THE SPHAERIACEAN PELECYPODS OF OKLAHOMA

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Keys, distributional and ecological data, descriptions and illustrations are presented for the three genera and 11 species of sphaeriid and corbiculid clams known from Oklahoma.

INTRODUCTION

Few studies have dealt specifically with Oklahoma sphaeriid pelecypods. The only checklist available is that of Branson (1), but it lacks keys and diagnostic characteristics. Since publication of that list, two additional species have been reported from Oklahoma, *Sphaerium lacustre* (2) and the exotic Oriental species, *Corbicula fluminea* (3,4,5).

In North America, the molluscan super-family Sphaeriacea is represented by the native family Sphaeriidae (three or four genera) and the introduced family Corbiculidae (one genus and species). The Oklahoma fauna includes representatives of all categories. In his revision of North American sphaeriids, Herrington (6) considered the putative genus *Musculium* as a subgenus of *Sphaerium*, whereas Burch (7) retained both as separate genera. This contribution follows the rationale of Herrington (6) and presents keys to the species of sphaeriacean clams known to occur in Oklahoma waters, delineates the known distribution, and discusses the ecology and diagnostic features of each species. Several of the records are based upon specimens deposited at the Stovall Museum, University of Oklahoma. Additional distribution records for Oklahoma fingernail clams will be published elsewhere by Dr. Horace Bailey, West Texas State University.

KEY TO THE SPHAERIACEAN CLAMS OF OKLAHOMA

In the key, and discussion which follows, reference to certain shell features is necessary. In the genera *Sphaerium* (including *Musculium*) and *Eupera*, the posterior end of the shell is longer than the anterior, whereas the reverse is true in *Pisidium*. The anterior end of the shell can be determined by observing the internal hinge teeth (Figs. 1, 2), the right valve containing only a single cardinal tooth and two pairs of laterals, whereas the left valve has two cardinals and two laterals.

1 a. Lateral shell teeth with obvious serrae ---------- *Corbicula fluminea*
b. Lateral shell teeth smooth ---------- 2
2 a. Shell beaks on anterior side of center ---------- 3
b. Shell beaks on posterior side of center ---------- *Pisidium* ---------- 10

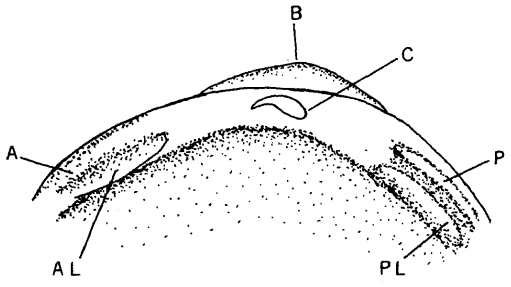


FIGURE 1. Internal view of right valve of a sphaeriid clam showing hinge teeth. A = anterior outer lateral, AL = anterior inner lateran and cusp; B = beak, C = cardinal tooth, P = posterior outer lateral and cusp, PL = posterior inner lateral.

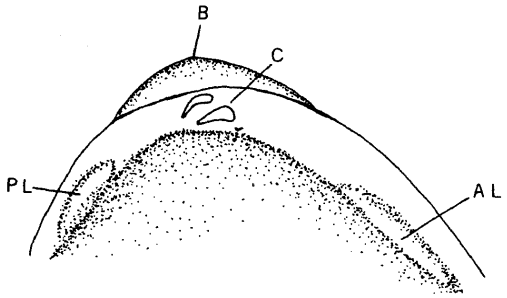


FIGURE 2. Internal view of left valve of a sphaeriid clam showing hinge teeth. AL = anterior lateral and cusp, B = beak, C = cardinal teeth, PL = posterior lateral and cusp.

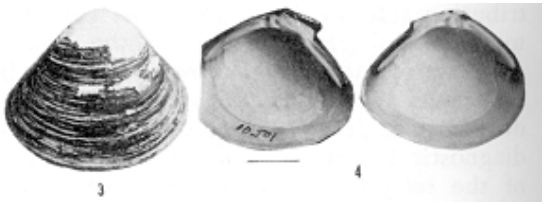
3 a. Each valve with only one cardinal tooth; valves mottled with black or dark brown-------*Eupera cubensis*
b. One valve with two cardinal teeth, the other with one; valves not mottled with dark----*Sphaerium* ----- 4
4 a. Umbos usually raised above rest of valve; siphons fused for entire length Subgenus *Musculium* -------- 5
b. Umbos usually not raised above rest of valve; siphons fused only near bases----Subgenus *Sphaerium*-- 9
5 a. Shell oblong in outline, its height three-fourths or less the length ---------- *Sphaerium transversum*
b. Shell not oblong and nearly as high as long ---------- 6
6 a. Umbos very prominent ---------- 7
b. Umbos only slightly raised above surface ---------- *Sphaerium securis*
7 a. Striae very fine, more than 12 per millimeter at middle of shell; hinge line nearly straight, the posterior margin meeting it at nearly right angles---------- *Sphaerium partumeium*
b. Striae coarser, about 12 per millimeter at middle of shell; hinge line curving, the posterior margin meeting it at an angle greater than 90° ---------- 8
8 a. Shell heavy, dense; Pleistocene and Pliocene fossil---------- *Sphaerium lavernense*
b. Shell fragile; Recent ---------- *Sphaerium lacustre*
9 a. Striae coarse, 8 or fewer per millimeter at middle of shell and not weaker on the beaks ----------
---------- *Sphaerium striatinum*
b. Striae finer, 12 or more per millimeter at middle of shell and weaker on beaks; Pliocene fossil
---------- *Sphaerium hibbardi*
10 a. Cardinal teeth centrally located with reference to beaks---------- 11
b. Cardinal teeth located near the anterior cusps---------- *Pisidium casertanum*
11 a. Shell rather glossy and minutely striate; no ridges on beaks ---------- *Pisidium nitidum*
b. Shell dull with well-developed striae and ridges on beaks ---------- *Pisidium compressum*

DISCUSSION

Corbiculidae

Since it was first reported from U. S. waters in 1938 (8), there has been disagreement with regard to the proper nomenclatural designation of the Asiatic clam. In the early years following the introduction, when most of the emphasis was on documenting the spread of this noxious (9, 10) pest, most authors diagnosed the species as *Corbicula fluminea* (Muller). However, when investigations shifted toward understanding population dynamics, life histories, and other biological phenomena (11, 12), it was discovered that American populations were monoecious, that they incubated their young, and had nonswimming larvae, all features militating against those populations being *C. fluminea*, a brackish-water, dioecious and nonincubating species (13). In view of this, most authors have been using the name *C. manilensis* (Philippi), a species widespread in Korea, Japan, Formosa, Indonesia, and the Philippines. Some authors (12, and others) have recently switched to *C. leana* Prime because of trivial morphological features. Most recently Britton and Morton (1979) marshalled evidence to support the use of *C. fluminea*.

Corbicula fluminea (Muller) Figures 3, 4



FIGURES 3, 4: *Corbicula fluminea*. 3 = external view of left valve, 4 = internal view of both valves. Scale = 14 mm.

Records: Lake Overholser, near Bethany, Oklahoma City (4); Lake Texoma and Buncombe Creek (5, 14); and Lake Thunderbird, Norman.

Although Oklahoma records are scanty at this point, we can expect the clam to rapidly expand its range. This expansion is unfortunate, for not only may the species be very strongly competitive with native pelecypods, it also has often become a

serious and costly pest because of its fouling water intakes at many industrial sites and at hydroelectric establishments (13).

The most distinctive feature of the clam is the shell (13), which bears widespread and heavy concentric ridges. It is usually pale brownish or olivaceous in color, although in many populations the shell is nearly black. Internally, there are three cardinal teeth in each valve and the lateral teeth are heavily serrated. The porcellaneous lining of the shell varies from white to salmon or deep purple.

The Asiatic clam reproduces in summer, incubating its eggs within the inner gills and releasing a planktonic veliger stage via the siphon. The larvae become benthonic within 48 hours (13), developing quickly to a pediveliger. Growth is rapid, so that young *Corbicula* may become sexually mature by the next breeding season, reaching a maximum size of approximately 60 mm. It appears that little can be done to control the populations of this clam, since it is possibly one of the most resistant clams to fisheries chemicals in North America. Massive spring mortalities sometimes occur, however, probably in response to heavy sediment loads (16). It often burrows a foot or more into the bottom, but the clam can attach itself to objects by means of a strongly developed byssus (13).

Sphaeriidae

Sphaeriacean clams are represented in Oklahoma by three genera — or four, if *Musculium* is allowed — and 11 species. The genera (see key) are easily recognized by conchological characteristics.

Genus *Pisidium* Pfeiffer, 1821

Small to minute clams possessing an anal siphon but either lacking a branchial siphon or having it represented by a slit in the mantle; byssal gland lacking. Embryos are incubated in each anterior gill. Shell minute (7.0 mm or less in length), striate to nearly smooth, with moderately developed umbos on the posterior side of the center; articulating surface with two cardinal teeth per valve. Three species have been reported from Oklahoma.

Pisidium casertanum (Poli) Figures 11, 12

FIGURES 11, 12: *Pisidium casertanum.* 11 = external view, 12 = internal view. Scale = 3.5 mm.

Records: Blue Creek, Wichita Mountains, Comanche Co. (17); Laverne Formation (18); Harper Co. (19, 20); Canadian and Caddo counties (21); Blue River at Connorville, Johnston Co. (1); small stream, Black Mesa, Cimarron Co. (22).

Shell long in side view with rather low beaks; growth striae fine, the periostracum of low gloss; posterior end truncate, the anterior end rounded; dorsal and ventral margins nearly parallel; hinge line fairly long and broad; lateral teeth distinct and rather short with sharp cusps; cardinal teeth close to laterals, that of the right valve slightly curved and thickened near the posterior end. Length 2.5 to 4.2 mm.

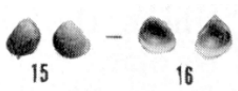
This clam lives in a wide variety of habitats, including ponds, swamps, creeks, and rivers (6).

Pisidium nitidum Jenyns Figures 13, 14

FIGURES 13, 14: *Pisidium nitidum.* 13 = external view, 14 = internal view. Scale = 4.0 mm.

Records: Harper Co. (19, 20); Canadian and Caddo counties (21).

Shell rhomboid in outline with subcentral, nonridged, nonprominent beaks; periostracum rather glossy with very fine growth striae; dorsal margin long and smoothly curved, contacting the ends without angulations; ventral margin also curved; hinge long, only moderately broad; lateral teeth moderately long, nearly straight, their cusps prominent but not sharp; cardinal teeth subcentral, that of the right valve only slightly curved, almost paralleling the hinge line; cardinal teeth of left valve nearly parallel to one another, the lower one heavier than the upper. Length 1.5 to 3.0 mm.



FIGURES 15, 16: *Pisidium compressum.* 15 = external view, 16 = internal view. Scale = 3.5 mm.

This clam lives mostly in large ponds, lakes, creeks and rivers, mostly in shallow water with copious vegetation.

Pisidium compressum Prime Figures 15, 16

Records: Harper Co. (19, 20); Canadian Co. (21); Cache Creek, 3.2 km east of Walters, Cotton Co. (1).

Shell thick and heavy, dull with ridges prominent on beaks and prominent growth striae elsewhere; moderately long; dorsal margin short and rounded, meeting posterior margin at an angle; lateral teeth short, almost a part of the hinge plate and curved, their cusps blunt; cardinal teeth centrally placed, the one of the right valve strongly curved and with a heavily thickened posterior end; both cardinals of left valve short, curved, and widely spaced at posterior end. Length 2.0-3.8 mm.

This common *Pisidium* lives in creeks, rivers, and clean lakes, mostly on sandy bottoms with rooted vegetation.

Genus *Eupera* Bourguignat, 1856

Minute clams possessing branchial and anal siphons and functional byssal glands. Individual embryos develop in a spherical marsupium between the inner and outer lamellae of the anterior gills (7). The shell, distinctively marked by black mottlings, is small, about 4.0 mm, and finely striate. The moderately prominent beaks are situated anterior to the shell's center. There is a single cardinal tooth in each valve.

Eupera cubensis (Prime) Figure 21

FIGURE 21: *Eupera cubensis,* external view. Scale = 4.0 mm.

Records: Briar Creek, Marshall Co. (1, 23) and Little River, McCurtain Co. (24).

With the characters discussed under genus. Originally reported from Oklahoma under the epithet *E. singleyi* Pilsbry, 1889, a name placed in the synonomy of *E. cubensis* by Heard (25). In general, this species may be found in streams of practically any size, where the shells are often found attached to plant roots (25), aquatic vegetation (23), or dead and decaying wood (24) by the byssal threads.

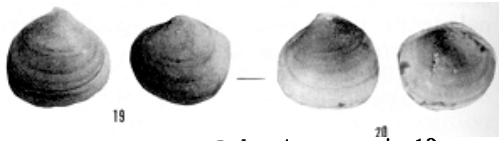
Genus *Sphaerium* Scopoli, 1777

FIGURES 7, 8: *Sphaerium transversum.* 7 = external view, 8 = internal view. Scale = 11.5 mm.

Small to minute clams with branchial and anal siphons partially to nearly completely fused for most of their length; byssal gland lacking. The embryos develop in each anterior gill in longitudinal sacs (7). The shell, with variable sculpturing, is never boldly mottled and is markedly longer in the anterior end; there are two cardinal teeth in one valve and one in the opposite. Several authors retain the generic epithet Musculium for those fingernail clams bearing calyculate (capped) beaks (see key) and thin and small cardinal teeth. However, I follow Herrington (6) in relegating the name to subgeneric level below *Sphaerium.* Seven species, including two Pliocene-Pleistocene forms, have been reported from Oklahoma.

Sphaerium transversum (Say) Figures 7, 8

Records: Red Rock Creek, Noble Co. (17); Williston, Grant Co. (26); Pleistocene, Canadian and Caddo counties (21); Blue River and Pennington Creek, Johnston Co., farm pond, Hickory and Briar creeks, Marshall Co., Sand Creek, Osage Co., small unnamed creek, Mayes Co., Gates Creek, Choctaw Co., and a small creek in Ellis Co. (1); farm pond and a tributary creek, Cherokee Co. (27); Coldwater Creek, Texas Co. (28).



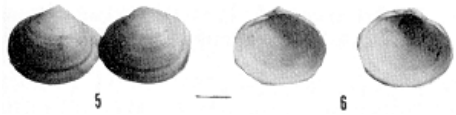
FIGURES 19, 20: *Sphaerium securis.* 19 = external view, 20 = internal view. Scale = 10.5 mm.

The shell, rather thin with moderately fine, closely packed striae, is oblong, the posterior end being higher than the anterior; length 8.0 to 12.5 mm, height 5.0 to 8.9 mm; capped specimens form only a small percentage of most populations; hinge line long and fairly straight; ventral margin gently curved and longer than the dorsal; hinge plate is thin and narrow, as are all teeth. Characteristically, the species is found in mud-bottomed streams and lakes with weak currents, mostly lowland in character.

Sphaerium securis Prime Figures 19, 20

Records: Mountain Fork River, McCurtain Co. (1).

The shell is small, 5.0 to 6.5 mm long and 2.3 to 5.2 mm in height, somewhat inflated and moderately striated; beaks well-developed, although not very high, with well-developed caps; periostracum dull; dorsal margin only very slightly curved, if at all, and only slightly shorter than the strongly curved ventral margin; hinge line long and narrow, the lateral teeth being relatively long and thin. The habitat is mostly sand-bottomed ponds, lakes and streams.



FIGURES 5, 6: *Sphaerium partumeium.* 5 = external view, 6 = internal view. Scale = 7.5 mm.

Sphaerium partumeium (Say) Figures 5, 6

Records: Chikaskia River, Kay Co. (26); Sand Creek, Osage Co., ponds in Cotton and Payne counties, Boomer Creek, Payne Co., Stillwater Creek, Noble Co., Blue River and Pennington Creek, Johnston Co., Muddy Boggy Creek, Pontotoc Co., small creeks in Cherokee and McCurtain counties, Bluff Creek, Grant Co., small creeks in Delaware Co. (1); Honey Creek, Murray Co. (22, 29); Pecan Creek, Muskogee Co. (28).

Shell thin, medium-sized, 3.0 to 7.0 mm in length, 2.3 to 6.1 mm in height; beaks low, only slightly swollen with (usually) prominent caps; sculpturing very fine, more than 12 growth lines per millimeter at middle of shell; hinge line nearly straight, meeting the posterior margin nearly at right angles; periostracum glossy; hinge plate very long and narrow, with barely enough space for cardinal teeth. The typical habitat is mud-bottomed ponds, swamps, and streams of sluggish current.

FIGURES 17, 18: *Sphaerium lacustre.* 17 = external view, 18 = internal view. Scale = 7.0 mm.

Sphaerium lacustre (Muller) Figures 17, 18

Records: Pennington Creek, Johnston Co. (2).

Shell small, 5.5 to 9.5 mm in length, 4.5 to 7.3 mm in height; sculpturing coarse, about 12 lines per millimeter at middle of shell; dorsal margin and hinge line curved, meeting posterior margin at an angle greater than 90 degrees; beaks usually considerably swollen, distinctly capped; hinge plate long and strongly curved, often nearly lacking; cardinal teeth very delicate. The principal habitat is mud-bottomed lakes and ponds and the backwaters of streams.

Sphaerium lavernense Herrington

Records: Pliocene deposits, Beaver Co. (19).

Since this small clam, a member of the subgenus *Musculium*, is sometimes washed out of deposits into floodplains, it is characterized here for identification purposes. The shell is relatively heavy and dense, rather short in relation to height; 2.4 to 8.2 mm in length, 1.8 to 7.1 mm in height; beaks narrow and prominent; shell sculpturing fine, equally spaced; anterior end usually truncate, as is the posterior end, which is often nearly vertical; hinge plate long, thin, curved; lateral teeth of left valve prominent, those of the right being low and flattened.

FIGURES 9, 10: *Sphaerium striatinum.* 9 = external view, 10 = internal view. Scale = 11.2 mm.

Sphaerium striatinum (Lamarck) Figures 9, 10

Records: Oklahoma Co. (30); Chikaskia River, Kay Co. (26); Pleistocene in Harper (19, 20) and Canadian counties (21); Sand Creek, Osage Co., Gates Creek, Choctaw Co., Lake Carl Blackwell, Payne Co., Mountain Fork River, McCurtain Co., small unnamed creek, Beaver Co. (1); Coldwater Creek, Texas Co. (28).

Shell, large for *Sphaerium*, 10.0 to 12.5 mm in length, 5.0 to 9.6 mm in height, moderately inflated with strong sides; beaks vary from low to rather prominent,

never capped; sculpturing rather irregular but prominent, 8 or fewer striae per millimeter at middle of shell; periostracum dull; dorsal margin moderately long and rounded, the ventral strongly curved, there being no angle at the point of union of the margins; hinge plate unevenly curved and slightly wider posteriorly than anteriorly; siphons fused only near their bases. The most abundant fingernail clam in Oklahoma, this species is found chiefly in rivers and creeks but it also occurs in ponds and lakes with sand bottoms and wave action.

Sphaerium hibbardi Herrington

Records: Pliocene deposits, Beaver Co. (19).

This extinct species also sometimes shows up in collections made from flood plains. Shell very finely striate (more than 12 striae per millimeter at middle of shell), thin, somewhat inflated, rhomboid in shape; beaks low; anterior end truncate; dorsal and ventral margins gently curved; hinge plate long, curved, moderately narrow; lateral teeth short, the cardinals located near anterior lateral cusps.

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