

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

PUBLISHED BY THE UNIVERSITY

NOTES ON THE GENUS *Physa* WITH DESCRIPTIONS
OF THREE NEW SUBSPECIES

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Physa pomilia Conr.

Plate I, fig. 1

P. pomilia Conr., Am. Jour. Sci., XXV, 1834, 343; Am. Jour. Cone., II, 1866, 278, pl. 15, figs. 1-3. *P. showalteri* Lea, Proc. A. N. S. P., 1864, 115; Jour. A. N. S. P., VI, 1866, 170, pl. 24, fig. 92; Obs., XI, 1866, 126, pl. 24, fig. 92. *P. pomilia* Conr., Tryon, G. W., A Monograph of the Freshwater Univalve Mollusca of the United States; Continuation, 1870, 152, pl. 8, fig. 10. *P. pomilia showalteri* Lea, DeCamp, Misc. Pub. No. 5 of the Kent Scientific Institute, 1881, 8. *P. pomilia* Conr., Crandall, O. A., The American Physae, Nautilus, XV, 1901, 70. *P. cubensis* Pfr. (in part of auth.).

Remarks: This species has been confounded with *Physa cubensis* Pfr. There is no direct relationship between the two, except for the fact that *P. cubensis* occupies a small portion of the *P. pomilia* territory along the east coast of Florida. This alone might account, in part, for the records based upon locality that occur in so many of the faunal lists.

DeCamp, in 1881 (*loc. cit.*), listed a form from Grand Rapids that he called *P. pomilia* var. *showalteri* Lea. This was listed by Walker¹ in 1892 as *P. pomilia* Conr. I have been fortunate in seeing this material in the collection of Dr. Walker, and, though the specimens have a color and general form somewhat similar, the remaining characters do not agree with *P. pomilia*. The Grand Rapids specimens are *P. gyrina hildrethiana* Lea of a rather elongate form. Though not familiar with the ecological conditions under which these particular specimens were collected, I would associate them with a swamp or woods pool habitat, a habitat that produces a reddish brown coloration on many specimens.

Physa pomilia ariomus, new subspecies

Plate I, fig. 2

Description: Shell sinistral, large, elongate-ovate, slightly imperforate, rather solid. Color straw yellow, varicose bands on the last whorl of a light reddish brown. Whorls 6. Spire acute, first $1\frac{1}{2}$ whorls wine colored. Aperture elongate-ovate, slightly flaring at the base, not regularly curved but slightly flattened laterally. Length nearly $\frac{2}{3}$ the length of the shell. Lip slightly thickened callus at the base toward the columella margin. Columella oblique, folded over the umbilical orifice, leaving only a slight vertical opening when viewed from the side. Suture rather deeply impressed but not indented. Sculpture rather coarse growth lines on the last whorl, the younger whorl exhibiting growth lines only along the superior sutural border. Cross striae absent.

Type specimen: Cat. No. 32231 (Univ. of Mich.), Gastonburg, Wilcox Co., Alabama. Received from Bryant Walker. Paratypes: Collection of Bryant Walker, of Detroit, Michigan, Academy of Natural Sciences of Philadelphia, U. S. National Museum, University of Alabama, and in my own collection.

Remarks: This subspecies differs mainly from *P. pomilia*

¹ Walker, B., Shell Bearing Mollusca of Michigan, Naut., VI, 1892, 30.

Conr. in the shouldered condition of the last or last two whorls, the lighter color, and in being more solid.

Measurements of P. pomilia arionus Cl.

	Length	Width	Ap. length	Ap. width	
Type	16	9	10	4.7 mm.	U. of M. 32231
Paratypes	16	9	11	5. mm.	Walker 79923
“	15.8	8.7	10	4.5 mm.	Nat. Mus. 361588
“	16	8.5	9.8	5.5 mm.	Phil. 134587
“	14.8	8.4	9.8	4.5 mm.	Univ. of Ala.
“	16.5	9.2	10	5 mm.	Clench 1790
“	15	8.8	9.5	4.5 mm.	
“	16	9.7	9.8	4.5 mm.	U. of M. 32232
“	14.1	8	9.7	4.4 mm.	

Shouldered or contabulate forms are not rare among other species of Physa. In this connection, *P. parkeri* Curr. (*P. lordi* in part of auth.) might be mentioned as the extreme to which this condition is produced in this genus, so far as is known. The function of this anatomical development is not definitely known, but a factor mentioned by Pilsbry² might, in part, explain this condition. “I would suggest that the form in these cases is correlated with an increase in the capacity of the air sac or lung which occupies that part of the shell. . . . It is not unlikely the result of a more continuous or prolonged subaquatic residence.”

As far as I have been able to observe, these shouldered forms are usually associated with the larger bodies of water instead of small streams, ditches or small ponds not subjected to surface agitation. Dall³ considers it probable that deep water forms (*Lymnaea* sp.) not having access to the atmosphere, gather up globules of oxygen freed by aquatic plants.

² Pilsbry, H. A., Land and Freshwater Mollusks collected in Yucatan and Mexico, Proc. A. N. S. P., 1891, 324.

³ Dall, W. H., Harriman Alaska Expedition, Land and Freshwater Mollusks, Vol. 13, 1905, 100.

Tryon⁴ cites, "*L. abyssicola* in the Lake of Geneva at a depth of 800 feet." As the Physidae are pulmonates this condition might well exist, enabling the animal to remain its entire life on the bottom of lakes and rivers. Dawson⁵ observed that *Physa* would pick up air bubbles under water if either the head or siphon came in contact with them. As the pulmonary sac occupies the part of the body producing the shoulder (Pilsbry, *loc. cit.*), the above observations well substantiate the two theories advanced. My own observations on a shouldered variety of *P. integra* Hald. also point in the same direction. Abundant material was collected in the Huron River at Ann Arbor, Michigan, clinging to stones and plants in swiftly flowing water. The usual methods of reaching the surface were not available (plants or other objects reaching out of water and mucus threads from the bottom to the surface film). The only known supply of oxygen was from plants that covered the stones. No direct count was made, but fully three-fourths of these Physae were found on the plants, the remainder on the sides of the stones.

Such observations as these do not prove that this shouldered formation is produced by this ecological condition, but are only suggestions as to its probable origin.

Physa pomilia hendersoni, new subspecies⁶

Plate I, fig. 3

P. cubensis Pfr., Henderson, J. B., Naut., Vol. XXI, 1907, 8.

Description: Shell sinistral, large, turbinata, imperforate, thin. Color light horn, varicose bands on the last whorl of a straw yellow color produced by internal thickenings of the shell. Whorls 6. Spire produced, rather elongate, nuclear

⁴ Tryon, G. W., Structural and Systematic Conchology, Vol. III, 1884, 101.

⁵ Dawson, Jean, The Biology of *Physa*. Behavior Monographs, Vol. I, No. 4, 1911, 90.

⁶ I take great pleasure in naming this subspecies after the late J. B. Henderson, who collected the types.

whorl reddish brown. Aperture rounded-ovate, flaring at the base, vertical distance nearly parallel with the shell axis. Lip slightly thickened, producing a light brownish-red callus along the inner margin. Columella slightly oblique and slightly twisted. Suture well impressed, with a very narrow reddish brown band on the superior border of the whorls along margin of the suture. Sculpture very fine growth lines on the last whorl, younger whorls nearly smooth. Cross striae absent.

	Length	Width	Ap. length	Ap. width	
Type	14	8.5	8	3.8 mm.	Walker 45640 (2)
Paratypes	13.5	7.7	8.5	3.5 mm.	Walker 45640 (1)
“	11.5	6.4	6.7	3.2 mm.	
“	12	6.8	7.5	3.4 mm.	U. of M. 32230
“	11	6.2	7	3.1 mm.	
“	12	7	7.1	3.6 mm.	Nat. Museum 361589
“	12.7	6.9	7.5	3.3 mm.	A. N. S. P. 134588
“	12.2	6.5	6.9	3.3 mm.	
“	12.1	6.6	7	3.5 mm.	Clench 1791
“	11.5	6.8	7.2	3.4 mm.	

Type specimen: Cat. No. 45640 (2), (collection of Bryant Walker), Yemassee, Beaufort Co., South Carolina. Paratypes: Collection of Bryant Walker, Museum of Zoology, University of Michigan, Academy of Natural Sciences of Philadelphia, U. S. National Museum, and in my own collection.

Remarks: This subspecies differs from the typical *P. pomilia* Conr. in having a shorter aperture as compared with the total length of the shell; the aperture more rounded; the spire more produced and acute, and the sutures more deeply impressed. In all other respects it is similar to *P. pomilia*.

Physa pomilia and this subspecies have been confounded with *P. cubensis*, but differ to a considerable degree from Cuban material and the figures in Conchylien Cabinet,⁸

⁸ Kuster and Dunker, Conchylien Cabinet, Linnaeiden, 1862, 22, pl. 3, figs. 17-18-19.

typical *P. pomilia* and variety *hendersoni* being larger, more elongate, and having a rounder aperture. The aperture both of *P. pomilia* Conr. and *P. pomilia hendersoni* is slightly flaring at the base, a character not usually found in *P. cubensis* Pfr.

Considerable *Physa* material from the southeast, especially from Florida, which has been determined as *P. cubensis* Pfr., has usually proved to be *P. pomilia* Conr. or this subspecies. *P. cubensis* Pfr. is found in Florida,⁹ but I believe it is more or less confined to the east coastal strip from Brevard County, south to Dade County. Another lot of *P. pomilia hendersoni* from Paradise Key, Florida, agrees in all points with the type lot. This subspecies seems to be confined to the coastal area of the southeast, typical *P. pomilia* extending as far north as Kentucky and west to Mississippi. Both lots, the type lot from Yemassee, South Carolina, and the lot from Paradise Key, Florida, are in the collection of Dr. Bryant Walker.

Physa parkeri (Curr.) DeCamp

Plate I, fig. 4

P. parkeri Curr., Kent Sci. Inst. Pub., 1868, 7 (no desc.); DeCamp, Kent Sci. Inst., Misc. Pub. No. 5, 1881, 15, pl. I, fig. 3. *P. lordi* Baird (in part of auth.). *P. ancillaria parkeri* Curr. (of auth.).

Remarks: There has existed considerable confusion concerning this species and *P. lordi* Baird. Typical *P. lordi* differs quite markedly from *P. parkeri* in many respects, and I am certain that the two species are distinct. Topotypes of *P. parkeri* Curr. and examples of this species from other localities in Michigan have been compared by Mina Winslow, of this museum, with the type specimens of *P. lordi* in the British Museum, and the differences between them are sufficient to warrant the recognition of *P. parkeri* as a species. The three specimens examined by Miss Winslow from Lake Osoyoos,

⁹ Pilsbry, H. A., Naut., Vol. 13, 1899, 70; Walker, B., Naut., 31, 1917, pp. 56-57.

British Columbia, the type locality, are believed to be the types collected by Lord. In any case, they are topotypes and can be considered as true examples of *P. lordi*. The figures given by Binney¹⁰ copied from the advance proofs of the British Boundary Commission Report at that time, and his figure 127 from the American Commission of the same survey, represent specimens quite different from the Michigan specimens.

Henderson and Daniels¹¹ (1917) pointed out a distinct difference between Douglas Lake specimens in Michigan and specimens collected in Utah Lake. The Eastern forms are characterized by a more sharply angled shoulder and a flat upper surface on the last whorl. From comparisons made by Miss Winslow, there is considerably more twisting to the columella in *parkeri* than in *lordi*.

Baird¹² states in his original description of *lordi* that the types are "finely decussately striated," a character not found in the type of *P. parkeri*. Other specimens of *parkeri* examined from the type locality and throughout the known range of *parkeri* fail to show this character to any extent. This striated condition was noticed by Miss Winslow on the *lordi* types as well, and it is a character that can be depended upon to quite an extent in specific determination. Like all

	Length	Width	Ap. length	Ap. width	
Type	27	22	22	11.5 mm.	Walker 11997 (1)
Paratypes	24	18.5	20	10 mm.	Walker 11997 (2)
"	22	17.5	19.5	10 mm.	
"	19	15	16	8.5 mm.	
Topotypes	25.4	20	21	10.8 mm.	U. of M. 29546
"	23.5	17	20	9.6 mm.	
"	19	15.5	17	8 mm.	

¹⁰ Binney, W. G., Land and Freshwater Shells of North America, Part II, 1865, figs. 125-126, p. 76.

¹¹ Henderson, Junius, and Daniels, L. E., Proc. A. N. S. Phil., 1917, p. 75.

¹² Baird, W., Proc. Zool. Soc. London, 1863, p. 68.

other characters in this complex family, there is a certain amount of variation in striation that has to be considered, but in these two species the presence of striations in one and their absence in the other seems to be fairly constant.

Type specimen: Cat. No. 11997 (1), collection of Bryant Walker, Houghton Lake, Roscommon Co., Michigan. *Paratypes*: In the collection of Bryant Walker. *Topotypes*: In the collection of the Museum of Zoology, University of Michigan.

***Physa lordi utahensis*, new subspecies**

Plate I, fig. 5

P. lordi Baird (in part).

Description: Shell sinistral, large, rhomboidal, slightly imperforate, slightly malleated, solid. Color light straw, varicose bands only slightly developed on a few individuals of type lot—not at all on the type. Whorls 5, rounded. Spire slightly obtuse, nuclear whorl reddish. Aperture slightly elongate, columella margin straight. Lip not noticeably thickening in the type; six of the paratypes have a slight reddish brown callosity a little behind the lip margin. Columella straight, not twisted, rather wide. Suture rather deep, slightly indented. Sculpture coarse, vertical growth lines on all last three whorls, a few not regularly spaced, more prominent, especially so toward superior border of body whorl. Cross striae absent, a few coarse spiral lines on center of body whorl of type, but not found on any of the paratypes.

Type specimen: Cat. No. 4257 (3), collection of Bryant Walker; Utah Lake, 2 miles south of Lehi, Utah, Henderson and Daniels collectors. *Paratypes*: Collection of Bryant Walker, the University of Michigan, and in my own collection.

Remarks: Henderson and Daniels (*loc. cit.*) used material from the type locality of this subspecies in making their analysis between the western and eastern forms of the supposed *P. lordi*. Miss Winslow also used this material in her

	Length	Width	Ap. length	Ap. width	
Type	31	21.5	22.5	11.5 mm.	Walker 4257 (3)
Paratypes	26.5	18	20	10 mm.	Walker 4257 (2)
“	24	17	20	9.5 mm.	
“	21	15	11.3	9 mm.	
“	21	13.4	15.2	7.8 mm.	
“	21.8	16.5	16.5	9.2 mm.	U. of M. 29549
“	21	16.5	16.8	8 mm.	
“	20.1	15	16.8	8.7 mm.	
“	23	16	18	9.5 mm.	Clench 1856
“	22.21	17.2	16.5	9.1 mm.	
“	21	15	17	9 mm.	

comparison with the type lot of *P. lordi* and noted sufficient differences to warrant subspecific distinction for the Utah Lake Physas.

The length of the aperture of *P. lordi utahensis* is, relatively, greater than that of *P. lordi*; the sutures are more deeply impressed and the columella much broader.

The type of *P. lordi utahensis* (Plate I, fig. 6) does not represent the relationship to *P. lordi* quite as much as some of the paratypes, especially in the character of the spire. The specimens in the type lot, however, show an intergradation of the spire character, ranging from the obtuse spire of the type to that somewhat approaching *P. lordi*. (Plate I, fig. 5.) The shoulder is somewhat produced in 4 out of the 39 paratypes of *utahensis*, but again this character does not approach the rounded shoulder of *P. lordi* or the sharply angled shoulder of *P. parkeri*. The specimens of *utahensis* agree with those of *lordi* in the rather straight and less twisted columella, as compared with the more twisted columella found in *P. parkeri*. A lot of specimens from New Mexico, contained in the collection of Dr. Bryant Walker, exhibits practically all of the characters of *P. lordi* with the exception of one specimen. This specimen can be referred to *P. lordi utahensis*. The re-

maintaining 6 specimens of this series are more or less constant in their characters.

A more critical survey of the freshwater mollusks of the Rocky Mountain system in the United States and Canada might bring to light many factors in the distribution of this species and subspecies to alter my present opinion of them. The extremes to which the characters of the subspecies have developed are sufficiently distinct from the characters of *P. lordi* to entitle it to subspecific rank, as it at least defines a geographical race. The type localities of *P. lordi* and *P. lordi utahensis* are in different drainage systems; both, however, fall well within the Pacific drainage area.

University of Michigan

PLATE I

- FIG. 1. *Physa pomilia* Conr. (2x.) Uniontown, Ala. (Clench 1563.)
FIG. 2. *Physa pomilia ariomus* n. sp. Type.
FIG. 3. *Physa pomilia hendersoni* n. sp. Type.
FIG. 4. *Physa parkeri* Curr. (DeCamp). Type.
FIG. 5. *Physa lordi utahensis* n. sp. Type.
FIG. 6. *Physa lordi* Baird. (From Binney.)







