SUBSECTION ZOOLOGY

The Recent Gastropoda of Oklahoma, III. Terrestrial Species: Pupillidae, Carychiidae, Strobilopsidae and Oligyridae

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INTRODUCTION

The land snail fauna of Oklahoma is a relatively large one. Since 1884 (see Branson, 1959b) 15 families, 38 genera and 95 species and 40 subspecies have been recorded from within its boundaries. This is in a large degree a reflection of the ecological diversity found in the region and compares favorably with surrounding areas. Kansas (Leonard, 1959), for example, seems to have only about 65 species, whereas Texas has upwards of 200 forms. This is in general agreement with the observation that there is a progressive increase in number of species' as one descends to the tropics and subtropics. However, it will be seen that several of the species reported from Oklahoma are the result of erroneous identification and others are synonyms. The present paper is concerned with four families and is presented in the form utilized for the aquatic species in part two of this treatise (Branson, in press).

ORIGIN AND AFFINITIES OF THE OKLAHOMA FAUNA

As pointed out above, even the most cursory observation will demonstrate the great ecological diversity present in Oklahoma. This diversity is reflected in all of the plant and animal groups which have been studied in detail to date. We have already mentioned that the freshwater snails are of diverse origin and the same is true of the land gastropods. Although many, if not all, of the pressures exerted on aquatic species also come to bear upon land forms, there are some special points in the dispersal of the latter not encountered by the forms restricted to bodies of water. H. B. Baker (1958) has very nicely summarized the major tenets of dispersal in the land snails:

> Terrestrial gastropods are as closely tied to moisture as any animal; their habitat must always be near the dew point (thus they are active in breeding and feeding only at night or during times of precipitation); in drought periods they aestivate in their shells (which they close by mucous plugs (epiphragms). A large percentage of species are calciphiles. Although it is possible that land snails might be distributed by many agents, it seems that by far the most usual method is by their own movements, i. e., laying down a tract of slime and gliding

through it by ciliary action. If some barrier did not intervene these snails would be quite universal in distribution. There are several kinds of barriers: mountain ranges, extensive dry areas, rivers, oceans and, for the calciphiles, areas depleted of limestone.

One other method of dispersal mentioned by Baker is of utmost importance, at least in the realm of my experience, in the Great Plains Region. During the advent of floods, which are of nearly annual occurrence, logs, bark and other bits of debris are washed into the streams. When the waters subside this material is deposited, often very extensively, in drift piles. Myriads of the smaller, and many of the larger, land snails are washed into the water with the debris and use the latter as rafts. I have picked many living specimens from such situations (floating in the water and from drifts). It is obvious that this route is probably one of extensive utilization by land forms in the arid and semi-arid lands of the United States. As pointed out by Baker (op. cit.), most land snails are hermaphroditic. Consequently, a single fortuitous transport, if deposited in the proper environment, would be enough to secure new range for a species.

Geographic Relationships of Oklahoma Gastropods

As in Kansas (Leonard, 1959) and as seen in part I of this work, the major affinities of the Oklahoma fauna lie with the east. However, there are other elements that are decidedly western and southern in nature. The eastern influence is most fully-developed in the Ozarkian region, especially in the Carolinian which is set off by the Neosho (Grand) River in Oklahoma. Pilsbry (1903) and Pilsbry and Ferriss (1906) long ago pointed out that a great deal of this fauna probably resulted from Tertiary migration of species from the Appalachians. Several species of *Mesodon*, toothed *Polygyras, Stenotrema, Mesomphix* and *Discus* are restricted to the Ozarks and are characteristic of the east. The Oklahoma pupillids are essentially eastern in nature but several of them extend all the way to the Rocky Mountain outliers.

The southeastern segment, which probably entered Oklahoma via the Austroriparian in extreme southeastern McCurtain County, is represented by such forms as *Polygyra leporina, Stenotrema fraterna, Stenotrema leai* and a few others. *Oligyra orbiculata* and *Bulimulus dealbatus* are both species which belong to rather large families of Mexico and South America and may be thought of as intrusions from the tropical and sub-tropical areas. *Rumina decollata* has recently been reported from southern Oklahoma (Branson, 1959a), which is further evidence for the continued influence from the south.

Western forms, such as *Gastrocopta cristata, Pupilla* and *Columella*, indicate another penetration route into Oklahoma. Although Franzen and Leonard (1947) and Taylor and Hibbard (1955) point out that members of the last two genera are at present known only as fossils in Kansas and Oklahoma, living specimens may be found, representing Pleistocene relicts, in the Black Mesa (Rocky Mountain Uplift) region of Cimarron County. Whatever the case, these are western species and are restricted to the western-most counties.

It is thus seen that the terrestrial species of Oklahoma have as diverse a history as the aquatic ones. The fauna is of composite origin with both western and eastern components, the eastern influence being the stronger.

Variation

The ecological plasticity of terrestrial and aquatic snails is prodigious. This plasticity is, of course, the result of the great amount of adaptive

polymorphism maintained in the genomes of these creatures. Consequently, one encounters much variation in each species, especially if large lots are inspected from a variety of habitats and from widely separated geographic localities. In the past it has been the practice to recognize almost all of these variants as distinct species or subspecies. However, as each of the species becomes more fully studied it is apparent that many of these so-called "races" are nothing more than genetic variants and should not be given taxonomic status. As we shall point out below, and in later works on the fauna, many of the subspecies from Oklahoma are not valid.

Special Terminology

Most of the terminology used herein is applicable to most other groups as well. However, in the Pupillidae and Strobilopsidae some special morphological terms are required because the taxonomy of these groups is mainly based upon the shell. Text Figure 1 adequately demonstrates the apertural armature (shell teeth) in the Pupillidae. These terms may also carry over to the Strobilopsidae, except that all of the denticulations of the latter snails are of the lamellar type. A *fold* is a tooth-like elevation in the aperture of or on the columella of a snail's shell; *lamellae* are rather long plaits of shell material, sometimes following the curvature of the whorls.

FAMILY PUPILLIDAE

Shell, 1.3 to about 6.0 mm in length, from less than 1.0 to 2.0 or more mm in diameter, but always much taller than wide; milky-white, tan or brownish-white, opaque to translucent, whorls smooth to variously sculptured, 4½ to 9½, flat-sided to inflated; umbilicus minute and mostly covered by the reflected lip to rimate (open and surrounded by a rim of shell); lip widely reflected and thickened to thin and scarcely reflected; aperture nearly round to ovate; 0 to 10 denticulations in aperture; a depression on the outside of aperture (sinulus) often marks the position of the upper palatal. Animal mostly colorless to brownish-white; tentacles present to lacking; penis simple or complex; marginal teeth of radula tricuspid or bicuspid; most species calciphilic.

There have been 25 species and subspecies of pupillid mollusks reported from Oklahoma. These forms make up about 18 percent of the terrestrial fauna in the state. Five genera are known from our fauna.

KEY TO THE GENERA OF PUPILLIDAE IN OKLAHOMA

1 (a) Lateral teeth of radula tricuspid; tentacles poorly-developed or lacking; shell inflated; outer lip with a definite sinulus, or if sinulus lacking, then the lip is thin, unexpanded and apertural teeth are lacking 2

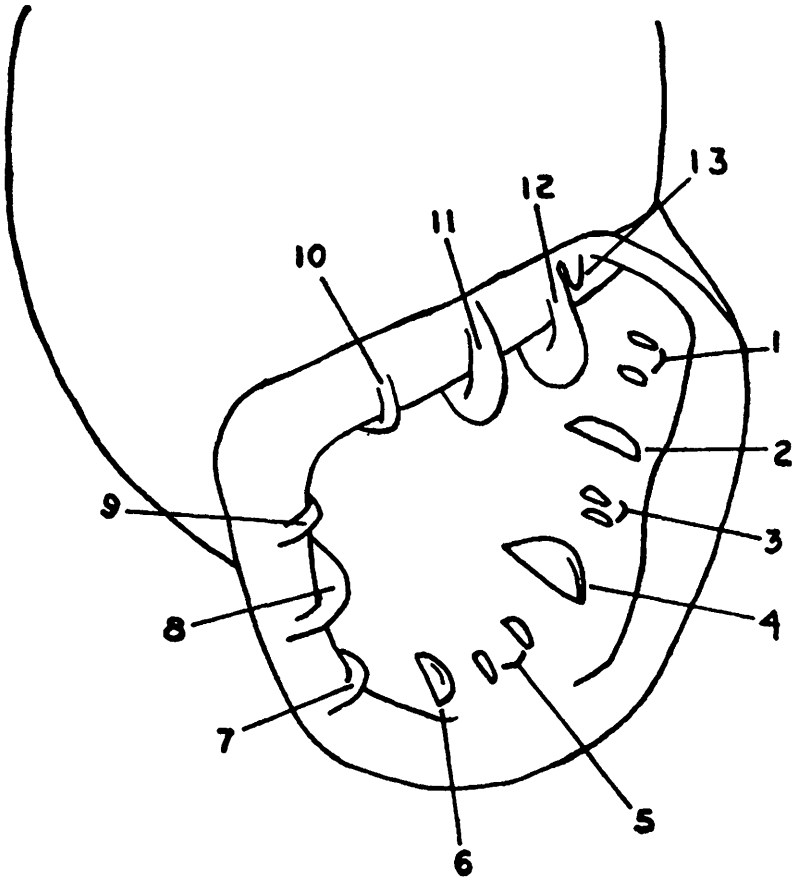
(b) Laterals bicuspid; tentacles well-developed; shell lacking a sinulus in outer lip; apertural teeth usually present 3

2 (a) Shell small and glossy; sinulus present; apertural teeth present ..... *Vertigo*

(b) Shell larger; sinulus lacking in outer lip; apertural teeth lacking ..... *Columella*

3 (a) Adult shell 4.0 to 4.5 mm. long, strongly tapered toward apex; lip much thickened within and greatly reflected ..... *Pupoides*

(b) Adult shell less than 4.0 mm. long; lip not strongly thickened within 4



Text Figure 1. Generalized Apertural Armature in the Pupillidae. 1 through 6 are folds (plicae), remaining denticulations are lamellae. 1, suprapalatal; 2, upper palatal; 3, interpalatal; 4, lower palatal; 5, infrapalatal; 6, basal; 7, subcolumellar; 8, columellar; 9, supracolumellar; 10, infraparietal; 11, parietal; 12, angular; 13, twin. Modified from Pilsbry (1948).

4 (a) Shell with a bluntly-rounded apex; whorls narrow and with a tendency toward slow increase in depth; penis branched..... *Pupill*

(b) Shell with a tapering apex; whorls less narrow and with a definite increase in depth from apex to body whorl; peni unbranched ..... *Gastrocopt*

Genus *Vertigo* Müller, 1774

Shell smooth to weakly striate, 1.4 to 3.2 mm in length, ovel, cylindri or ovate-oblong, usually glossy and nearly always some shade of tan c

brown; 4 to a little more than 5 whorls; apex rounded and blunt; rimate to nearly imperforate; lip thin and looped inward on outer margin (sinulus), 3 to 6 apertural denticulations. Animal nearly colorless; eyestalks present but tentacles lacking; jaws arched and weakly ribbed; most radular teeth tricuspid, some marginals bicuspid; usually found under decaying vegetation but some prefer moist situations near bodies of water.

KEY TO THE OKLAHOMA SPECIES OF *VERTIGO*

1 (a) Adult length less than 1.7 mm; lower palatal much longer than upper palatal; inner end of columellar lamella bent strongly inward ..... *Vertigo milium*

(b) Adult length 1.7 mm or more; lower palatal not much longer than upper; inner end of columellar not strongly bent inward 2

2 (a) Aperture with 3 teeth ..... *Vertigo tridentata*

(b) Aperture with 4 to 9 teeth 3

3 (a) Shell distinctly striate; angular lamella emerging as far as parietal lamella ..... *Vertigo rugosula*

(b) Striate weakly developed or lacking; angular lamella not emerging as far as parietal 4

4 (a) Aperture with 4 or 5 teeth; shell smooth, 1.7 to 2.0 mm in diameter ..... *Vertigo ventricosa*

(b) Aperture usually with 7 to 9 teeth; shell weakly striate, 2.2 or more in diameter ..... *Vertigo ovata*

Vertigo milium (Gould) Pl. II, Fig. 19.

Previous Records: Muskogee County (Wallen, 1951); Cimarron, Texas, Beaver, Harper, Woods, Woodward, Greer, Grady and McCurtain counties (Wallen and Dunlap, 1953); Roger Mills, Beckham, Osage, Pottawatomie, Hughes, Pawnee, Sequoyah, Ottawa, Haskell and LeFlore counties (Branson and Wallen, 1959); Murray County (Branson, 1959c); "Oklahoma" (Franzen and Leonard, 1947).

Additional Records: Choctaw County.

Shell exceedingly small, seldom attaining a length of 2.0 mm, pale brown to cinnamon in color, smooth to very weakly striate, ovel to globose-ovate; whorls 4 to nearly 5, apex smooth and glossy; lip whitish to corneous; 5 or 6 teeth: angular lamella tall and deeply placed, parietal lamella entering deeply, columellar lamella horizontal distally but looping downward proximally, upper palatal thin and high, lower palatal quite thin, high and bent downward within. Eyestalks very short, eyes almost sessile.

The aperture of southern Oklahoma specimens, when compared with those from northwestern Arkansas and Kansas, is rather capacious. Goodrich and van der Schalie (1944) pointed out that in Indiana the aperture is nearly closed by teeth. Specimens from southern Kansas and northeastern Oklahoma, although not to the extremes found in the last-cited work, also have rather large teeth whereas those from Texas and southern Oklahoma have rather reduced ones. This is probably a clinal character.

Franzen and Leonard (1947) indicated that *Vertigo milium* inhabited marshy areas or stream margins and was not able to exist in regions of high summer temperatures and/or very low annual precipitation. This has been cited by several authors (Hibbard and Taylor, 1960; Taylor, 1960). However, intensive collecting in many parts of arid Oklahoma, such as Cimarron and Texas counties, has shown that the species can and does live in these regions. It is always found near springs and other permanent bodies of water. Furthermore, the species can withstand near desiccation for several months by aestivation.

Vertigo rugosula Sterki Pl. II, Fig. 23.

Previous Records: Atoka County (Pilsbry and Ferriss, 1906); Muskogee County (Wallen, 1951); Logan and McCurtain counties (Wallen and Dunlap, 1953); Beckham, Pottawatomie, Hughes, Bryan, Pittsburg, Haskell, Sequoyah and LeFlore counties (Branson and Wallen, 1959).

Additional Records: Murray and Choctaw counties.

Shell, about 2.0 mm in length, elongate-ovoid, dark brown or tan; 4⅔ to 5 distinctly-striate whorls, the upper 1½ smooth; general aspect of aperture and of its teeth like *V. ovata,* but angular lamella very low in front, rising within and emerging as far as parietal lamella; basal fold situated higher on columella (basal in *V. ovata).* Animal as in *V. ovata.*

This species is nearly always found under moist humus in woodlands.

Vertigo ovata Say Pl. II, Fig. 20.

Previous Records: Payne County (Greger, 1915); Beaver County (Pleistocene) (Leonard and Frazen, 1944); Blaine, Johnston and Muskogee counties (Wallen, 1951); Cimarron, Texas, Beaver, Harper, Woods, Woodward, Washita, Caddo, Cotton, McCurtain and Grady counties (Wallen and Dunlap, 1953); Ellis, Roger Mills, Beckham, Pottawatomie, Hughes, Haskell, LeFlore, Sequoyah and Ottaawa counties (Branson and Wallen, 1959); Craig County (Branson, 1959c); Cleveland and McClain counties (Lutz, 1950); Harper County (Pleistocene) (Hibbard and Taylor, 1960). Also reported from several of the above counties as *V. ovata diaboli.*

Shell, 2.2 to 2.3 mm in length, yellowish or reddish-brown to cinammon, apex lighter; 4⅔ to 5 inflated whorls; a yellowish crest normally present behind the outer lip; usually 7 to 9 teeth (a few specimens had 5 or 6); parietal and columellar lamellae strong, basal small and thin, upper and lower palatals stand on a ridge. Animal very dark above and nearly white below; tail pointed and eye stalks distally inflated (Goodrich, 1932).

Pilsbry's (1919) *Vertigo ovata diaboli,* as indicated above, has been recorded from Oklahoma on several occasions. However, the topological characters of this "subspecies" make it possible to "recognize" certain individuals throughout most of the *V. ovata* range as belonging to the *diaboli* type. Consequently, grave doubt as to the validity of this form are herein expressed.

The species is generally found in close proximity to bodies of water or in marshy regions (Leonard and Franzen, 1944; Franzen and Leonard, 1947; and Leonard, 1959) but I have also found it to inhabit various crevices in the very porous soils of the Oklahoma Ozarks where moisture is conserved. In this last region one must dig deeply to find specimens or collect during and after rains. Furthermore, contrary to the findings of Leonard and Franzen (1944), this is a relatively common species in Beaver County, where it is often abundant near ponds and other bodies of water. *V. ovata* appears to be a calciphile and to prefer a slightly basic to neutral pH range (Burch, 1955).

Observations and experiments have shown that *V. ovata* (and possibly others) can act as intermediate host for *Hasstilesia tricolor* (Stiles and Hassall) and *H. texensis* Chandler, small flukes parasitizing *Sylvilagus* and *Lepus* (Robinson, 1953, 1959; Rowan, 1955a and b).

Vertigo ventricosa (Morse) Pl. II, Fig. 21.

Previous Records: Blaine County (Wallen, 1951); Beaver and Kiowa counties (Wallen and Dunlap, 1953).

Shell, 1.7 to 1.9 mm in length, ovate-conic, auburn in color, smooth to faintly striate; 4 or slightly more whorls separated by deep sutures; sinulus slight; aperture with 5 teeth: prominent parietal lamella, small basal and columellar folds, small lower and upper palatals; general contour of shell is like that of *V. ovata,* from which it differs in the small size and in lacking the angular lamella.

The rarity of this form in Oklahoma and its apparent absence in Kansas suggests that the species is a relictual one. The author has not seen a living specimen.

Vertigo tridentata Wolf Pl. II; Fig. 22.

Previous Records: Muskogee Connty (Wallen, 1951); Pottawatomie and LeFlore counties (Branson and Wallen, 1959).

Shell, 2.0 to 2.5 mm in length, ovate-oblong, shining yellow-brown to pale yellow; smooth to very faintly striate; 4½ to 5 whorls; aperture subovate with 3 or 4 rather stout teeth; parietal and columellar lamellae, a strong upper palatal and a smaller lower one.

Franzen and Leonard (1947) called the parietal lamella the angular but this denticle is obviously not in the position of the latter.

Vertigo tridentata is an uncommon species and is usually found near bodies of water. Since it is restricted to the eastern part of the state, an observation agreeing with records of Leonard (1959) in Kansas, it may also be a calciphile. We have found it only in Mississippian-Pennsylvanian out-cropped areas.

Vertigo decora (Gould)

Previous records: Tecumseh, Oklahoma (Walker, 1915).

This species is a synonym of *V. modesta* (Say) Pilsbry, 1948, and has not lived in this area since at least the Pleistocene. The closest its range comes to Oklahoma is northern Kansas (Leonard, 1959). Thus, Walker either had a Pleistocene fossil or he misidentified *V. ventricosa* as this form.

Genus Columella Westerlund, 1878.

Shell cylindric, 2.0 to 2.22 mm in length, brown to whitish-brown, weakly striate to smooth; apex very blunt; 5½ to nearly 7 whorls; aperture edentulous, thin and unexpanded. Foot oval, short and ungroved; lower tentacles lacking; genitalia similar to those of *Vertigo;* jaw solidly united flat plates; radular formula 21-1-21, centrals tricuspid, laterals bicuspid (Pilsbry, 1948). One genus and species in Oklahoma.

Columella edentula (Draparnaud). Pl. II, Fig. 18.

Previous Records: Blaine County (Wallen, 1951); Lincoln County, (Wallen and Dunlap, 1953).

With the characters of the genus.

I have not collected specimens from Oklahoma and, according to Pilsbry (1948), living specimens are not found in these latitudes. Observation of the specimens listed above quickly reveal that they are fossils, probably of Pleistocene age.

Genus **Pupoides** Pfeiffer, 1854

Shell, 5.0 to 5.2 mm in length, cinnamon brown to pale tan, elongate and conical, heavy and finely striate; 5½ to nearly 7 whorls separated by deeply-cleft sutures; lip white, strongly reflected and thickened; a very small tubercular tooth at insertion of outer lip with the body whorl (often lacking). Ovotestis trilobed, penis branched at tip; radula with 32 teeth per row (centrals trifid, laterals bifid and marginals multicuspid) and in 82 or 83 rows. One species in Oklahoma.

Pupoides albilabris (Adams) Pl. II, Fig. 14.

Previous Records: Atoka County (Pilsbry and Ferriss, 1906); Beaver, Payne, Noble, Kay and Comanche counties (Walker, 1915); Payne County (Greger, 1915); Beaver County (Pliocene) (Leonard and Franzen, 1944); Kay, Blaine, Payne, Murray, Pontotoc, Johnston, and Muskogee counties (Wallen, 1951); Cimarron, Texas, Beaver, Harper, Woods, Woodward, Alfalfa, Grant, Garfield, Noble, Dewey, Logan, Lincoln, Canadian, Washita, Caddo, Greer, Tillman, Cotton and McCurtain counties (Wallen and Dunlap, 1953); Osage, Washington, Nowata, Ottwa, Roger Mills, Beckham, Pottawatomie, Love, Bryan, Choctaw, Pittsburg, LeFlore, Haskell, Sequoyah, Cherokee and Adair counties (Branson and Wallen, 1959); Cleveland County (Lutz, 1950); Mayes, Latimer and Cleveland counties (Dundee, 1955); Craig and Pawnee counties (Branson, 1959c); Harper County (Pleistocene) Taylor and Hibbard, 1955).

Additional Records: Custer, Major, Garvin, Carter and Marshall counties.

With the characters of the genus. *Pupoides* is a rather calciphilic form and is highly tolerant of hot and dry periods. It is the most widely spread pupillid in Oklahoma and is most often found near the roots of grasses in the plains region and under forest litter or rocks in the Ozarks.

This species has been recorded under two other names in Oklahoma *P. albilabris* (C. B. Adams, 1841) and *P. marginatus* (Say, 1821). However, van der Schalie (1948), observing Puerto Rican specimens, found them to be conspecific with Say's (1821) *P. (Cyclostoma) marginatus*

Cyclostoma marginata is an out and out homonym of *Cyclostoma marginata* Fischer, 1807 and therefore is unavailable. Consequently, Adams (1841) erected the name *P. albilabris* to replace the latter.

Genus Pupilla Leach, 1828

Shell, 2.37 to 4.0 mm in length, light cinnamon, very light brown to nearly white; 5½ to nearly 8 whorls of slowly-increasing diameter, finely striate; apex very broad and blunt; lip narrowly reflected with a low crest behind it; teeth 0 to 3. Animal pale to brown on the back; foot narrow, milky and about 2.3 the length of the shell; both pairs of tentacles present but the anterior ones are very short; penis bifid. Ovoviviparous (Pilsbry, 1948).

In the Rockies, species of *Pupilla* are found in protected forest situations (Hibbard and Taylor, 1960), under fallen bark, rocks and litter, where moisture is abundant. The only possible site in Oklahoma where living specimens *(P. blandi)* may be found is near some springs in the Black Mesa region of Cimarron County.

KEY TO THE OKLAHOMA SPECIES OF *PUPILLA*

1 (a) Three teeth present in aperture ..... *Pupilla blandi*

(b) Aperture toothless or with 1 or 2 very small teeth 2

2 (a) Shell dextral ..... *Pupilla muscorum*

(b) Shell sinistral ..... *Pupilla sinistra*

Pupilla blandi Morse Pl. II, Fig. 17.

Previous Records: Cimarron, Texas, Harper, Woods and Woodward counties (Wallen and Dunlap, 1953); Ellis County (Branson and Wallen, 1959) Pottawatomie County (Branson, 1959c); Harper County (Pleistocene) (Taylor and Hibbard, 1955).

Shell, 2.46 to 3.60 mm in length, light brown to nearly white; 5½ to 6 whorls, which increase in diameter only very slightly from apex to body whorl, faintly striate; rimate; aperture nearly circular, thin and only slightly reflected; three small teeth, the parietal lamella largest.

Although Franzen and Leonard (1947), Leonard (1959) and Pilsbry (1948) have pointed out that this species is not found east of the Rocky Mountains, it is possible that living specimens may occur near the Black Mesa. Some shells found in that region have intact periostraca and Hibbard and Taylor (1960) found a dead animal still in the shell in South Dakota; other fresh shells were found in Montana.

Pupilla muscorum (Linnaeus) Pl. II, Fig. 16.

Previous Records: Cimarron, Beaver, Harper and Woodward counties (Wallen and Dunlap, 1953); Harper County (Pleistocene) (Taylor and Hibbard, 1955).

Shell, 2.86 to nearly 4.0 mm in length, brownish-white to cinnamon, weakly striate; whorls 5½ to slightly more than 7; aperture slightly reflected and toothless or with one or two very small denticles. All Oklahoma specimens are doubtless Pleistocene fossils.

Pupilla sinistra Franzen Pl. II, Fig. 15.

Previous Records: Woodward County (Wallen and Dunlap, 1953); Roger Mills County (Cenozoic) (Hibbard and Taylor, 1960).

Shell, 3.0 to nearly 4.0 mm in length, whitish-brown, faintly striate and granular; sinistral; 6½ to 7½ whorls; lip slightly reflected and thickened within, toothless. Pleistocene.

Franzen (1946), in her original description, designated *P. sinistra* as a subspecies of *P. muscorum*. However, Hibbard and Taylor (1960) studied a large series of Cenozoic specimens from Roger Mills County and have concluded that the form should be elevated to full-species rank.

Genus Gastrocopta Wollaston, 1878

Shell, 2.0 to 5.0 mm in length, milky-white to dark cinnamon brown, smooth to srongly striated; axis narrowly perforate to rimate; 4½ to nearly 7 whorls; lip thin and not reflected, to thickened and strongly reflected; teeth 3 to 9 or more. Animal nearly white to brownish on the back with a creamy foot; penis not bifid; radula with very narrow tricuspid centrals, wider bicuspid laterals and marginals with a large mesocone; mostly mycophagous and calciphilic. Nine recent and nine fossil species in Oklahoma.

KEY TO OKLAHOMA SPECIES OF *GASTROCOPTA*

1 (a) Palatal folds on a ridge just inside lip; color white 2
(b) Palatals not situated on a ridge; shell color usually some shade of brown 5

2 (a) Shell length 3.0 to nearly 5.0 mm ..... *Gastrocopta armifera*
(b) Shell length 2.5 mm or less 3

3 (a) Aperture nearly filled by very large teeth; shell length greater than 2.0 mm ..... *Gastrocopta contracta*
(b) Aperture more capacious; shell length less than 2.0 mm 4

4 (a) Parietal lamella large, situated on a ridge and with a shallow depression or groove near its center ..... *Gastrocopta holzingeri*
(b) Parietal small and knob-like (tuberculate), not on a ridge or grooved ..... *Gastrocopta tappaniana*

5 (a) Shell oblong-conic, usually transparent or milk-white ..... *Gastrocopta pentodon*
(b) Shell cylindric, usually some shade of brown 6

6 (a) Shell teeth much reduced or absent ..... *Gastrocopta corticaria*
(b) Shell teeth well-developed 7

7 (a) Lip thickened; diameter of shell more than 1.0 mm 8
(b) Lip thin; diameter of shell less than 1.0 mm ..... *Gastrocopta pellucida*

8 (a) Parietal lamella branched at the tip, appearing to be bifid in a front view ..... *Gastrocopta procera*
(b) Parietal not branched or bifid ..... *Gastrocopta cristata*

Gastrocopta armifera (Say) Pl. I, Fig. 5.

Previous Records: McIntosh and Atoka counties (Simpson, 1888); Craig and Atoka counties (Pilsbry and Ferriss, 1906); Payne, Noble and Kay counties (Walker, 1915); Payne County (Greger, 1915); Beckham, Kay, Payne, Cleveland, McClain, Craig and Johnston counties (Lutz, 1950); Garfield, Blaine, Logan, Murray, Pontotoc and Muskogee counties (Wallen, 1951); McCurtain, Lincoln, Noble, Grant, Canadian, Grady, Alfalfa, Caddo, Comanche, Woods, Dewey, Washita, Kiowa,

Tillman, Greer, Woodward, Harper, Cimarron, Texas and Beaver counties (Wallen and Dunlap, 1953); Ellis, Roger Mills, Oklahoma, Love, Pottawatomie, Osage, Hughes, Washington, Nowata, Ottawa, Rogers, Adair, Pittsburg, Haskell and LeFlore counties (Branson and Wallen, 1959); Sequoyah, Mayes, Bryan and Latimer counties (Dundee, 1955); Harper County (Pleistocene) (Taylor and Hibbard, 1955); Pawnee County (Branson, 1959c).

Additional Records: Major, Custer, Garvin, Carter, Marshall and Choctaw counties.

Shell, largest in genus, 3.5 to slightly more than 5.0 mm in length, perforate, oblong-oval, paraffin white and weakly striate; whorls 5 to 7; aperture rounded, teeth 5 to 7: angular lamella united distally with parietal to form a bifid structure, 4 palatals situated on a low ridge.

The subspecies *G. armifera abbreviata* Sterki, reported from Oklahoma by Lutz, is not a valid race (Franzen and Leonard, 1947) and Leonard's Pliocene and Pleistocene *G. proarmifera* does not seem to be sufficiently differentiated from *G. armifera* to be retained (Hibbard and Taylor, 1960).

I have not collected living specimens west of western Payne County. However, living animals are commonly found under stones, bits of wood, other moisture-retaining bodies and in dead logs east of this. These observations agree with those of Burch (1955).

Gastrocopta contracta (Say) Pl. I, Fig. 6

Previous Records: Atoka County (Pilsbry and Ferriss, 1906); Payne County (Greger, 1915); Payne and Noble counties (Walker, 1915); "Oklahoma" (Franzen, 1947); Comanche County (Franzen and Leonard, 1947); Payne, Cleveland, McClain and Muskogee counties (Lutz, 1950); Kay, Logan, Comanche, Pontotoc, Johnston and Murray counties (Wallen, 1951); Beaver, Dewey, Washita, Tillman, Caddo, Grady, Cotton, Garfield, Noble, Lincoln and McCurtain counties (Wallen and Dunlap, 1953); Mayes and Bryan counties (Dundee, 1955); Harper County (Pleistocene) (Taylor and Hibbard, 1955); Osage, Washington, Ottawa, Cherokee, Adair, Sequoyah, Pottawatomie, Hughes, Pittsburg, Haskell, LeFlore, Choctaw and Love counties (Branson and Wallen, 1959); Craig and Pawnee counties (Branson, 1959c); Beaver County (Hibbard and Taylor, 1960).

Additional Records: Garvin, Carter, Marshall and Tulsa counties.

Shell, 2.0 to 3.2 mm in length, ovate-conical, paraffin white or semitransparent and finely striate; whorls slightly more than 4 to nearly 6; aperture with thin lips, strongly contracted basally and triangular in shape, almost filled with large teeth; anguloparietal relatively huge and palatals connected by a low ridge.

This species is found on moist shaded areas which are abundantly supplied with limestone and rich decaying organic matter; mycophagous.

Gastrocopta holzingeri (Sterki) Pl. I, Fig. 7.

Previous Records: Noble County (Walker, 1915); "Hickory Creek" (Lutz, 1950); Muskogee and Pontotoc counties (Wal-

len, 1951); Texas, Beaver, Harper, Woods, Woodward, Garfield, Noble, Blaine, Logan, Washita, Caddo, Grady, Harmon, Kiowa, Jackson, Tillman and Grady counties (Wallen and Dunlap, 1953); Harper County (Pleistocene) (Taylor and Hibbard, 1955); Roger Mills, Beckham, Payne, Osage, Pottawatomie, Hughes, Ottawa, Sequoyah and LeFlore counties (Branson and Wallen, 1959); Murray and Johnston counties (Branson, 1959c).

Additional Records: Cimarron, Custer, Carter and Marshall counties.

Shell, 1.66 to 1.90 mm in height, ovoid or ovoid-cylindrical, waxen-white to transparent; 4½ to 5 whorls, faintly striate to smooth; a low crest behind the outer lip; aperture oval, lip thin; teeth 6 or 7: angular and parietal fused proximally so that a "Y" shaped structure results, palatals on a white, heavy ridge.

G. holzingeri is found in wooded ravines and other shaded areas under litter. It may be collected in rather large numbers from such areas (with *G. pentodon)* by using a seive.

The subspecies *G. h. agna* was reported from Grady County by Wallen and Dunlap (1953). However, since this "variety" may be found throughout the range of the species it is of doubtful validity.

Gastrocopta pentodon (Say) Pl. I, Fig. 8.

Previous Records: Payne, Noble, Grady and Pottawatomie counties (Walker, 1915); Payne, Pontotoc, Johnston and Muskogee counties (Wallen, 1951); Cleveland and McClain counties (Lutz, 1950); Woods, Woodward, Washita, Jackson, Garfield, Kay, Noble, Logan, Grady, Lincoln and McCurtain counties (Wallen and Dunlap, 1953); Osage, Ottawa, Mayes, Sequoyah, Pottawatomie, Hughes, Comanche, Tillman, Haskell, and LeFlore counties (Branson and Wallen, 1959); Murray and Washington counties (Branson, 1959c).

Additional Records: Greer, Garvin and Choctaw counties.

Shell, 1.45 to 1.95 mm in length, oblong-conic with a body whorl only slightly enlarged over preceding ones, waxen-white to transparent; 4½ to 5 whorls; lip thin and aperture ovate; teeth typically 5 but varying from 5 to 9: a simple anguloparietal (largest), a large columellar and smaller subcolumellar, moderate upper and lower palatals and a varying number of interpalatals; palatals on a white ridge; umbilicus minute.

G. pentodon is mainly a species of the woodlands but may be found near the roots of grasses. It prefers soils that are slightly alkaline (Burch, 1955).

There has been some discussion as to the possibility that *G. tappaniana* is nothing more than a variable form of *G. pentodon*. Hibbard and Taylor (1960) concluded that the two are distinct, as did Vanatta and Pilsbry (1906). Leonard and Goble (1952), on the other hand, considered *G. tappaniana* to be a synonym of *G. pentodon*. This writer, after having observed many specimens from Kansas, Oklahoma and Texas, considers the two as distinct. It is possible that some of the above authors were observing the form called *G. pentodon gracilis* Sterki, which is only a genetic variant of the parent species. This form may easily be confused with *G. tappaniana*.

Gastrocopta tappaniana (C. B. Adams) Pl. I, Fig. 9.

Previous Records: Noble, Grady, Comanche and Pottawatomie counties (Walker, 1915); Cleveland, McClain, Tulsa and Muskogee counties (Lutz, 1950); Blaine, Kay, Payne, Pontotoc and Johnston counties (Wallen, 1951); Cimarron, Texas, Beaver, Harper, Woods, Grant, Woodward, Garfield, Noble, Dewey, Logan, Lincoln, Washita, Caddo, Grady, Greer, Kiowa, Jackson, Tillman and McCurtain counities (Wallen and Dunlap, 1953); Beaver County (Pleistocene) (Taylor, 1954); Harper County (Pleistocene) (Taylor and Hibbard, 1955); Ellis, Roger Mills, Beckham, Pottawatomie, Osage, Washington, Nowata, Ottawa, Mayes, Sequoyah, Haskell, Hughes, LeFlore and Choctaw counties (Branson and Wallen, 1959); Pawnee, Craig and Murray counties (Branson, (1959c).

Additional Records: Marshall, Alfalfa, Major and Garvin counties.

Shell, 1.52 to nearly 2.0 mm in length, obtusely-conic, averaging larger than *G. pentodon,* waxen-white to nearly transparent; 4½ to 5 whorls, the body whorl being *markedly larger* than those preceding it; lip thin; aperture ovate, usually bearing 7 teeth (6 to 9): a rather high, thin anguloparietal, a long lamellar columellar, 5 to 6 palatals on a high lip callus, and a tubercular lower columellar.

G. tappaniana is a hydrophilic species, often being found under moist decaying logs and leaves. This has been noted by several authors as being a different station than that occupied by *G. pentodon.*

Gastrocopta corticaria (Say) Pl. I, Fig. 10.

Previous Records: Cleveland and McClain counties (Lutz, 1950); Kay and Muskogee counties (Wallen, 1951); Texas, Noble, Logan, Grady and Lincoln counties (Wallen and Dunlap, 1953); Hughes, Cherokee, and Sequoyah counties (Branson and Wallen, 1959).

Shell, 2.4 to 2.7 mm in length, ovate-cylindric, thin and smooth, translucent white; sutures deep between 4½ to 5 whorls; umbilicus very small; lip thin and unexpanded, aperture oval; teeth 0 to 3, very poorly developed: anguloparietal low and lamelliform or tuberculate(sometimes angular separate from parietal), a poorly-developed columellar and a very small lower palatal (usually lacking).

G. corticaria appears to be a shade lover and has been found only in limestone-rich areas in Oklahoma. It is a relatively rare species throughout its range (Pilsbry, 1948).

Gastrocopta procera (Gould) Pl. I, Fig. 11.

Previous Records: Muskogee county (as *G. rupicola)* (Simpson, 1888); Payne County (Greger, 1915); Logan, Beaver, Payne and Noble counties (Walker, 1915); "Oklahoma" (Franzen, 1947); Payne, Tulsa, Cleveland and McClain counties (Lutz, 1950); Kay, Blaine, Pontotoc, Johnston and Muskogee counties (Wallen, 1951); Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Grant, Woodward, Garfield, Noble, Dewey, Logan, Washita, Greer, Kiowa, Caddo, Harmon, Jackson, Comanche, Grady, Lincoln, Tillman, Cotton and McCurtain counties (Wallen and Dunlap, 1953); Payne County (Taylor, 1954); Harper

County (Pleistocene) (Taylor and Hibbard, 1955); Bryan County (Dundee, 1955); Ellis, Roger Mills, Beckham, Oklahoma, Pottawatomie, Murray, Osage, Washington, Nowata, Ottawa, Hughes, Choctaw, Haskell, Sequoyah and LeFlore counties (Branson and Wallen, 1959); Pawnee and Craig counties (Branson, 1959c).

Shell, 2.2 to 2.5 mm in length, cinnamon to washed-brown, cylindric, irregularly and lightly striate; 5 to slightly more than 6 whorls separated by deeply incised sutures; lip thickened, white or flesh-colored and strongly reflected, thickened within by a callous ridge; aperture nearly oval with 5 or 6 teeth: a moderately to strongly bifid anguloparietal, tubercular upper palatal, a lamelliform, deeply-placed lower palatal, a small, low basal placed nearly as deeply as the upper, a long lamelliform columellar fold and a knob-like subcolumellar.

This species lives in wooded areas which border streams and ponds and is very abundant in the Carolinian. It approaches *G. rupicola* (Say) in the Austroriparian region of McCurtain County. The last-named species may be nothing more than a southern *G. procera*.

Gastrocopta procera has been reported from Oklahoma on several occasions as *G. p. mcclungi* (Hanna and Johnston) and *G. p. sterkiana* Pilsbry. However, all three forms can be found within a single area and in New Mexico and Arizona collections I have found in all three in approximately equal mixtures. Consequently, these "subspecies" are regarded as invalid forms which should be dropped.

Gastrocopta cristata (Pilsbry and Vanatta) Pl. II, Fig. 12.

Previous Records: Logan, Beaver and Payne counties (Walker, 1915); Payne County (Greger, 1915); "Oklahoma" (Franzen, 1947); "Oklahoma" (Franzen and Leonard, 1947); Lincoln and Cleveland counties (Lutz, 1950); Cimarron, Texas, Beaver, Woods, Alfalfa, Kay, Woodward, Garfield, Blaine, Logan, Washita, Caddo, Canadian, Harmon, Greer, Kiowa, Jackson, Tillman, Grady and McCurtain counties (Wallen and Dunlap, 1953); Harper County (Pleistocene) (Taylor and Hibbard, 1955); Ellis, Roger Mills, Beckham, Pottawatomie, Washington, Hughes, Haskell, LeFlore, Bryan and Choctaw counties (Branson and Wallen, 1959); Pawnee, Murray and Johnston counties (Branson, 1959c).

Additional Records: Garvin and Marshall counties.

Shell, 1.9 to nearly 3.0 mm in length, glossy-cinnamon to yellowish brown, weakly but distinctly striate; 5 to about 6 convex whorls separated by deep sutures; aperture ovate; lip whitish or flesh-clored, strongly reflected and thickened within and without; a strong brownish-white crest lies parallel to and behind the lip; 5 teeth: a rather strong anguloparietal which is not in the least bifid in a frontal view (an occasional specimen may be found in which a slight spur occurs), a small tubercular upper palatal, a moderate, deeply-placed lower palatal directly under the anguloparietal, a short, entering lamelliform basal, and a short, horizontal columellar which is strengthened below by a tubercle similar to the one in *G. procera*.

In habitat choice *G. cristata* is similar to *G. procera* and is usually found with it throughout the Oklahoma region.

Because these two species are morphologically similar and because they occupy similar ecological stations it has been thought by several

authors (Greger, 1915; also personal communications) that these two were conspecific. However, one seldom finds the two difficult to separate. Furthermore, Taylor (1960), having compared many specimens and thoroughly studied their fossil record, concludes that they are distinct species.

Gastrocopta pellucida (Pilsbry) Pl. II, Fig. 13.

Previous Records: Payne County (Walker, 1915); "northeastern Oklahoma" (Franzen and Leonard, 1947); "eastern Oklahoma" (Pilsbry, 1948); Woodward County (Lutz, 1950); Texas, Beaver, Harper, Woods, Dewey, Noble, Blaine, Canadian, Lincoln, Washita, Harmon, Greer, Kiowa, Jackson, Tillman and Grady counties (Wallen and Dunlap, 1953); Ellis, Roger Mills, Beckham, Payne, Osage, Ottawa, Pottawatomie, Hughes, Bryan, Haskell and LeFlore counties (Branson and Wallen, 1959); Murray and Johnston counties (Branson, 1959c).

Additional Records: Cimarron, Custer, Alfalfa, Major, Garvin, Carter, Marshall and Choctaw counties.

Shell, 1.6 to 2.6 mm in length, always less than 1.0 mm in diameter, oblong-cylindric, whitish to brownish-white, distinctly but faintly striate; whorls, slightly over 5 to 5½, separated by deeply-incised sutures; aperture nearly circular, lip thin and corneous; 5 teeth: a slender, strongly bilobed anguloparietal, a strong, horizontal columellar which enters rather deeply, basal small and tuberculate or lamelliform, lower palatal largest of the three outermost teeth and placed deeply within, upper palatal tuberculate and moderately deep within.

The ecological station of this species is little known. I have found it under rocks and piles of Bermuda grass in Payne County.

The nominate forms of *G. pellucida, G. p. parvidens* (Sterki) and *G. p. hordeacella* (Pilsbry), are largely imaginary (Branson, Sisk and McCoy, in press). Series collected from western Oklahoma, through New Mexico and Arizona, into Sonora, Mexico, demonstrate continuous variation in shell characters. Shells matching the characteristics of the two "races" can be found throughout the range of the species.

NOTES ON FOSSIL *GASTROCOPTA* OF OKLAHOMA

Since the Pleistocene deposits of central and western Oklahoma are very abundantly supplied with fossil *Gastrocopta* it would be wise for anyone collecting in those regions to observe any dead shells found there with a suspicious eye. The following key is added to facilitate identification of western Oklahoma *Gastrocopta* which will not fit the key characters given above.

KEY TO FOSSIL *GASTROCOPTA* FROM OKLAHOMA

1 (a) Shell widely umbilicate ..... unnamed form (see Taylor, 1960)
(b) Umbilicus small to minute 2

2 (a) Palatals standing on a low ridge 3
(b) Palatals not connected by a ridge 4

3 (a) Shell ovate; anguloparietal with a buttress within (Lower Pliocene) ..... *Gastrocopta anterides*
(b) Shell cylindric; anguloparietal buttress lacking (Middle Pleistocene) ..... *Gastrocopta falcis*

4 (a) Angular and parietal not fused (Upper Pliocene-Lower Pleistocene) ..... *Gastrocopta rexroadensis*
(b) Angular and parietal at least partially fused 5

5 (a) Columella lamella strongly descending within; a long, deeply-placed lower palatal fold present 6
(b) Columellar lamella not descending within; lower palatal not both long and deeply placed 7

6 (a) Anguloparietal simple, not grooved or bifurcate anteriorly (Lower Pleistocene) ..... *Gastrocopta chauliodonta*
(b) Anguloparietal grooved or bifurcate anteriorly (Pliocene) ..... *Gastrocopta lavernensis*

7 (a) Lip callus thin; a small tubercle (infraparietal) between the anguloparietal and the columella (Recent in lower Texas and eastern Mexico; Upper Pliocene and Lower Pleistocene in Oklahoma) ..... *Gastrocopta riograndensis*
(b) Lip callus relatively heavy; infraparietal lacking 8

8 (a) Shell sinistral (uppermost Pliocene and Lower Pleistocene) ..... *Gastrocopta scaevoscala*
(b) Shell dextral 9

9 (a) Subcolumellar lamella present (Upper Pliocene) ..... *Gastrocopta franzenae*
(b) Subcolumellar lamella lacking (Upper Pliocene-Lower Pleistocene) ..... *Gastrocopta paracristata*

According to Taylor (1960) *G. scaevoscala* is the ancestral form to both *G. cristata* and *G. procera; G. paracristata* would be the supposed intermediate form between *G. scaevoscala* and our Recent *G. cristata.*

FAMILY CARYCHIIDAE

Shell, 1.64 to 1.7 mm in length, glistening white, distinctly striate, tapering-cylindric; 4½ to 5½ whorls; lip greatly thickened and aperture obliquely placed; a small tooth at junction of parietal and columellar margins which expands into a broad plate within; internal axis eroded away in upper whorls. Animal mostly colorless to clear tan; foot and tentacles short and blunt; eyes sessile at bases of posterior tentacles. One genus and species.

Genus Carychium Müller, 1774

With the characters of the family.

Carychium exiguum (Say) Pl. I, Fig. 1.

Previous Records: Pontotoc, Johnston and Muskogee counties (Wallen, 1951); Cimarron, Texas, Harper, Woods, Woodward and McCurtain counties (Wallen and Dunlap, 1953); Beckham, Osage, Pottawatomie, Hughes, Bryan, Choctaw, Haskell and Sequoyah counties (Branson and Wallen, 1959); Harper County (Taylor and Hibbard, 1955).

With the characters of the family.

Carychium is a rather hydrophilic species and is usually found near bodies of water, under logs, leaves or rocks. Leonard (1959) reported the species to enter the water occasionally. Burch's (1955 data would indicate it to be also a calciphile.

Carychium exiguum has been called *C. exile* (H. C. Lea) since it was first reported from Oklahoma in 1951. Leonard (1959) reports both forms from Kansas, as have several other authors. However, it has been known for some time (Winslow, 1922) that some sort of taxonomic difficulty existed in this group. Although she found some shells in which the lamellae differed greatly, some examples were also noted in which the characters of both species were combined. This in itself bespeaks of some doubt as to the validity of one or the other species. A series of specimens from Oklahoma compared with a similar series from Texas shows continuous variation in the thickness of the lip and in the morphology of the lamellae. The extreme south-central Texas form is much more distinctly striate than are Oklahoma specimens, the latter specimens being more striate than ones from northern Kansas. Harry (1952) concluded, because of so much variation in some of these characters, that only *C. exiguum* occurs in Michigan. Therefore, it is felt that the species called *C. exile* is only a variant and should be listed as a synonym of *C. exiguum*, a name which has priority. Taylor (1960) is of a like opinion.

As an added note, some specimens from south-central Oklahoma approach the form of *C. minimum* Müller of Europe.

FAMILY STROBILOPSIDAE

Shell, 3.0 mm in diameter or less, trochiform, varying shades of brown and conspicuously marked by raised, oblique ribs; umbilicus very small (9 to 13 times in diameter); whorls 4½ to nearly 6; aperture basal and semilunate, lip thickened and reflected, brownish in color; several lamellae are placed on the parietal wall but only 1 or 2 of these can be seen in the aperture; those placed deeply are usually nodose. Animal with dark tentacles and back, sides of foot gray, venter nearly white. One genus and species.

Genus Strobilops Pilsbry, 1893

With the characters of the family.

Strobilops labyrinthica (Say) Pl. I, Figs. 3, 4.

Previous Records: Atoka County (Simpson, 1888); Ottawa, Atoka, Muskogee, and Pottawatomie counties (as *S. texasiana)* (Pilsbry and Ferriss, 1906); Payne County (Greger, 1915); Payne County (Walker, 1915); Harper County (Taylor and Hibbard, 1955) (as *S. texasiana);* McClain *(S. labyrinthica),* McClain, Cleveland, Pottawatomie, Atoka, Muskogee, and Ottawa counties (as *S. texasiana)* (Lutz, 1950); Payne, Muskogee, Pontotoc, Johnston, Pushmataha and McCurtain counties (as *S. labyrinthica)* (Wallen, 1951); Greer, Washita, Tillman, Comanche, Lincoln, Kay (as *S. labyrinthica),* Harper *(S. texasiana),* Woods, Logan, Muskogee *(S. labyrinthica parietalis)* and Muskogee *(S. aenia)* counties (Wallen and Dunlap, 1953); Murray, Tulsa, Bryon, Okmulgee, Hughes and Latimer counties *(S. texasiana)* (Dundee, 1955); Osage, Washington, Ottawa, Mayes, Cherokee, Pottawatomie, Hughes, LeFlore, Murray, Love, Bryan, Choctaw *(S. labyrinthica),* Roger Mills, Payne *(S. texasiana),* Osage, Adair, Sequoyah, Pontotoc, Haskell *(S. labyrinthica parietalis),* Osage and LeFlore counties *(S. aenia)* (Branson and Wallen, 1959).

As is made obvious by the records above, several forms of *Strobilops* have been reported from Oklahoma. However, when viewed in a broad sense, *Strobilops* shows considerable variation in its shell characters. In

a collection made from Cherokee County, we have found specimens under a single log which could pass for *S. aenia, S. texasiana* and *S. labyrinthica.* Since it is possible to find specimens which match the characteristics of *S. texasiana* (Pilsbry and Ferriss) throughout the geographic and geologic range of *S. labyrinthica* this form is hardly worth retaining as a species or as a subspecies and should be suppressed. The nominate subspecies *S. l. floridana* Pilsbry should also be thoroughly investigated to determine its status.

Although Pilsbry (1948) records *Strobilops affinis* Pilsbry from northeastern Oklahoma and Kansas I have not found specimens which fit that species characteristics. Leonard (1959) is apparently also of this opinion since he did not list it in his booklet on the fauna of Kansas.

Strobilops labyrinthica form *parietalis* Pilsbry is without nomenclatural sanction and should be dropped completely.

Strobilops aenia spiralis Pilsbry is another dubious species. Whatever its standing, a careful analysis of Oklahoma specimens (all young shells) does not reveal shells capable of being labeled *S. aenia.* Professor Joseph Bequaert (personal communication) is of the opinion that *S. aenia* does not occur west of the Mississippi River.

Strobilops labyrinthica is most often found under decaying logs and litter in forested areas but is not restricted to this habitat. It has often been found under large stones in Oklahoma.

FAMILY OLIGYRIDAE

Shell, 4.5 to 6.78 mm in length, globose-conic, nearly white, shades of gray, yellow, olive, buff, pinkish (Cheatum and Brooks, 1937) or metallic ivory in color, all phases occasionally being banded with buff or gray; 4½ to nearly 5 whorls, the body whorl being much the largest; spire very short; aperture ½ oval, lip usually very thick and thickened within; operculum same color as shell and lacking obvious whorls. Animal light in color with a blunt foot; sexes separate (Baker, 1926) and radula long and narrow with about 100 transverse rows of teeth (Baker, 1922). One genus and species.

Genus Oligyra Say, 1818

With the characters of the family.

Oligyra orbiculata (Say) Pl. I, Fig. 2.

Previous Records: Atoka and Muskogee counties (Simpson, 1888); Murray, Atoka, Pushmataha, Love, McIntosh, and Muskogee counties (Lutz, 1950); Pontotoc, Johnston and Cherokee counties (Wallen, 1951); McCurtain County (Wallen and Dunlap, 1953); Bryan and Sequoyah counties (Dundee, 1955); Hughes, Haskell, Choctaw, and LeFlore counties (Branson and Wallen, 1959).

Additional Records: Carter, Marshall, Coal, Pittsburg, and Latimer counties.

With the characters of the family.

Oligyra is also found associated with limestone-rich areas in Oklahoma in both grass plains and forested areas. However, except in times of rain, it is seldom seen alive. During droughts it must be sought beneath deeply implanted rocks and logs.

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PLATE I

Index Lines are 1.0 mm

FIGURE

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2. *Oligyra orbiculata tropica*
3. *Strobilops labyrinthica*
4. *Strobilops labyrinthica*
5. *Gastrocopta armifera*
6. *Gastrocopta contracta*
7. *Gastrocopta holzingeri*
8. *Gastrocopta pentodon*
9. *Gastrocopta tappaniana*
10. *Gastrocopta corticaria*
11. *Gastrocopta procera*

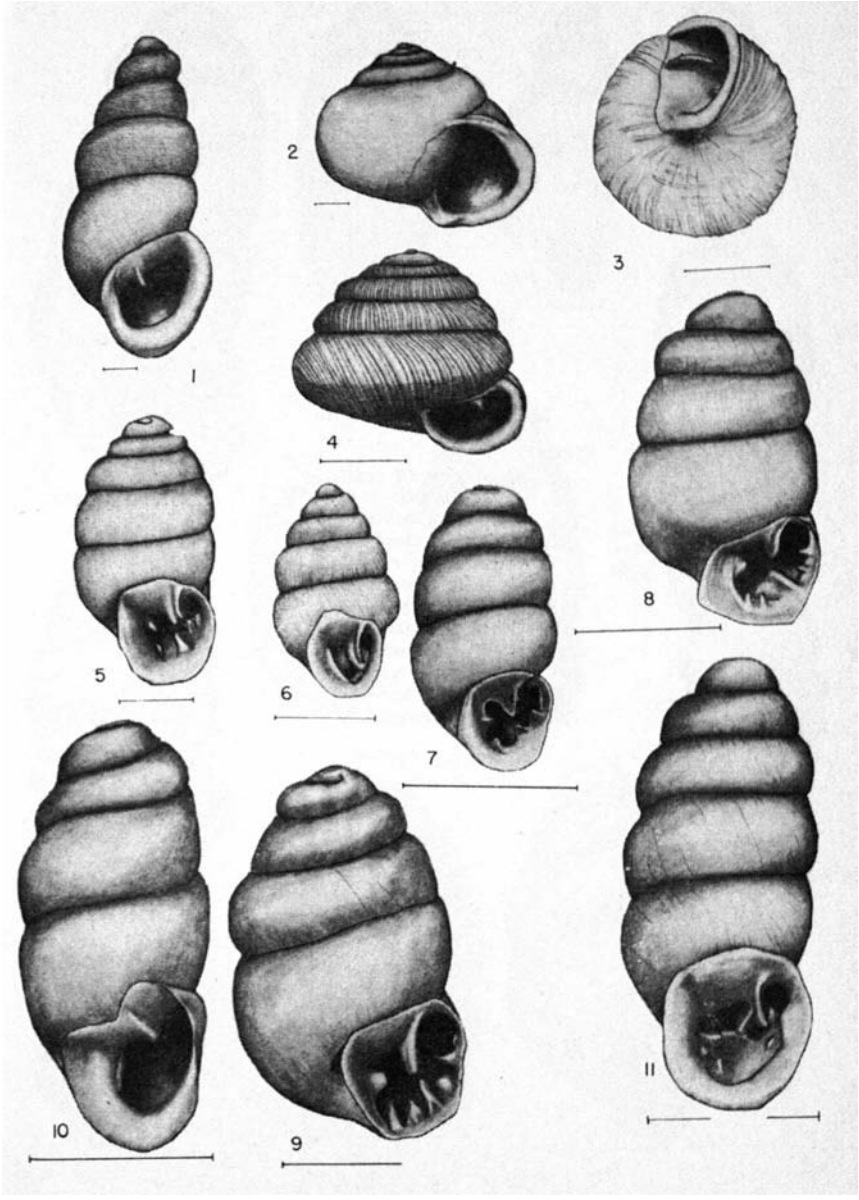
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PLATE II

Index Lines are 1.0 mm

FIGURE

12. *Gastrocopta cristata*
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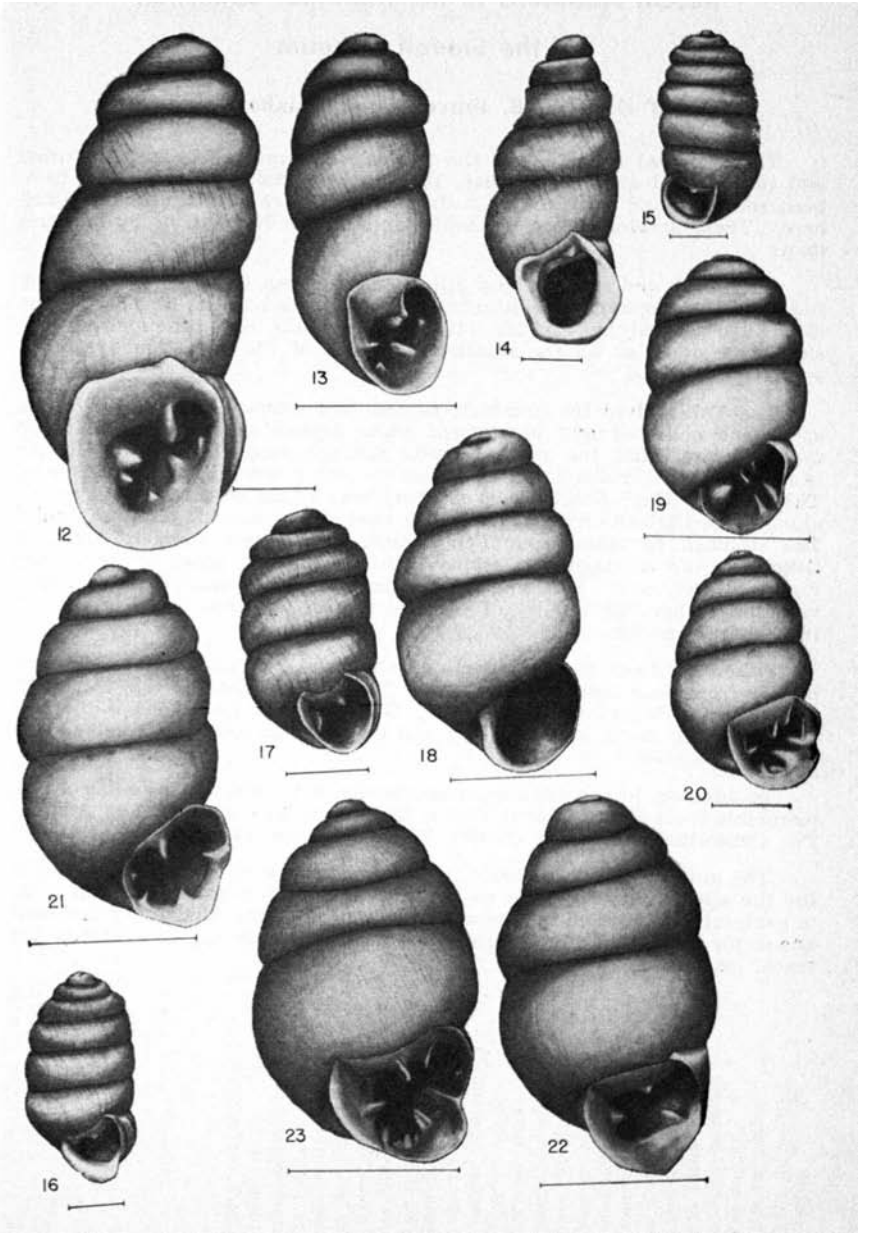
14. *Pupoides albilabris*
15. *Pupilla sinistra*
16. *Pupilla muscorum*
17. *Pupilla blandi*
18. *Columella edentula*
19. *Vertigo milium*
20. *Vertigo ovata*
21. *Vertigo ventricosa*
22. *Vertigo tridentata*
23. *Vertigo rugosula*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