Shells, 78, fig. 40, (1885).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Var. **UNIDENTATA** C. Pfr.

A single denticle on the parietal wall.

Pupa unidentata, C. Pfr., Nat. Deutsch L. & S. Moll. I. pl. III., fig. 19-20, (1821).

Var. **BIGRANATA** Rossmæsler.

Two teeth, one parietal and one basal.

Pupa bigranata, Rossmæsler, Icon. IX., X., 27, fig. 645 (1839).

Easily distinguished from all other Michigan species by its stout, cylindrical form, and strong white rib behind the outer lip. The only localities reported are Grand Rapids and Detroit. The single example from the former locality which I have seen, is the typical edentulous form, but all three forms are represented in the Detroit lot, the unidentate variety, as usual, being the most numerous.

Genus **VERTIGO** Draparnaud.

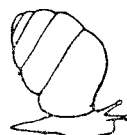


Fig. 143.
Animal of *Vertigo*.
(Leach.)

Shell deeply rimate, ovate, spire acuminate, apex obtuse, whorls 5-6, convex, the last rounded, aperture semi-oval, with 4 to 7 folds; peristome scarcely expanded, white lipped.

Animal as in *Pupilla*, but lower tentacles wanting.

Jaw more or less arched, ends but little attenuated, blunt; anterior surface with delicate vertical striæ; cutting margin with a more or less developed median projection.



Fig. 144. Jaw of
V. ovata. (Binney.)

Radula long and narrow; centrals with basal plates higher than wide, sub-rectangular, tricuspid; laterals similar to centrals, but asymmetrical; marginals low, wide, multidentate.

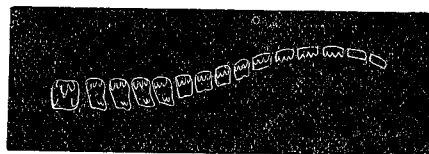


Fig. 145. Dentition of *V. ovata*. (Binney.)

KEY TO SUBGENERA OF *VERTIGO*.

- I. Palatal folds simple, no accessory gular fold. *Vertigo* s. s.
- II. A long gular fold deflected at its inner extremity, connected with one of the palatals. *Vertilla*.

KEY TO SPECIES OF *VERTIGO*.

- I. Outer lip flattened, not indented.
 - a. Aperture regularly rounded below, two columellar teeth, palatal teeth lamellar. *bollesiana*.
 - aa. Aperture rounded above, narrower below. One columellar tooth, palatal teeth tubercular. *tridentata*.

II. Outer lip strongly indented at its upper third.

- a. Shell oval or subcylindrical, last whorl not wider than the penultimate.
 - b. Last whorl scarcely higher and narrower than penultimate. Alt. 2.7 mm. *morsei*.
 - bb. Last whorl nearly one-half entire length, wide as penultimate. Alt. 2 mm. *gouldii*.
 - bbb. Penultimate whorl widest, shell very minute. Alt. 4-5 mm. *milium*.
- aa. Shell ovate, conic, ventricose, last whorl widest.
 - b. Larger, ventricose whorls 5, Alt. 2 mm. *ovata*.
 - bb. Smaller, sub-cylindrical, whorls 4, Alt. $1\frac{3}{4}$ mm. *ventricosa*.

Subgenus **VERTILLA** Moquin-Tandon.

Shell minute, last whorl narrowed toward the aperture, which is indented by a deep constriction corresponding to the superior palatal fold, a long gular fold connecting with one of the palatals and abruptly deflected at its inner extremity, columellar lamella long, bulging in the centre and parallel with the columella; inferior palatal smaller than the superior.



Fig. 146. Arrangement of apertural folds in *Vertilla*. (Sterki.)

VERTIGO MILIUM (Gould).

Shell very minute, subcylindrical, diminishing equally to both extremities; dark amber or chestnut color; whorls 5, rounded, very minutely striate; apex obtuse; suture deep, peristome white; aperture within brownish, general shape semi-circular, truncated above by the last whorl, outer lip incurved in the middle, lamellæ 6-8, two parietal, two columellar, two palatal, the superior one large, lamellar, and sharply bent downward at its inner extremity.

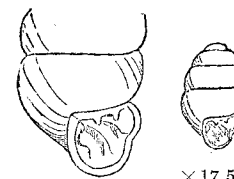


Fig. 147. *V. milium*. (Morse.)

Alt. 4-5, diam. 2-5 mm.

Pupa milium, Gould, Bost. Jour. Nat. Hist. III., 402, pl. III., fig. 23, (1840).

Vertigo ———, W. G. Binney, Man. Am. Land Shells, 332, fig. 361, (1885).

———, Currier, Shell-bearing Moll. Mich., 6, (1865).

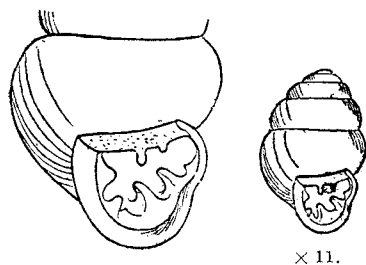
———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

Pupa ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Rarely reported, probably on account of its small size. Reported from Newaygo, Kent, Bay, Oakland, Washtenaw and Lenawee counties.

Subgenus **VERTIGO** s. s.

- * Palatal folds simple; no gular fold.

VERTIGO OVATA Say.Fig. 148. *N. ovata*. (Morse.)

to; umbilicus open.

Alt. 2, diam. 1 mm.

Vertigo ovata, Say, Jour. A. N. S. P., II., 375, (1822).

———, W. G. Binney, Man. Am. Land Shells, 333, fig. 362, (1885).

Pupa ———, Sager, Doc. H. Rep. Mich., 1839, 420, separate 14.

Vertigo ———, Miles, Rep. Geol. Surv. Mich., 236, (1861).

———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

The most common species of the genus and of general distribution over the entire state. Distinguished from *V. morsei* by its ventricose last whorl and conical spire, and from the other species of the genus by its larger size and usually greater number of apertural lamellae.

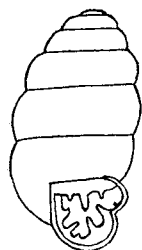
VERTIGO MORSEI Sterki.

Fig. 149.

V. morsei. x13. two on the columella, the columellar strong, with the tip abruptly bent upwards, the subcolumellar horizontal, lamelliform, thin, high and directed obliquely upward; basal small, sometimes double, rarely wanting; palatals high and rather long, curved and directed upward, suprapalatal small, nodule-like.

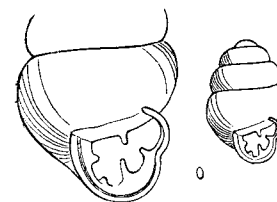
Alt. 2.7, diam. 1.3; apert. alt. 0.9, lat. 0.8 mm.

Vertigo morsei, Sterki, Naut. VIII., 89, (1894).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

The types of this species were discovered by the late Dr. W. H. DeCamp at Dewey's mill near Grand Rapids. Also found in Eaton and Washtenaw counties. It has been found in the post-glacial deposits in Bay and Washtenaw counties.

Easily distinguished from *V. ovata*, which is the only species with which it is likely to be confounded by its greater size, cylindrical shape and peculiar columellar lamella.

VERTIGO VENTRICOSA (Morse).Fig. 150. *V. ventricosa*. (Morse.)

Isthmia ventricosa, Morse, Ann. N. Y. Lyc., VIII., 1, fig. 1-3, (1865).

Vertigo ———, W. G. Binney, Man. Am. Land Shells, 192, fig. 196, (1885).

———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Var. ELATIOR Sterki.

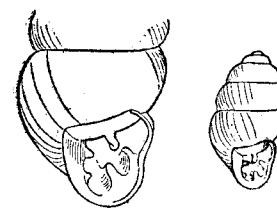
Larger and more elevated than the type, ovate to oblong, with rather a pointed apex; a strong callus on the parietal wall, into which the plicae merge, a strong tooth-like lamella in the base.

Vertigo ventricosa elatior, Sterki, L. & F. W. Moll. New Phila., 5, (1894).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Grand Rapids and Beulah, Benzie county are the only reported localities for the typical form. The variety is more common and has a general range through the lower peninsula.

Smaller, lighter colored and less ventricose than *V. ovata* and more regularly cylindrical, especially the var. *elatior*.

VERTIGO GOULDII (Binney).Fig. 151. *V. gouldii*. (Morse.)

Alt. 2, diam. 1, Alt. aper. $\frac{2}{3}$ mm.

Pupa gouldii, Binney, Proc. B. S. N. H., I., 105, (1843).

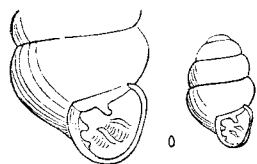
Vertigo gouldii, W. G. Binney, Man. Am. Land Shells, 190, fig. 191, (1885).

——— *gouldii*, Miles, Rep. Geol. Surv. Mich., 236, (1861).

———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Generally distributed over the state, but it is apparently not as common a species as *ovata*, though usually abundant where found. A well marked species, not likely to be confounded with any of the other species found in the state, except, perhaps, *V. ventricosa elatior*, from which it is to be distinguished by its subcylindrical rather than conical shape, striate surface and "position of the tooth-like lamella at the base, somewhat nearer the margin than the end of the columella, the base perceptibly widening at that place."

VERTIGO BOLLESIANA (Morse).Fig. 152. *V. bollesiana*. (Morse.)

Shell perforate, cylindrical-ovate, delicately striate; light horn-color; apex obtuse; whorls four, subconvex; suture well impressed; aperture sub-orbicular, somewhat flattened on its outer edge but not indented; lamellæ five, one parietal, two columellar and two slightly elevated, lamelliform, within and at the base; peristome subreflected and thickened.

Alt. $1\frac{5}{8}$, diam. $\frac{7}{8}$ mm.

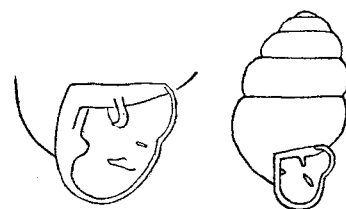
Isthmia bollesiana, Morse, Ann. N. Y. Lyc., VIII., 209, fig. 4-6, (1865).

Vertigo ———, W. G. Binney, Man. Am. Land Shells, 191, fig. 193, (1885).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Rare in Michigan. Petoskey, Charlevoix, Crystal Lake, Benzie county, and Huron mountain, Marquette county, are the only localities reported.

Distinguished by its flattened, not incurved, outer lip, and lamellar teeth on base of aperture.

VERTIGO TRIDENTATA Wolf.Fig. 153. *V. tridentata*. $\times 16$.

Shell narrowly ovate, amber-colored, highly polished; whorls five, rather convex, smooth, apex obtuse; suture impressed; aperture very slightly thickened within, apertural lamellæ typically three, one parietal, one columellar and one palatal, forming a regular triangle, a very minute upper palatal is occasionally present.

Alt. 1.66, diam. 1.1 mm.

Vertigo tridentata, Wolf, Am. Jour. Con., V., 198, pl. XVII., fig. 1, (1870).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Apparently rare, but probably overlooked on account of its size. Ann Arbor and Grand Rapids are the only localities thus far reported. A well marked species characterized by its regularly ovate outline, few and small apertural lamellæ and very slight internal thickening of the outer lip. The figure of the aperture is copied from that of Sterki.

Family **COCHLICOPIDÆ**.

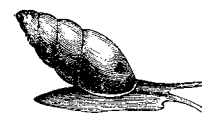
Shell oblong, cylindric-oblong or narrowly tapering, smooth and glossy, with imperforate axis; aperture ovate or acuminate, the columella notched below or continuous with the basal lip. Foot without pedal grooves. Kidney with direct ureter, of the Basommatophorus type. Genitalia with a long appendix on the penis.

Jaw vertically striate, thin, arcuate.

Radula with central tooth small, tricuspid; central cusp long and narrow; side cusps of subequal length; laterals bicuspid; marginal teeth low, wide, multidentate.

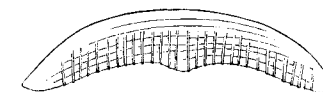
Genus **COCHLICOPA** (Fer.) Risso.

Shell ovate-oblong, imperforate, smooth, pellucid, glistening, dark horn-colored; whorls rather convex; aperture less than half the shell's length,

Fig. 154. Animal of *C. lubrica*. (Binney.)

ovate; columella more or less truncated; peristome blunt, its margins joined by a callus.

Animal heliciform, obtuse before, pointed behind; mantle subcentral, thin, simple, protected by a shell; anal and respiratory orifices on the right of the mantle under the peristome of the shell; generative orifice behind the right eye-peduncle; no locomotive disk; no caudal mucus pore.

Fig. 155. Jaw of *C. lubrica*. (Binney.)

Jaw low, slightly arcuate, wide, with but little attenuated, blunt ends; cutting edge with a slightly produced, wide, median projection; anterior surface without ribs, but with fine vertical striæ. There is a strong muscular attachment on its upper margin.

Lingual membrane; centrals with basal plates small and narrow, expanding at lower angles, tricuspid; laterals subrectangular, bicuspid, asymmetrical; marginals low, wide and multidentate.

Fig. 156. Dentition of *C. lubrica*. (Binney.)**COCHLICOPA LUBRICA** (Muller).Fig. 157. *C. lubrica*. $\times 3\frac{1}{2}$ (Binney.)

Shell imperforate, oblong-oval; smoky horn-color, smooth, and shining; whorls 5-6; somewhat rounded, the last two-fifths of entire length, rounded at base; apex obtuse; suture somewhat impressed; aperture oval, longitudinal, peristome simple, thickened, often slightly rufous; columella obtusely truncated at base.

Alt. 6, diam. $2\frac{1}{2}$ mm.

Helix lubrica, Muller, Verm. Hist., I., 104, (1774).

Ferussacia subcylindrica, W. G. Binney, Man. Am. Land Shells, 194, fig. 202, (1885).

Achatina lubrica, Miles, Rep. Geol. Surv. Mich., 236, (1861).

Zua subcylindræ, Currier, Shell-bearing Moll. Mich., 6, (1865).

——— *subcylindræ*, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

Ferussacia subcylindrica, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Var. **MORSEANA** Doherty.

Longer and more slender than the typical form.

Alt. 7, diam. 2 mm.

Cionella morseana, Doherty, Jour. of Con., I., 342, pl. IV., fig. 2, (1878).

The typical form is generally distributed all over the state. The variety has thus far been detected only in Ontonagon county.

Family **VALLONIDÆ**.

Jaw arcuate, lower margin with or without a median projection; lingual membrane similar to that of the *Pupillidæ*, central tooth narrower than the

laterals, tricuspid, laterals quadrate, marginal teeth wide and low, multicusp.

Shell minute, heliciform, depressed, umbilicated, aperture subcircular or short oval, peristome elevated or straight, with or without a whitish lip; no apertural lamellæ or folds.

Genus VALLONIA Risso.

Shell minute, openly and widely umbilicate, depressed; the spire low-convex, consisting of 3-4½ whorls; color light and uniform; surface smooth or ribbed; periphery rounded; last whorl usually descending in front. Aperture oblique, circular or short oval; peristome continuous or nearly so, expanded or reflexed, often thickened within. Foot small, short with no pedal grooves; edges of sole somewhat crenulated; sole undivided; eye-peduncles cylindrical, not enlarged distally; tentacles short; labial lobes well developed.

Genitalia having the penis short with terminal retractor; epiphallus short bearing a flagellum. Dart sack present, containing a straight, bladeless dart. No mucus glands. Duct of spermatheca long, branchless.

Jaw arcuate with a slight median projection or none, sculptured with numerous (18 to 25) crowded, low riblets denticulating the margins.

Radula having twenty-three to thirty-three teeth in a transverse row, median teeth decidedly narrower than laterals, tricuspid, the mesocone not half as long as the basal plate, side cusps smaller. Laterals with large square basal plates, the mesocone extending to its edge, ectocone small; marginal teeth wide and low, multicusp.

KEY TO THE SPECIES OF VALLONIA.

- I. Surface smooth or very finely striate.
 - a. Umbilicus regularly rounded..... *pulchella*.
 - aa. Umbilicus elongate..... *excentrica*.
- II. Surface with distinct, membranous ribs *costata*.

VALLONIA PULCHELLA (Muller).

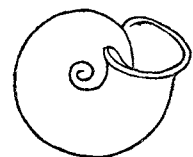


Fig. 160. *V. pulchella*. (Sterki.) × 10.

Shell moderately umbilicated, the umbilicus regularly rounded; slightly convex above; straw-colored or whitish, transparent, with fine and dense striæ; whorls 3½-4, the last comparatively large, well rounded, little expanded toward the aperture; suture moderately deep; aperture nearly circular; peristome abruptly everted, with a strong white lip, thinner at either end.

Alt. 1.2, greater diam. 2.4, lesser 2 mm.

- Helix pulchella*, Muller, Verm. Hist., II., 30, (1774).
Vallonia ———, W. G. Binney, Man. Am. Land Shells, 77, fig. 39, (1885).
Helix ———, Miles, Rep. Geol. Surv. Mich., 236, (1861).
Vallonia minuta, Currier, Shell-bearing Moll. Mich., 5, (1868).
 ———, DeCamp, Shell-bearing Moll. Mich., 6, (1881).
 ——— *pulchella*, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Common and of general distribution in the lower peninsula. Not yet reported from the upper peninsula, except on Isle Royale.

The *Vallonia* are easily distinguished from the other genera represented in our fauna by their small size and strongly reflected white lip. The regular rounded umbilicus and scarcely expanded body-whorl are very characteristic of this species, and when typical, it can easily be separated from *V. excentrica*, but occasional examples are often difficult to determine.

VALLONIA EXCENTRICA Sterki.

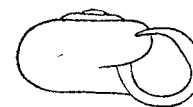


Fig. 161. *V. excentrica*. (Sterki.) × 10.

Vallonia excentrica, Sterki, Man. Con., VIII., p. 249, pl. 32, fig. 6-9, (1893).
 ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Apparently of general distribution in the southern part of the lower peninsula. Not yet reported north of Newaygo county. Typically easily distinguished by the peculiar shape of the umbilicus and the expanded form of the last whorl toward the aperture.

VALLONIA COSTATA (Muller).

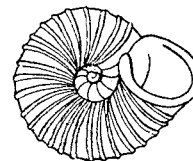
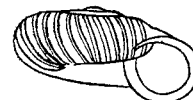


Fig. 162. *V. costata*. (Sterki.) × 10.

Helix costata, Muller, Verm. Hist., II., 31, (1774).
Vallonia ———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Rare in Michigan. Owosso, Shiawassee county, Isle Royale and Monroe are the only recorded localities.

Suborder BASOMMATOPHORA.

Superfamily GEHYDROPHILA.

Tentacles contractile, subcylindrical. Eyes sessile at the inner sides of the bases. Operculum wanting. Genital orifices separated but on the same side. Tegument rugose as in the *Stylommatophora*.

Family AURICULIDÆ.

Shell spiral, covered with a heavy epidermis; aperture elongate or oval, with strong folds on the columella; outer lip often dentate. Internal septa usually absorbed.

Head ending in a snout; mouth with a heavy lunate jaw, and with two dilated buccal lobes, united above, separated below; tentacles cylindrical, contractile; eyes sessile at the under sides of the bases. Mantle closed, with a thickened margin; foot long, posteriorly blunt; respiratory orifice posterior on the right side, excretory orifice near it. Sexes united, orifices of generative organs distant, on the right side.

Genus CARYCHIUM Muller.

Shell pupæform, very thin, transparent, with but few whorls; aperture sub-oval, with one dentiform columellar fold, sometimes obsolete; parietal wall with one or two teeth; peristome expanded; extremities united by a parietal callus, the right hand one with one internal tooth.



Tentacles relatively large, cylindrical, obtuse, eyes situated below and behind the tentacles near their base; foot thick, obtuse behind, not transversely divided beneath.



Fig. 164. Jaw of *Carychium*. (Moquin-Tandon.)

Jaw slightly arched, without ribs or marginal denticulations, broadly striated towards the margin.

Teeth in slightly bent cross series; centrals equilateral, narrow; laterals broad, short, denticulated.



Fig. 165. Dentition of *C. exiguum*. (Binney.)

CARYCHIUM EXIGUUM (Say).

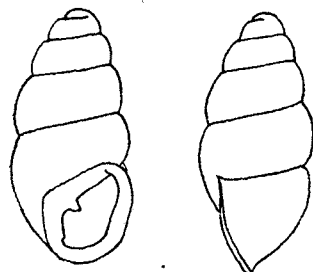


Fig. 166. *C. exiguum* (Clapp.) $\times 20$.

Shell minute, perforate, cylindrical, apex obtuse, white, translucent, shining; whorls $4\frac{1}{2}$, regularly convex, nearly smooth, the last two of about equal diameter; suture impressed; aperture obliquely oval, decidedly more than one-third the total altitude; outer lip reflected, sinuous, moderately thickened, very strongly arcuate at the upper outer portion; columellar margin having an obtuse fold below and a prominent entering fold above.

Alt. 1.75-2.15, diam. .75-.85 mm.

Pupa exigua, Say, Jour. A. N. S. P., II., 375, (1822).

Carychium exiguum, W. G. Binney, L. & F. W. Shells, II., 6, fig. 8, (1865).

———, Miles, Rep. Geol. Surv. Mich., 236, (1861).

———, Currier, Shell-bearing Moll. Mich. p. 6, (1868).

———, DeCamp, Shell-bearing Moll. Mich., 7, (1881).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

This minute, slender, white species is semi-amphibious in its habits, and has a general distribution over the entire state. Distinguished from *C. exile*, by its shorter, more inflated shape and nearly smooth surface. The larger examples noted above are analogous to the var. *canadense* of *C. exile*, but they are more discontinuous in their range and seem rather to be the effect of specially favorable conditions of environment rather than a true race.

CARYCHIUM EXILE H. C. Lea.

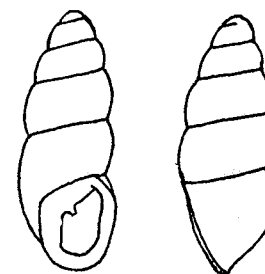


Fig. 167. *C. exile*. (Clapp.) $\times 20$.

Shell minute, elongated, cylindrical, apex obtuse, white, transparent, shining; whorls $5-5\frac{1}{2}$, somewhat shouldered, closely, regularly and distinctly striate; suture deeply impressed; aperture small; very oblique, about one-third the length of the shells; outer lip reflected, more or less thickened; columellar having an obtuse fold below and a prominent entering fold above.

Alt. 1.75, diam. .6 mm.

Carychium exile, H. C. Lea, Am. J. Sc. (1), XLII., 109, pl. I., fig. 5, (1841).

———, Walker, Rev. Moll. Fauna Mich., 17, (1894).

Var. CANADENSE Clapp.

Uniformly larger.

Alt. 2.1, diam. .75 mm.

Carychium exile canadense, Clapp, Naut. XIX., 138, pl. VIII., figs. 1, 2, 6 and 7, (1906).

This species is easily separated from *C. exiguum* by its more slender, elongated shell, which is distinctly striate. The typical form is apparently rarely found in the southern part of the state, having been recognized only from Saginaw and Shelby, Macomb county. The variety is characteristic of northern part of the state where it ranges from Roscommon county northerly through the entire upper peninsula.

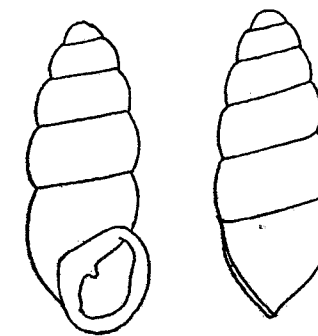


Fig. 168. *C. exile canadense*. (Clapp.) $\times 20$.

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NOTE.—Names of genera and other groups are printed in SMALL CAPITALS; of synonyms in *Italics*. The specific name precedes that of the generic in all cases.

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