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Land Snails and Slugs of Missouri

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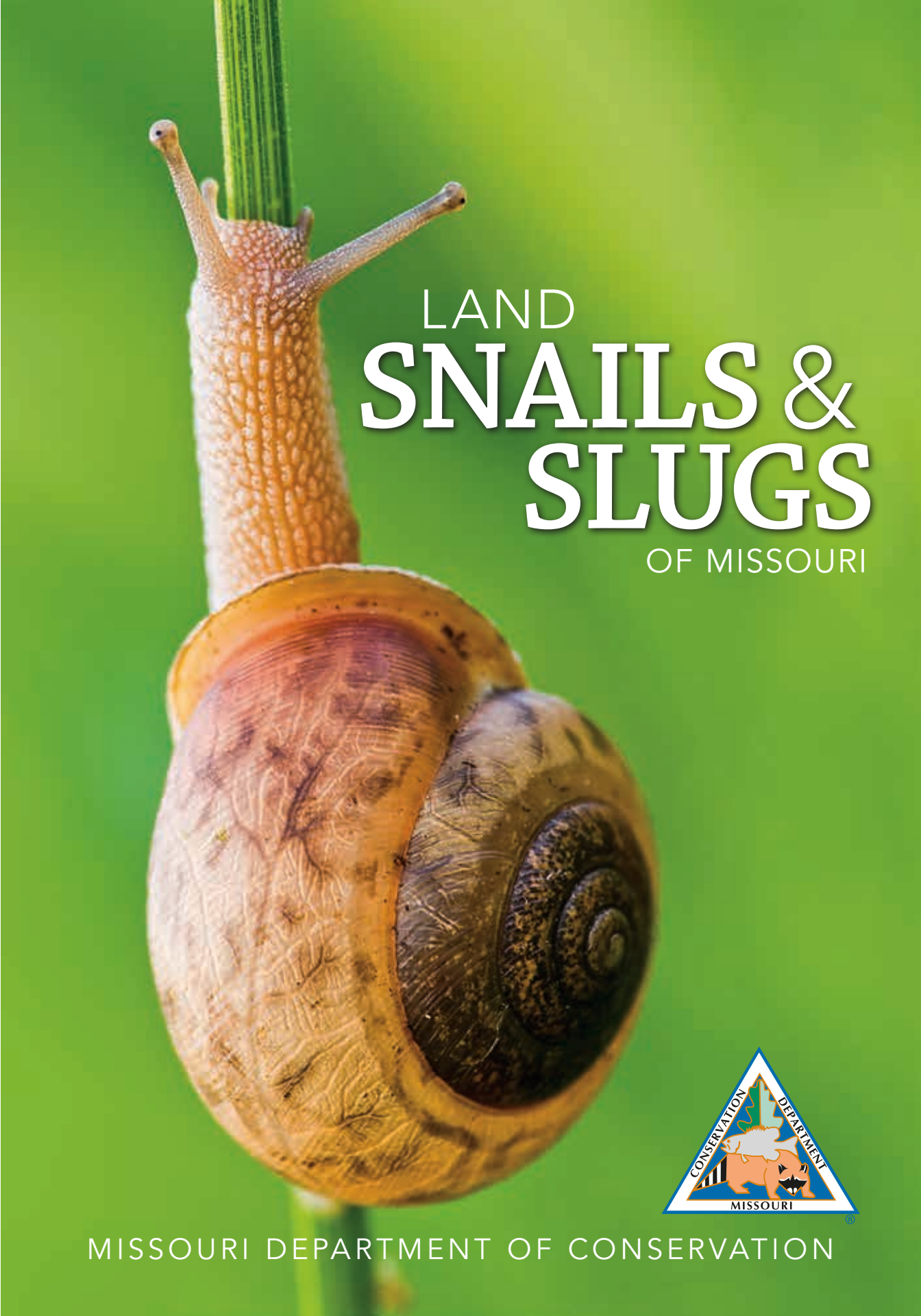

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by
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Edited by Carol Davit

Dedicated to the memory of Frieda Schilling, 1924–2010

Front cover: A land snail at Prairie Garden Trust in New Bloomfield, Mo.
Photograph by Noppadol Paothong.

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INTRODUCTION

This book is an identification guide and a natural history of the terrestrial mollusks of the state of Missouri. The authors hope to encourage interest in mollusks in general and land snails in particular. We freely admit to being infatuated with our slimy friends, and we can't imagine that those who take time to look won't feel the same way. Distributional information (that is, who lives where) is based on field collections by Ronald Oesch (RO) and Larry Watrous (LW). Both RO and LW began collecting shells in 1990 and record here the results of examining snails from more than 800 sites across the state. The photographs of shells and the maps are the handiwork of LW. Chris Barnhart (CB) contributed the sections describing the biology of gastropods. The Oesch collection has been donated to the University of Colorado, Boulder. The Watrous collection is privately held.

A Historical Perspective on the Importance of Land Snails

The creation legend of the Osage tribe tells that the first man began as a snail, who passed a quiet existence on the banks of the Osage River. His wants were few, and he seldom hunted. He went out only when driven by hunger to seek food, and he took whatever could be most easily obtained. One day a great storm came and the river swept everything before it. The snail was carried along and deposited at last in a strange country. It was very warm and the sun came out and baked the earth in which he was embedded. Feeling a change, the snail began to grow and developed into a man. At first, the new being was stupefied, but with returning memory, he set out for his former home. Arriving on the banks of the Osage River, he became faint from hunger. Although game and fish were plenty, he had no means of catching them, and lay down to die. Luckily, the Great Spirit appeared. He gave the man a bow and arrows, and taught him to hunt. Later the man saw a beaver lodge, on which the chief of the family was sitting. The beaver invited the man to live with them. He accepted the offer and soon married one of the beaver's daughters. From this happy union there came the village and the nation of the Wasbasha, or Osages (adapted from Lewis 1814 and De Voe 1904).

Few modern Missourians would ascribe such momentous significance to snails. Nonetheless, these inconspicuous creatures have special appeal. Their familiar shape and leisurely pace invite our curiosity. Snails don't startle us with fast moves, and they don't sting or bite to discourage our attention. I (CB) can recall childhood experiences with the snails that appeared after rain on the mossy rocks behind my grandparent's cottage. My sister showed me how to touch the snail's eyestalks and watch as they retracted, outside in, before slowly extending again to gently investigate my finger.

Snails belong to the Class Gastropoda of the Phylum Mollusca. These soft-bodied but hardshelled creatures are one of the great success stories of the animal kingdom. The phylum Mollusca is large, second only to the arthropods in number of species, and more than threequarters of all mollusks are snails. Although the majority of snails are aquatic, many live on land. More than 100 terrestrial species occur in Missouri, and there are more than 30,000 species found worldwide. It may be surprising to learn that, globally, there are more species of land snails and slugs than all of the land vertebrates (amphibians, reptiles, birds and mammals) combined (Solem 1974).

How to Find and Study Land Snails

Land snails are found in a wide variety of habitats, including wetlands, forests, prairies and even hot deserts. Limestone and calcareous soils favor snails by providing calcium for shell building. In our region, forested areas with limestone outcrops are especially productive. Many species of snails can be found in such areas by turning over rocks, logs, and fallen bark. Large numbers of snails can also be found in crevices at the base of large trees, particularly walnut and butternut but also buckeye, basswood and sugar maple (Dourson and Dourson 2006).

Land snails can be found in very small patches of habitat, even in urban areas. The foundations of old buildings where they meet the ground, or large rocks left undisturbed in a suburban neighborhood, often harbor several species of snails and slugs. In these sheltered places, snails live out their lives much as they did during the millennia before the neighborhood was built.

Collecting is an important part of studying land mollusks. Dead shells persist for a long time and they are often more numerous than live specimens. Many of the shells shown in this book have their beautiful outer protective layer (periostracum) intact, but the casual collector may not find shells as perfectly preserved. In fact the majority of shells may have this colored, proteinaceous layer eroded away, leaving only the white mineral portion of the shell remaining. Long-dead shells may be bleached and fragile, but they can still be identified, and they are evidence of which species are or were present in an area. Live snails may also be collected. Most species are abundant and widespread and there is no harm in collecting (local permits may be required) them for study.

Many land snails are very small (Fig. 1) so that careful examination is necessary to find them. Serious collectors will gather bags of surface litter and soil in likely spots, and then take this material home to examine it more closely. A set of screen-bottom trays, called "soil sieves" in science supply catalogs, can be helpful. Suitable sieves can also be made from 2-lb coffee cans with both ends removed, and window screen, vent screen, or nylon mesh secured over one end with rubber bands or duct tape. Nylon mesh cloth (Nitex) in different mesh sizes is available from several suppliers on the Internet. It is helpful to have sieves of two sizes, one coarse (2–3 mm) and one fine (~1 mm).

Litter may be dried, sieved and hand sorted, or it may be processed wet. For wet processing, litter is placed into the coarse sieve first and washed with water in a bucket to rinse soil and fine sand out of the sample. The remaining coarse material is placed in a flat glass dish, half full of water. Empty shells float, and the shells and larger floating materials can be removed. The remaining sediment should be examined for live snails. Gently shaking the dish back and forth to agitate the sediment often causes some specimens to rise to the surface. Repeat this process until all the collected material has been processed. Lastly, the finer sediments in the bottom of the bucket should be processed. Pour all the sediment into the finer mesh sieve. From the tap, run water over the fine soil and sand, flushing the finer fraction through the mesh. Then examine the remaining sediment for shells.

See (Pearce & Örstan 2006) for more information on land snail collecting and preserving methods, and Nekola (2003b) for discussion of land snail microhabitats and community composition.

In the classroom, snails and slugs can be used to study biological diversity, ecology, behavior and physiology. Simply collecting and identifying snails is a worthwhile exercise. The empty shells are permanent and easy to store, and students can learn to identify and classify most species from the

Fig. 1. Many land snails are very small. This spoonful of several species was collected around and under stones in an old pasture in Cass County.

shells alone. Instructions for preparing a shell collection can be found in several of the references listed below. For specimens to be most interesting and useful, records of where and when they were collected should be written on labels that are stored with the shells. However, don't put a label inside a container with live snails. Most species will readily eat paper, and will soon consume your labels!

When snails are studied in the field, the distribution and habitat associations of different species can be documented. Each species tends to occur within a certain range of geographic distribution, which reflects both history and environmental conditions. Geographic distribution of land snail species changes over time as climate and habitat change. This information is particularly interesting to archaeologists, because snail shells are often preserved in archaeological sites. Archaeologists can make inferences about environments of the past by identifying the snails that were present and comparing them with the habits and habitat of those same species today (e.g., Evans 1972, Goodfriend 1992).

Live snails and slugs provide many opportunities for student projects. For example, if a snail is placed in front of a light, the heart can be seen through the shell and the heartbeat can be counted. Just as the human heart beats faster during exercise and slower at rest, so does a snail's. This simple observation can be used to investigate changes during activity and dormancy, the effects of temperature, and so on. Water uptake and loss, which are very important to land gastropods, can be studied by simply weighing the animals as they gain and lose water. Gastropods are also good subjects for study of behavior. They move slowly enough to be easily observed, and they are capable of associative learning. For example, *Limax* slugs quickly learn to avoid foods that are paired with an unpleasant stimulus, and they will remember this association for weeks afterward (Gelperin 1975, 2002).

An important scientific use of land snails and other gastropods is in the study of neurobiology. The cell bodies of nerve cells of gastropods are unusually large, so that they can easily be mapped and identified. The activity of these giant neurons can be recorded with electrodes, and their functions studied by the application of hormones and other stimuli. The study of neurobiology in gastropods and other mollusks has led to many important advances in our understanding of nervous system function and of fundamental processes such as learning (e.g., Koester and Byrne 1981).

The Classification of Land Snails

Unlike more conspicuous animals, most land snails don't have well recognized common names. Scientific names seem awkward to use at first, but with a little practice they become useful and informative. The biggest obstacle may be uncertainty about pronunciation, but a quick search on the Internet for "pronouncing scientific names" will provide many resources. The scientific name of a species is in two parts, e.g., *Stenotrema hirsutum*. The two parts of the name indicate the genus and the species. The genus name *Stenotrema* should be capitalized, and the species name *hirsutum* should be lowercased. Both names are customarily italicized or underlined in print. Latin and Greek words are normally used for these names, and biologists all over the world use the same names for the same species. Most scientific names are descriptive. For example *Stenotrema hirsutum* indicates a genus that has a narrow (*steno*) opening (*trema*) to the shell, and a species that is hairy (*hirsute*). In other cases, the genus or species name may honor a particular person.

The two-part scientific name, or binomial, is the first step in taxonomic classification of species. Closely related species are given the same genus name. Biologists classify species into genera, families and other groups, collectively called taxa, which are arranged hierarchically according to their similarities and relationships to one another. The methods for understanding relationships among species, particularly genetic methods, are currently improving rapidly, and classifications, including many genera, are changing as new information becomes available. These matters are not yet settled. The classification scheme in this book (Table 1) follows Bouchet and Rocroi 2005, with the exception of the family Carychiidae (treated as a subfamily of Elobiidae in Bouchet and Rocroi). For a checklist of common and scientific names of mollusks, see Turgeon et al. (1998).

Table 1. The major taxa of land gastropods found in Missouri. This classification follows Bouchet & Rocroi 2005.

Phylum Mollusca
Class Gastropoda
Clade Cycloneritimorpha
Family Helicinidae Férussac, 1822

Clade Littorinimorpha
Family Pomatiopsidae Stimpson, 1865

Clade Eupulmonata
Family Carychiidae Jeffreys 1830

Clade Stylommatophora
Subclade Elasmognatha (=Heterurethra)
Family Succineidae Beck, 1837

Subclade Orthurethra
Family Cochlicopidae Pilsbry, 1900
Family Pupillidae Turton, 1831
Family Vertiginidae Fitzinger, 1833
Family Valloniidae Morse, 1864
Family Strobilopsidae Wenz, 1915

Informal Group Sigmurethra
Family Orthalicidae Ibers, 1860
Family Subulinidae P. Fischer & Crosse, 1877
Family Haplotrematidae H. B. Baker, 1925
Family Punctidae Morse, 1864
Family Discidae Thiele, 1931
Family Helicodiscidae H. B. Baker, 1927

"Limacoid Clade"
Family Gastrodontidae Tryon, 1866
Family Euconulidae H. B. Baker, 1928
Family Oxychilidae Hesse, 1927
Family Milacidae Ellis, 1926
Family Limacidae Lamarck, 1801
Family Agriolimacidae H. Wagner, 1935
Family Vitrinidae Fitzinger, 1833
Family Arionidae Gray, 1840
Family Philomycidae Gray, 1847
Family Polygyridae Pilsbry, 1895

Characteristics of the Major Taxa

If "variety is the spice of life," as the saying goes, the gastropods are spicy indeed. In this text, 25 families, 55 genera and 149 species of land snails and slugs are included. Because there are so many species, it is useful to learn the characteristics of the higher (more inclusive) taxa, particularly the families. Once you can recognize the taxonomic groups, particularly the families (see Key to Families, Page 23), identifying species becomes easier, and organizing a shell collection becomes more meaningful.

Land gastropods in Missouri include representatives of three major clades (Cycloneritimorpha, Littorinimorpha and Eupulmonata). Two of these, the Cycloneritimorpha and the Littorinimorpha, are more primitive land snails, and are related to mainly aquatic groups that have a few terrestrial species. These two primitive clades share some basic characteristics and are often referred to as "prosobranchs." Prosobranchs have an operculum, which is a sort of "trap door" on the foot that closes the aperture of the shell when the snail retracts. They have only a single pair of sensory tentacles, with the eyes at the base (Fig. 2). The sexes are separate. Only three prosobranch land snails are found in Missouri. These species are *Helicina orbiculata*, *Hendersonia occulta,* and *Pomatiopsis lapidaria*. *Pomatiopsis* is amphibious and retains a gill in its mantle cavity (van der Schalie & Getz 1961). *Helicina* and *Hendersonia* are fully terrestrial, lack gills, and respire with the wall of the mantle cavity, similar to more advanced species.

The third major group, the Clade Eupulmonata ("pulmonates"), includes most of the land snails and slugs as well as a large number of freshwater snails. Several anatomical differences distinguish pulmonates from the prosobranchs. Pulmonates lack an operculum. They have a closable breathing pore (pneumostome) that opens into the air-filled mantle cavity, which acts as a lung (Fig. 4, Page 10). The pulmonates are hermaphrodites, meaning that each individual is both male and female and produces both sperm cells and eggs.

The Clade Eupulmonata in Missouri includes two taxonomic subgroups, the family Carychiidae and the Clade Stylommatophora. The Carychiidae have a single pair of head tentacles with the eyes at the base, similar to prosobranchs. The Stylommatophora have two pairs of head tentacles, with the eyes at the tips of the longer, uppermost pair (Fig. 2, right). This group includes the great majority of the terrestrial gastropods, both slugs and snails.

Fig. 2. Left: *Helicina orbiculata* is one of only three prosobranch land snail species in Missouri. Note the black eye at the base of the single pair of sensory tentacles. Right: *Succinea forsheyi* is a pulmonate. Note the two pairs of tentacles; the eyes are at the tips of the upper pair.

Shells and What's Inside

The shell of gastropods consists mostly of calcium carbonate, mainly in the crystalline form of aragonite. This calcareous portion of the shell is covered with a protective outer layer of protein called the periostracum, which gives the shell its color and protects it from dissolving. The shells of most Missouri snail species are uniformly white, tan or brown, but there are colorful exceptions, such as the red or yellow shells of *Hendersonia*, and the striped shells of *Allogona* and *Anguispira*. The shells of some tropical land snails, such as the *Liguus* tree snails of Cuba and Florida, are brilliantly colored and boldly marked. Dead shells may fade over time but they generally retain their appearance and color when stored indoors. Outdoors, the periostracum of dead shells weathers away, leaving the chalky white appearance of old bones.

Unlike most animals, snails are not bilaterally symmetrical. That is, the left side of a snail is not a mirror image of the right. Viewed from above, the shell of most land snail's circles clockwise as it expands from the apex to the aperture. Such shells are said to be right-handed, or dextral. Shells that coil in the counterclockwise direction are left-handed or sinistral (Fig. 3). The body of the snail is also asymmetrical. Typically the breathing pore, anus and reproductive openings are on the animal's right side, if the shell is dextral (Fig. 4, Page 10).

Each turn of the gastropod shell is called a *whorl*. The last and largest whorl is called the *body whorl*, although in most snails the body actually fills the shell all the way to the apex. Most snails have determinate growth, meaning that the animal reaches a fixed size and a fixed number of shell whorls at maturity. The edge of the shell often folds back (reflexes) as it ceases to grow. The number of whorls of the adult shell is one of the features that are used to identify species.

The shapes of land snail shells are surprisingly varied. The opening (aperture) of the shell is especially interesting. Many snails, such as those in the families Vertiginidae and Polygyridae, have folds and projections ("teeth") that lie just within the aperture (Fig. 3, Page 10). These structures may help to prevent the entry of carnivorous insects (Symondson 2004). The number and shape of these structures are useful for identifying species. The surface of the shell may be smooth or it may be elaborately ornamented with ridges, grooves, ribs, bumps, pits or hairs. The functions of these features are not understood.

Snails are hard on the outside but soft on the inside. There is no internal skeleton, so the muscles have no joints and levers to pull. Instead, movements are accomplished by hydraulic pressure. When the snail emerges from the shell, it is blood pressure that inflates the body and extends the head and tentacles. Muscles attached to the inside of the tentacles and head can pull the body back into the shell, turning the tentacles and head outside in.

The internal anatomy of a snail is intricate and has some unusual features compared to other complex animals such as vertebrates (Fig. 4, Page 10). The mouth leads to a large stomach (crop) followed by the intestine, which leads up into the spire of the shell and connects to a digestive gland. Surprisingly, the intestine then returns forward so that the anus opens beside the pneumostome (breathing pore). Luckily the mouth is not so close by!

The pneumostome connects with the mantle cavity, an air-filled space lined with blood vessels that acts as a simple lung. The blood vessels converge on a large vein that leads to the heart. The shells of many small snails are transparent enough to show the internal organs, including the lung, the heart and the brown digestive gland in the spire of the shell. Also found in the spire of the shell is the gonad. The pulmonate land snails and slugs are hermaphrodites, and the gonad is an "ovotestis" that produces both eggs and sperm. Each individual has complete sets of male and female reproductive organs (see Reproduction, Page 12).

About the Slugs

Of course, not all gastropods have shells. Slugs are those species of gastropods that have a reduced shell or no shell at all. Some still retain a small calcareous plate, a remnant of the shell, under the fleshy mantle; others have only calcareous granules or spicules within the mantle. While slugs exhibit a bilateral symmetry externally, they still retain the general arrangement of the internal structures found in the coiled shelled snails. All slugs in Missouri have an opening to the lung, a genital orifice and an excretory opening on the right side of the body near the anterior end. There is some variation of the positioning of these openings in different species, which the authors note in the keys and species accounts when it is of value in identification.

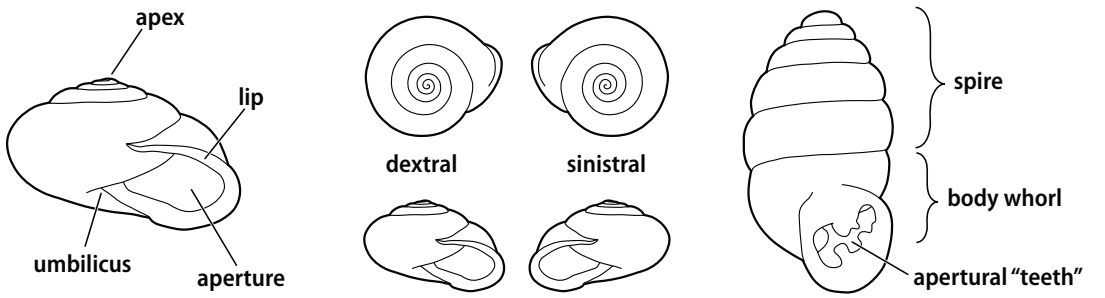


Fig. 3. Basic terminology used to describe shells for identification purposes.
See also the Characters and Terms Used in Descriptions section, Page 19.

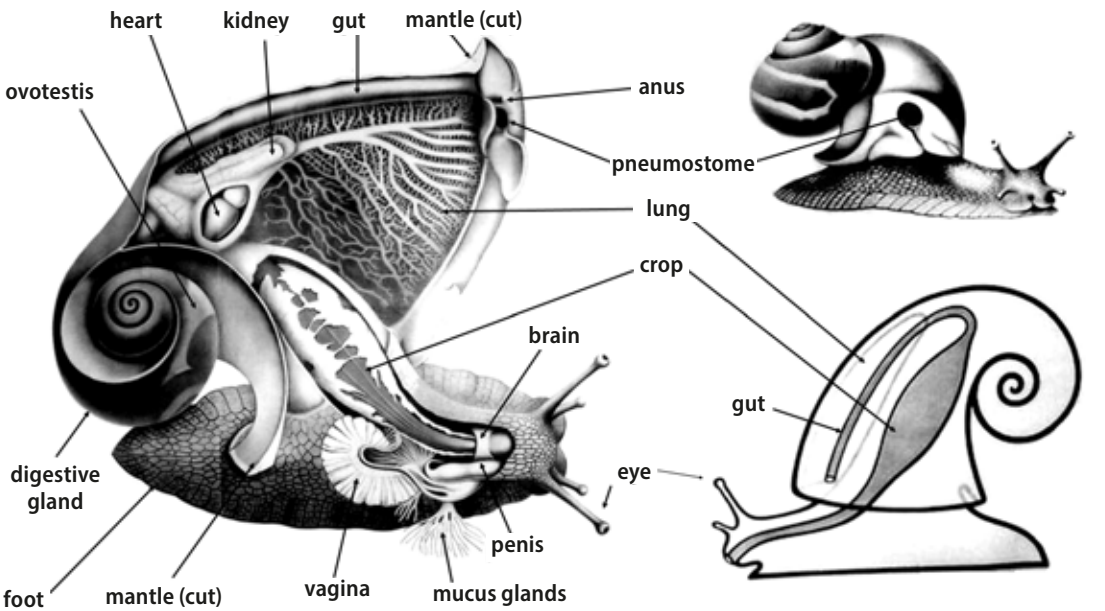


Fig. 4. Pulmonate land snail anatomy, based on the genus *Helix*. The diagram at left shows a snail viewed from above with the shell removed and the mantle cut and turned back, revealing the inner mantle surface (lung) and heart. The dorsal body wall is also cut away to show the crop and reproductive organs. Smaller diagrams at right show the arrangement of the pneumostome, lung and digestive tract. Image adapted from Zoologische Wandtafeln (Zoology wall charts) by Paul Pfurtscheller (1855–1927) from the collection of Carleton College.

The slug condition has arisen independently in several different groups of land pulmonates. There appear to be certain advantages to being shell-less. These advantages include the ability to enter small spaces for shelter, to burrow more effectively and perhaps a reduced dietary need for calcium. Slugs tend to mature quickly and may have a shorter lifespan than shelled snails. Many species seem to be particularly adept at being transported and introduced to new areas by human commerce. As a result, these slug species have become widely distributed outside of their native geographic range.

Water Relations and Dormancy

Of all the animals that live on dry land, gastropods are the wettest. The surface of a gastropod's body is much like that of your tongue. It is covered by a living layer of cells, the epidermis, which is kept moist by secretion of mucus. The epidermis of a snail has no feathers, fur or scales, and there are no dry layers of dead cells to protect it. It is protected from contact with the ground by secretion of a trail of mucus on which the animal glides along. These trails are persistent and can sometimes be seen glistening on the ground in the morning. They trace the nocturnal travels of gastropods.

Some species produce mucus useful in identifying the species; color and consistency are the most useful characteristics. Mucus also serves a defensive function. Some species, such as in the genus *Anguispira*, blow a froth of mucus bubbles when disturbed. Some slugs, such as *Deroceras*, secrete copious and slippery mucus, while others, including *Arion*, produce special sticky mucus to discourage predators.

Active land gastropods lose water rapidly by mucus secretion and evaporation. This is particularly true of small gastropods, because small animals have more surface area relative to their volume. Not surprisingly, land gastropods require high humidity and contact with moist soil, rain or dew to remain active for very long. Snails absorb water through their body surface, particularly the bottom of the foot. This "foot-drinking" occurs by osmosis and depends on the presence of the dissolved salts and other small molecules in the body fluids. A dehydrated snail or slug that is foot-drinking on a wet surface can be recognized by its posture. The foot is spread out to maximize the area for absorption. The eyestalks droop, suggesting that blood pressure is lowered. Perhaps even more remarkable is the uptake of water through the lung and rectum (Neuckel 1985). The rate of water uptake in the slug *Limax* can be as much as 40 percent of the body weight in an hour (Prior et al. 1983).

If you examine an active land snail on a damp night and shine a light behind the shell, you will see that up to a third of the volume of the lung is full of water. This water is technically urine, but it is stored in the lung as a water supply. When conditions become dry and the snail begins to lose water, the water in the lung will be reabsorbed, permitting activity to continue longer than would otherwise be possible (Smith 1981). This function of the snail lung seems very foreign to our physiology. However, the urinary bladder of toads and frogs has a similar function to the lung of land snails, storing water that can later be reabsorbed osmotically.

Land snails are the "Rip van Winkles" of the animal world. They are very susceptible to water loss if they are active in dry conditions. The solution to this problem is to retract into the shell and enter a state of dormancy. In dormancy the snail reduces its metabolic rate and rate of water loss to very low levels. For example, a small land snail, *Gastrocopta armifera*, crawling in 60 percent relative humidity, loses water at a rate of more than 1 percent of its body mass every minute and remains active for only about 12 minutes. The same snail, when dormant, reduces the water loss to less than 1 percent per month and can survive for at least nine months in dry air (Barnhart 1989). Larger, desert-adapted snails can survive for several years of dormancy. This ability has inspired researchers to study the physiology of dormancy in land snails and learn more about the metabolic controls that allow long periods of starvation.

A dormant pulmonate snail protects the opening of the shell by secreting one or more covers, called epiphragms, of dried mucus or calcified mucus. Some species produce very heavy epiphragms

before seasonal dormant periods, and thinner ones at other times. The epiphragm may include a special hole or porous area near the pneumostome to allow gas exchange (Boss 1974, Barnhart 1979, 1983).

Feeding and Diet

Gastropods feed by means of a rasping "tongue"—the radula-covered odontophore. The radula is a tough ribbon of connective tissue with hundreds of tiny teeth, made of chitin. This ribbon lies over a tongue-like structure, the odontophore, which can be protruded from the mouth. The radula is pressed against the food and then pulled upward by muscles, scraping bits of food and pulling them into the mouth. Pulmonate snails also have a sharp hardened plate or "jaw" on the upper side of the mouth, against which the radula can press to help pinch off pieces of food.

Little is known of the diet of most land gastropods. Most of the few species that have been investigated seem to feed mainly on dead and decaying plant material and associated fungi and bacteria. However, live plants, mushrooms, lichens and animal feces may also be eaten. Most snails and slugs held in captivity eat a variety of foods, including lettuce, cabbage, corn, carrots, oatmeal, dog food, etc. (Örstan 2006).

Some land gastropods are predators that prey on other gastropods, earthworms and other invertebrates. *Webbhelix multilineata* is at least an occasional carnivore (see species account). Many of the Gastrodontidae and Oxychilidae (formerly Zonitidae) are at least partly carnivorous (Barker 2004). *Haplotrema* prey primarily on other snails and their eggs. They penetrate the shell of their prey by rasping with the radula and secreting acid to dissolve the calcium carbonate. This process leaves a distinctive hole with thin and bleached edges in the spire of the empty shells. Interestingly, *Haplotrema concavum* prefers to eat in private. When prey is found in the open, *H. concavum* carries it to a covered location before feeding. This transport is accomplished by a curiously inefficient method: The snail drops its prey, moves forward, then turns and reaches back to pull the prey forward. These steps are repeated until shelter is reached, and only then will the food be consumed (Atkinson 1998).

Gastropods are capable of other surprisingly sophisticated behaviors with respect to their food. Some foods can be detected by air-borne odors from a considerable distance, while carnivorous species can track the trails of their prey. Experiments show that slugs quickly learn to avoid particular foods if those foods have been paired with unpleasant stimuli or toxic chemicals (Gelperin 1975, 2002). Even more remarkably, slugs also learn to avoid foods that lack particular nutrients, such as certain amino acids. If these nutrients are added, the food again becomes acceptable (Delaney and Gelperin 1986). Imagine if we humans were so selective in our diet!

Reproduction

The pulmonate land snails are hermaphrodites, meaning that each individual is both sexes and produces both sperm and eggs. Although many species are capable of self-fertilization, most prefer to mate with another individual. Mating is preceded by prolonged face-to-face contact, touching with the tentacles, "kissing" and biting. This rather intense foreplay probably helps ensure the correct identity, and alignment, of the partners. The genital opening is normally on the right side of the body, so a mating pair meets head-on and then passes on the left to juxtapose their right-sided openings. A "left-sided" individual would presumably be at a serious disadvantage! After the preliminaries, each partner inflates its penis with hemolymph and inserts it into the partner's genital opening. The act is usually reciprocal, with each member of the pair fertilized by the other. Mating may continue for hours.

Snails are notorious for peculiar sexual behavior and anatomy. Before mating, many species harpoon each other with sharp-pointed "love darts" of calcium carbonate. These dagger-like darts are held in a muscular organ and pushed from the genital opening with enough force to completely

transfix the partner! It has been suggested that the Cupid legend was based on observations of snail love darts. Several hypotheses have been advanced to explain this bizarre behavior, including possible functions in species recognition or transfer of calcium as a nuptial gift. However, researchers have recently learned that the darts actually inject hormones that improve the survival of sperm in the darted snail's reproductive tract. Thus, they improve the probability that the sperm of the darter will fertilize the eggs of the dartee (Chase & Blanchard 2006).

The mating of pulmonate slugs in the family Limacidae is also remarkable (see *Limax maximus* Remarks, Page 100).

Land gastropods lay eggs, typically placing them singly or in clusters in damp, sheltered places. Some snails, such as *Rabdotus*, carefully excavate a flask-shaped nest burrow in the ground, using the foot like a conveyor belt to pull soil through a narrow opening. After depositing the eggs, the snail closes the opening of the nest with soil and mucus. Beyond nest building, land snails usually do not tend their eggs or young.

The eggs of some land gastropods have a hard calcareous shell, while others are gelatinous. In general, species with small body size lay proportionately larger and fewer eggs. The tiny *Rabdotus* snails, for example, lay only an egg or two at a time, and the eggs are so large that they barely fit through the aperture of the shell. In contrast, many larger species lay clutches of several dozen eggs. The eggs hatch in a few days or weeks, depending on temperature. The hatchlings are fully formed miniature gastropods. They usually make a first meal of their own eggshell, and in some species may also eat unhatched eggs of their own siblings.

Predators

Snails and slugs are abundant and widespread, so it is no surprise that other animals eat them. Among the most notorious land snail predators are certain insects, including the larvae of ground beetles (Carabidae), lightning beetles (Lampyridae), flesh flies (Sarcophagidae), and snail flies (Sciomyzidae) (Barker 2004). These predators enter the shell through the aperture and attack the snail within. Adult carabid beetles can use their strong jaws to break the edge of the shell.

Among the vertebrates, the amphibians, reptiles, birds, and mammals all include predators of gastropods. Toads may swallow snails and slugs whole. North American brown snakes, *Storeria*, have specialized jaws and teeth for pulling snails from their shells (Rossman & Myer 1990). Small mammals, especially shrews, eat snails by breaking through the spire of the shell beside the aperture. The short-tail shrew also has the interesting habit of hoarding live snails during the winter months as a form of food storage. The shrews may construct separate chambers in their burrow system for storing snails and for discarding empty shells (Blinn 1963).

Although the practice is rare in Missouri, snails and even slugs are eaten as a delicacy in some cultures. Escargots (helicid land snails) are common in European cuisine. One author stated that German immigrant families in the 1800s and early 1900s ate banana slugs (a very large species found in the Pacific Northwest) by removing the slime with vinegar, gutting them like fish and deep-frying them in a batter (Harper 1988: 24). Archaeological evidence suggests that Native Americans ate land snails (Theler 2000).

Controlling Pest Species

A few species of gastropods can be pests on certain garden plants, particularly lettuce, cabbage, asparagus, strawberries, and ornamental hosta. Native snails are seldom at fault. More often, the troublemakers are introduced European slugs, such as *Limax maximus*, *Lehmannia valentiana,* and *Deroceras reticulatum*. Plants with leaves growing close to the ground are most susceptible to damage by slugs. Gardeners that wish to control slugs have several choices. Commercial slug baits, sprays and dusts that contain metaldehyde should be avoided, because this compound is toxic to people, pets and

wildlife. Newer formulations containing iron phosphate or methiocarb are less toxic. If you prefer not to use poisons, consider beer traps. These consist of small dishes buried level with the soil and filled with stale beer. Slugs are attracted to the beer, crawl in and drown, (presumably without suffering). Slugs can also be trapped by laying wet, folded newspapers on the ground overnight. The slugs will shelter under these and can then be collected and discarded the next day. Slugs and snails can also be repelled using copper strips (slug fences) to surround the base of plants, or diatomaceous earth spread on the soil surface.

MISSOURI LAND SNAILS AND SLUGS

Missouri Snail Researchers

The study of the land snails over the years in Missouri has been very spotty. An early visitor to the state was Thomas Say. He traveled and collected through Missouri, as the chief zoologist on the first Long expedition (1819–1820), to the Rocky Mountains, and on a second expedition to the St. Peters River (Minnesota River) in 1823.

F. A. Sampson published several articles on the land snails from 1883 to 1913 (Sampson 1913). His research covered 64 counties, with "only one approaching thoroughness," he reported.Sampson's work included aquatic mollusks as well as land snails.

Leslie Hubricht ranks second only in stature to Henry A. Pilsbry in the study of land snails and the number of new species he named. He interacted with the Field Museum of Natural History's scientists for 46 years and his collection, containing 500,000 specimens is now housed at the Field Museum. His publishing career spanned 51 years and included some works specific to Missouri (Hubricht 1938, 1941, 1964a, 1972b).

Hubricht was born in Los Angeles in 1908. Stories of him as a budding naturalist date back to a time when at the age of two he remembers, when after a rainstorm, he noticed eight different species of ants running about the backyard. His family was living in Kokomo Indiana in 1923 and relocated in St. Louis, ending his high school education, because he was needed to help provide support for the family. He worked at one temporary job after another; however, during all the intervening years his interest in all things natural continued to occupy him. A highlight is his life was the Webster Groves Nature Society, a group of amateur naturalists and some colleagues from local universities and the Missouri Botanical Garden. Such eventually famous naturalists as Ralph Swain the entomologist, Richard Grossenheider the mammalogist, Julian Steyermark the botanist and Phil Rau of insect behavior fame, were at the start of their careers. They interacted with Hubricht and encouraged his interests. A critical turning point came when Edgar Andersen, the famous geneticist, arrived at the Missouri Botanical Garden and hired Hubricht as his research assistant. Joint field trips, coauthored papers, and a happy 7½–year association lasted until 1943 (Solem 1986). Following this breakup he worked for Remington Rand as a tabulating machine repairman and servicing UNIVAC computers until his retirement. This job allowed him to live in many of the eastern and southern states where he continued to investigate snail locations and describe new species. L. Hubricht's interesting background and work are documented in Solem 1986.

Among the notable recent collectors who worked in Missouri were Frieda Schilling and Hessie Kemper. Frieda and Hessie were sisters, devoted collectors and students extraordinaire of Mollusca. Their collections now are in the Field Museum of Natural History in Chicago and the American Museum of Natural History in New York City, respectively. In the 1980s, Gene Gardner reported land snails and slugs from all publicly owned caves and springs in Missouri (Gardner 1986).

Other contributors to collections and publications of Missouri's land mollusks include A. F. Archer, J. H. Britts, O. A. Crandall, J. H. Ferriss, D. K. Greger (1933), R. W. Jackson, G. Hambach (1890), Miles & Reeder (1969), C. J. Miller, F. A. Sampson (1913), A. F. Saterthwait, R. K. Smith, G. C. Swallow (1855), G. Van Ingen and S. Weller.

Total Species, New State Records, Introduced Species, and Fossils

The combined total for recent collecting and historic records is 149 species of land snails and slugs for the state of Missouri. Of these, the following 18 are new records for species living in Missouri: *Arion hortensis, Arion intermedius, Arion subfuscus, Deroceras reticulatum, Euconulus fulvus, Gastrocopta cristata, Gastrocopta rogersensis, Gastrocopta similis, Hawaiia alachuana, Lehmannia valentiana, Lucilla singleyanus, Milax gagates, Opeas pyrgula, Oxychilus draparnaudi, Oxyloma retusa, Triodopsis hopetonensis, Vallonia gracilicosta,* and *Vertigo pygmaea*. Eleven of the newly recorded species are not native to North America: *Arion hortensis, Arion intermedius, Arion subfuscus, Deroceras reticulatum, Lehmannia valentiana, Milax gagates, Opeas pyrgula, Oxychilus draparnaudi, Triodopsis hopetonensis,* and *Vertigo pygmaea*.

The following 13 species were reported by Hubricht (1985), but were not found during recent field work by the authors: *Anguispira strongylodes, Carychium exiguum, Catinella oklahomarum, Cochlicopa lubricella, Daedalochila deltoidea, Glyphyalinia lewisiana, Inflectarius edentatus, Linisa texasiana, Oxyloma salleana, Pallifera fosteri, Succinea indiana, Xolotrema denotatum,* and *Zonitoides kirbyi*.

Fourteen species are known in Missouri only from fossil records: *Catinella gelida, Columella columella alticola, Discus macclintocki, Discus shimeki, Discus whitneyi, Euconulus chersinus, Lucilla scintilla, Novisuccinea chittenangoensis, Pupilla blandi, Pupilla muscorum, Succinea bakeri, Vertigo hubrichti, Vertigo modesta,* and *Vertigo ventricosa*.

Thirteen species in this book are not known from Missouri, but do occur in adjacent counties of neighboring states, and may be found in Missouri in the future. These include: *Catinella wandae, Daedalochila lithica, Daedalochila simpsoni, Euchemotrema hubrichti, Gastrocopta sterkiana, Glyphyalinia luticola, Mesomphix globosus, Paravitrea capsella, Paravitrea multidentata, Strobilops texasianus, Triodopsis vulgata, Vertigo teskeyae*, and *Xolotrema obstrictum*.

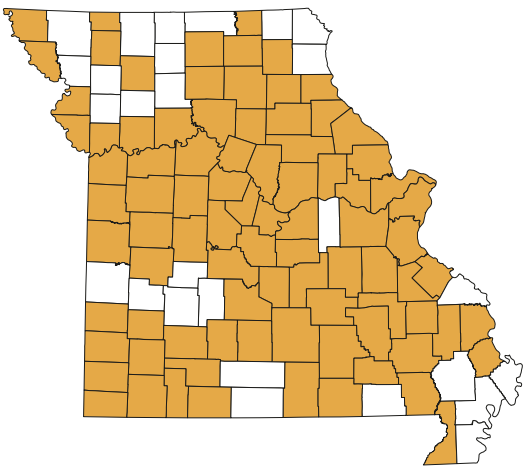


Fig. 5. Compilation of historic land snail and slug distributions (shaded counties) from Hubricht (1985). Land snails and slugs occur in every Missouri County, but no records were made by early researchers in the unshaded counties.

Some Key References

The following publications are among the most comprehensive general accounts of the diversity, distribution, and biology of North American land mollusks:

Burch, J. B., 1962. *How to Know the Eastern Land Snails.* Wm. C. Brown Company Publishers, Dubuque, Iowa, 214 pp.

Chichester, L. F. and L. L. Getz. 1973. The terrestrial slugs of northeastern North America. *Sterkiana* No. 51: 11–42.

Emberton, K. C. 1988. The genitalic, allozymic, and conchological evolution of the eastern North American Triodopsinae (Gastropoda; Pulmonata: Polygyridae). *Malacologia* 28(1–2): 159–273.

Emberton, K. C. 1991. The genitalic, allozymic, and conchological evolution of the tribe Mesodontini (Pulmonata: Stylommatophora: Polygyridae). *Malacologia* 33(1–2): 71–178.

Emberton, K. C. 1995. When shells do not tell: 145 million years of evolution in North America's Polygyrid land snails, with a revision and conservation priorities. *Malacologia* 37: (1): 69–109.

Hubricht, L. 1985. The Distributions of the Native Land Mollusks of the Eastern United States. *Fieldiana*, Zoology, New Series, No. 24, i–viii, 191 pp.

Pilsbry, H. A. 1940. *Land Mollusca of North America north of Mexico.* The Academy of Natural Sciences Philadelphia. Vol. I, Part 2, pp. 575–994.

Pilsbry, H. A. 1946. *Land Mollusca of North America north of Mexico.* The Academy of Natural Sciences Philadelphia. Vol. II, Part 1, pp. 1–520.

Pilsbry, H. A. 1948. *Land Mollusca of North America north of Mexico.* The Academy of Natural Sciences Philadelphia. Vol. II, Part 2, pp. 521–1113.

Solem, A. G. 1974. *The Shell Makers: Introducing Mollusks.* Wiley & Sons, New York, 289 pp.

Sturm, C. F., T. A. Pearce, and A. Valdés. (Eds.) 2006. The Mollusks: A Guide to Their Study, Collection, and Preservation. American Malacological Society, Universal Publishers, Boca Raton, FL.

Turgeon, D. D., J. F. Quinn, Jr., A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P.M. Mikkelson, R. J. Neves, C. F. E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F. G. Thompson, M. Vecchione and J. D. Williams. 1998. *Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks, 2nd edition.* American Fisheries Society, Special Publication 26, Bethesda, MD.

The following are leading journals (scientific periodicals) that publish research on mollusks, including land snails and slugs:

American Malacological Bulletin
Journal of Conchology
Journal of Medical and Applied Malacology
Journal of Molluscan Studies
Malacologia
Malacological Review
The Nautilus
The Veliger

Other useful regional studies include Baker (1939), Burch and Jung (1988), Burch and Van Devender (1980), Nekola (2003a), and Leonard (1959).

The Natural Divisions of Missouri

Missouri has been divided into six major natural divisions on the basis of geologic history, soils, bedrock geology, topography, plant and animal distribution, presettlement vegetation and other natural factors (Fig. 6, Page 17; Thom & Wilson 1980; Nigh and Schroeder 2002). The borders of

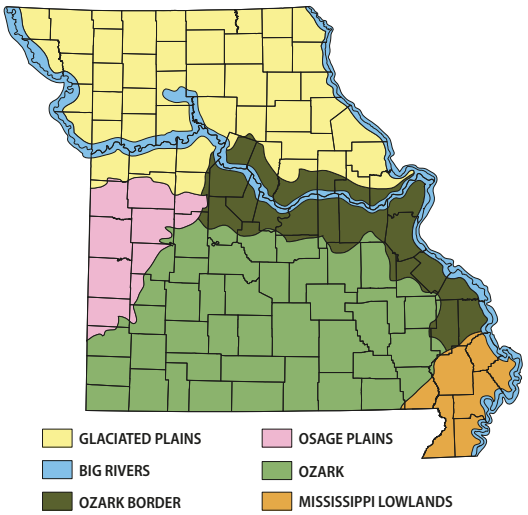


Fig. 6. Natural Divisions of Missouri (after Thom & Wilson 1980).

these divisions are somewhat arbitrary because the various factors each have their own distributions. However, the terminology is useful for making general statements about geographic distribution and major habitat types in Missouri. The six divisions are Glaciated Plains, Big Rivers, Ozark Border, Osage Plains, Ozark, and Mississippi Lowlands. This descriptive system of natural divisions is used in the Distribution section of the species accounts and is summarized below.

The Glaciated Plains Natural Division encompasses roughly the northern one-third of the state and is characterized by soils and topography that resulted from the influence of Pleistocene glaciations beginning about 400,000 years ago. Soils are derived from loess and glacial till or from alluvium. The topography is younger than that of the unglaciated portions of the state, although much of this division is moderately dissected. Upland and bottomland deciduous savanna, woodland, forest, and prairie were the main presettlement vegetation, with prairies comprising about 45 percent of this division.

The Big Rivers Natural Division comprises about five percent of the state, and includes the floodplains and terraces of the largest rivers, primarily the Missouri and Mississippi, but also the lower Grand and the lower Des Moines rivers. Soils are mostly alluvial, deep, and productive. Presettlement natural features included mesic to wet prairie, bottomland and upland forests and woodlands, marshes, sloughs, islands, sandbars, mud flats, oxbow ponds, and rivers. Until extensive channel modification began in the early 1900s, the Missouri River was a braided stream with many chutes, sloughs, islands, and seasonal wetlands.

The Ozark Border Natural Division comprises about 13 percent of the state. It extends along both sides of the lower Missouri River and the lower Mississippi River to the Mississippi Lowlands Natural Division. It includes rugged river hills with deep, relatively productive soils and a few isolated rolling plains. Although the main presettlement vegetation was upland deciduous forest and woodland, glade, marsh, prairie and bottomland forest communities were also present. Prairie accounted for less than 10 percent of the presettlement vegetation. Many of the soils are derived from loess and are relatively productive. Today, rolling pastures, shrubby, fragmented forests, and forested bottomlands characterize this division.

The Osage Plains Natural Division occupies about eight percent of the state. It is an unglaciated region in central western Missouri with an open, grassland aspect and gently rolling topography.

Compared to the prairies of the Glaciated Plains, the upland prairie of this natural division has a greater proportion of Southwestern plants and animals, and fewer Northern species. More than 70 percent of the Osage Plains was prairie in presettlement times. Savanna, upland and bottomland deciduous woodland and forest and marsh also occur. Streams commonly had shallow valleys and broad floodplains with many sloughs and marshes.

The Ozark Natural Division is a large, unglaciated region of greater relief and elevation than the surrounding areas. This division comprises almost 40 percent of the state. It is characterized by thin, often stony, residual soils. Topography is often very steep. Caves, springs, bluffs, and high-gradient, clear-flowing streams with entrenched meanders are characteristic features. Deciduous forests and woodlands and pine-oak and pine woodlands formed the predominant vegetation in presettlement times. Glades, some of them extensive, commonly occur where bedrock surfaces. Bottomland deciduous forests are common along many of the streams. The great age and physiographic diversity of the Ozarks make it the region of greatest species diversity in Missouri.

The Mississippi Lowlands Natural Division comprises about five percent of the state and is primarily composed of flat, alluvial plain and low terraces at the head of the Mississippi Embayment. This division has the highest average precipitation and temperatures in Missouri. Relief is slight, with much of the division less than 100 meters above sea level. Historically, much of this division was bald cypress (*Taxodium distichum*) and tupelo gum (*Nyssa aquatica*) swamp forest, mixed deciduous bottomland forest, and low upland deciduous forest. Small prairie openings also occurred. Clearing and draining began in the early 1900s. Conversion to agriculture has been almost total and today only small remnants of natural forest and swamp remain (Thom & Wilson 1980).

Characters and Terms Used in Descriptions

The following are terms for describing shell size (from Nekola 2005, as modified from Emberton 1995b):

0–1.9 mm = micro
2–4.9 mm = minute
5–9.9 mm = small
10–19.9 mm = medium
20 mm+ = large

Shell Shape. The shape of the shell is determined from lateral view. Since the aperture disrupts the symmetry of the shell, it is generally excluded when evaluating the overall shape. Intermediate shapes are sometimes used, such as depressed-globose. Generalized shapes are shown in Table 2.

Whorls. Whorls are the turns a snail shell forms as it grows. The whorls may be convex or flattened, and the degree of convexity determines how deep or shallow the suture between the whorls will be. A few species have a margined suture, (*Paravitrea significans*, Fig. 87, Page 95) which is a thickened band visible through the translucent shell material. One species (*Opeas pyrgula*) has a crenulated suture, which is formed where ridges meet the suture.

The first 1½ whorls are termed the embryonic whorls, they usually have different surface sculpture than the remainder of the shell. Whorls are numbered by starting at the embryonic whorl and counting outward. In the species accounts, the number of whorls given is for adults.

The number of whorls is an important taxonomic feature, and although simple in concept, counting whorls consistently can be confusing, and quite often the shell being examined may not be full-grown. The main issue is where to begin and end the first whorl; some workers trace along the center of the embryonic whorl for one full rotation to define the first whorl, while others trace along the suture. These methods differ by ½ whorl, with the suture method giving the larger count. In this text we use the suture method, which appears to match most whorl counts given by Pilsbry (1940,

Table 2. Shell shapes

1946, 1948) and other authors.

The suture method for counting whorls is easiest to visualize by tracing a full rotation along the suture starting at its origin, then placing a radius across the origin and the endpoint of the first full rotation. This counting radius will lie at about 90 degrees to the first suture segment of the embryonic whorl. The amount of body whorl beyond the counting radius is the fractional whorl, which is usually rounded to the nearest ¼ turn (Fig. 7, Page 21).

The body whorl is the last or bottom whorl of the shell, the open end of which forms the aperture. In some shells the body whorl turns downward near the aperture, and is said to be descending. The penultimate whorl refers to the whorl previous to the body whorl; it's the next-to-the-last whorl of the shell. "Body whorl" and "penultimate whorl" terms are used to describe the last and prior whorls, regardless of shell maturity. The periphery is the outermost edge of the shell at the widest part of the body whorl. The shape of the body whorl at the periphery is sometimes significant. Most shells have

an evenly rounded periphery, but some are angulate. The spire is the top portion of the shell, usually visible above the body whorl in lateral view.

Umbilicus. The umbilicus of a shell is on the ventral surface, at the end of the shell opposite the spire. It is usually apparent as a hole formed by whorls spiraling around the axis of the shell. The umbilicus size varies from widely open (*Anguispira kochi*, Fig. 63, Page 74) to very narrow (*Ventridens ligera*, Fig. 70, Page 81). The size of the umbilicus in relation to the largest diameter of the shell is often used in species descriptions. The shape of the umbilicus is usually circular, but may be deformed by the mature body whorl in some species, and thus be compressed (oval) or slit-like (rimate). The umbilicus of some snails is partially or completely covered by an extension of the lip or the parietal callus, described below. Usually, the covered umbilicus is evident only in mature shells; rarely, the umbilicus is also covered in immatures (*Glyphyalinia solida*, Fig. 79, Page 90). Shells with a covered umbilicus are termed imperforate; shells with an open, uncovered umbilicus are termed perforate.

Aperture. The shell aperture varies considerably in shape. Some of the notable shapes are oval (*Pomatiopsis lapidaria,* Fig. 12, Page 30), round (*Vallonia parvula*, Fig. 48, Page 61), triangular (*Gastrocopta contracta*, Fig. 28, Page 42), squarish (*Discus nigrimontanus*, Fig. 64, Page 75), and slit-like (*Stenotrema blandianum*, Fig. 113, Page 119). Many apertures are also lunate—lunate or halfmoon shaped (*Euconulus fulvus*, Fig. 75, middle, Page 86), where the aperture joins the body whorl.

Many land snails are ornamented with lamellae or "teeth" on the lip, on the parietal callus (see below), or located deep inside the shell. Lamellae located near the aperture are usually visible in apertural view; those inside the shell may be visible only through the base of the shell, or may be entirely hidden. These structures are not "teeth" as used for chewing food, but are variously shaped folds and thickenings of the shell material.

The literature varies in the terms used for these structures; they are variously called teeth, lamellae, folds or plicae. In the Polygyridae, they have been generally called teeth, while in other families a distinction has been drawn between the structures on the parietal or columella walls (lamellae) vs. those on the basal and outer margins of the aperture (folds or plicae). To avoid confusion between apertural "teeth" and the teeth of the feeding structures (radula), all apertural "teeth" are termed lamellae in this text.

In the Vertiginidae the parietal wall has two primary lamellae (parietal and angular), which are joined in the genus *Gastrocopta*. Some vertiginids have smaller accessory lamellae on the parietal wall, or there may be no parietal lamellae at all (*Columella*). The number and relative sizes of the lamellae are important diagnostic characters. Other lamellae include the columellar lamella on the inner margin of the columella, the basal lamella within the basal margin of the aperture and the lower and upper palatal lamellae within the outer margin of the aperture (*Gastrocopta abbreviata*, Fig. 26, Page 40). There may also be smaller lamellae on either side of the basal and palatal lamellae.

In the Polygyridae, lamellae include a variable-sized structure on the parietal wall (parietal lamella), a long low structure on the basal segment of the lip (basal lamella), and sometimes additional lamellae on the outer lip (palatal lamellae).

In the Strobilopsidae, visible lamellae include a large parietal lamella and a smaller and recessed infraparietal lamella. Other lamellae are internal and not visible through the aperture of the shell. On the inner surface of the body whorl are a variable number of basal lamellae. The number, size, and position of these lamellae are used to distinguish species (Fig. 52, Page 64).

The margin of the shell at the aperture is referred to as the lip or peristome. This lip may be thin and simple, or may be reflected. Often the lip is thickened along the inner surface. Sometimes there is a groove behind the lip, or an elevated thickening or crest behind and parallel to the lip.

The parietal callus is a thin layer of shell material covering the previous whorl. It provides a

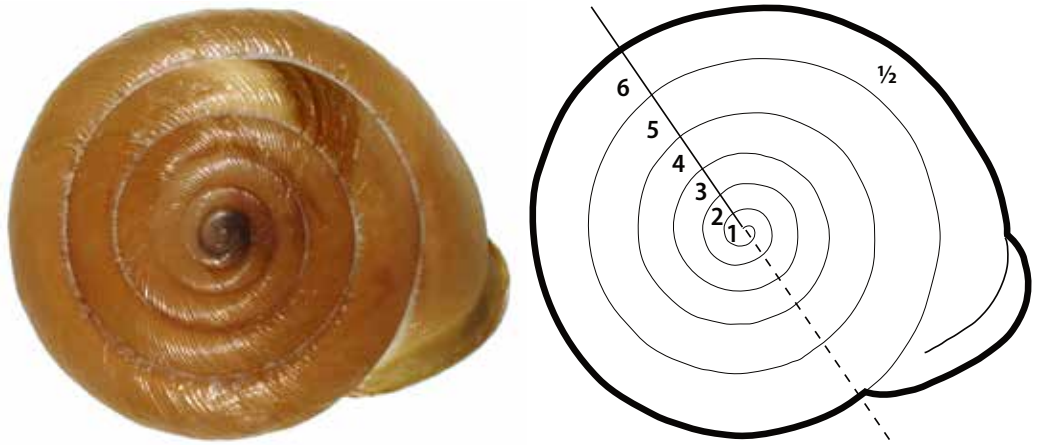


Fig. 7. Counting whorls, suture method. Trace one full rotation along the suture starting at the origin. Place a radius across the origin and the endpoint of the first full rotation of the suture. Count the number of full whorls plus the remainder of the body whorl. Round up or down to the nearest ¼ whorl. This shell has about 6½ whorls.

smooth surface for the animal. The outer edge of the parietal callus usually extends slightly beyond the edge of the aperture, and is variously shaped, concave, convex, or "S"-shaped.

Surface Sculpture. The shell surface is covered in all species by a thin proteinaceous layer, the periostracum, which is usually brownish in color. In some species the periostracum is very thin and transparent. The periostracum is easily damaged and is often partially or completed eroded on older shells. Shells are ornamented with a variety of surface textures and sculpture. Coarse sculpture is part of the calcareous shell as well as the periostracum, while fine sculpture is a feature of the periostracum itself. In most shells, microsculpture is best studied with the periostracum intact. Sculpture is usually different on the embryonic whorls of the shell.

Growth lines or ridges are oriented across the whorls, parallel to the aperture of the shell. These structures are sometimes very regular in size and spacing. When the ridges are small, irregular, and incomplete, they are referred to as growth wrinkles. Some shells have grooves, called axial striae, rather than ridges; axial striae may also be regularly or irregularly spaced. In some species of Vallonia and Punctum there are major ridges, termed axial ribs, with smaller growth lines in between.

Many shells have indented spiral lines, spiral striae, which are oriented parallel to the whorl and at right angles to growth ridges or axial striae. Spiral striae are usually less prominent than other surface features and are sometimes barely visible under high magnification. In a few species, these spiral lines are spiral ridges or threads rather than indented lines (*Striatura meridonalis, Helicodiscus* species).

Some shells are ornamented with short hairs or bristles, which are commonly worn away, leaving small pits or "hair scars." One species (*Stenotrema labrosum*) has short ridges on the periostracum, termed prostrate hairs.

The Fossil Record

Fossils of land snails have been found in various types of very old sedimentary deposits, with the oldest fossils dating back to the Carboniferous period, 325 million years before present. Some land snails living during the Eocene, which began about 55 million years before present, are little changed from their modern forms (families Pupillidae (=Vertiginidae) and Valloniidae, Pilsbry 1916).

Table 3. Summary of modern Missouri species found in Pliocene and Early Pleistocene deposits of Kansas, Nebraska, Oklahoma, and Texas local faunas (Taylor 1960).

	Pliocene				Early Pleistocene		
	Buis Ranch local fauna, Oklahoma	Saw Rock Canyon local fauna, Kansas	Rexroad local fauna, Kansas	Bender local fauna, Kansas	Dixon local fauna, Kansas	Sand Draw local fauna, Nebraska	Sanders local fauna, Kansas
Carychium exiguum					•		
Cochlicopa lubrica			•				
Gastrocopta armifera					•		
Gastrocopta cristata				•	•	•	•
Gastrocopta holzingeri		•	•				
Gastrocopta procera					•		
Gastrocopta tappaniana		•	•	•	•	•	•
Glyphyalinia wheatleyi			•				
Hawaiia minuscula		•	•	•	•	•	•
Helicodiscus parallelus					•		
Lucilla singleyanus		•	•	•	•	•	•
Nesovitrea electrina			•		•		
Oxyloma retusa					•		
Pupoides albilabris		•	•	•	•	•	•
Strobilops labyrinthicus		•					
Vallonia gracilicosta			•				
Vallonia parvula				•			
Vallonia perspectiva		•	•		•		•
Vallonia pulchella						•	
Vertigo milium		•	•	•	•	•	•
Vertigo ovata	•				•	•	•
Zonitoides arboreus					•		

A remarkable number of species living today in Missouri have been in the same area for a very long time and have persisted through many climatic changes during the ice ages. Of the 122 species of snails and slugs living in Missouri today, 83 are also known in Missouri from late Pleistocene-aged fossils, which date to 12.5 to 21 thousand years before present. Older fossils have not been found in Missouri, not because the fauna did not occur here, but because conditions were not right for creating or preserving fossil deposits. Some older deposits do occur in nearby states (summarized in Table 3); the oldest of these with species living in Missouri today date from the early Pliocene, 5 million years before present.

In the species accounts that follow, fossil records are listed for Missouri counties. These are all late Pleistocene age (about 15 thousand years before present). None of these fossil species are restricted to Missouri, and often fossils are known from areas where the species are not living at the present time.

Key to Families of Land Snails and Slugs in Missouri

The following is a key identification for familes of land snails and slugs in Missouri.
For key identifications for genera and species of land snails and slugs, see Page 200.

Phylum Mollusca
> **Class Gastropoda**

1a. Animal without an external shell (slugs)..... **2**
1b. Animal having an external shell (snails)..... **6**

Key to Slugs

2a. Mantle very large, covering more than ⅔ of body..... **Philomycidae**
2b. Mantle smaller, covers less than ½ of body..... **3**

3a. Breathing pore located in anterior half of mantle..... **Arionidae**
3b. Breathing pore located in posterior half of mantle **4**

4a. Mantle with a horseshoe shaped groove giving it a two-tiered appearance; dorsum keeled, with keel extending forward to the mantle; rare in Missouri ..... **Milacidae**
4b. Mantle not grooved, surface even; dorsum either without distinct keel or with keel not extending forward to mantle; some species common in Missouri..... **5**

5a. Color usually uniform, light cream to dark gray or black, rarely with pigmented blotches or reticulations on the body outlined in dark colors; size smaller, length less than 50 mm extended..... **Agriolimacidae**
5b. Color patterned with bold dark blotches or faint to dark stripes; size larger, usually 60 mm or more extended..... **Limacidae**

Key to Snails

6a. Shell shape elongate, or oval (shell higher than wide)..... **7**
6b. Shell shape globose to discoidal (shell usually wider than high)..... **15**

7a. Shells very glossy and without growth lines; fresh shells somewhat transparent; color light yellowish or reddish brown; aperture without lamellae ..... **Cochlicopidae**
7b. Shells dull, usually with clearly visible growth lines; usually opaque; color variable; aperture variable, but often with many lamellae..... **8**

8a. Aperture very large, occupying ½ or more of shell height ..... **Succineidae**
8b. Aperture smaller, occupying much less than ½ of shell height..... **9**

9a. Aperture lip not reflected..... **10**
9b. Aperture with reflected lip..... **13**

10a. Shell larger, height 17 mm or greater; color brownish gray, streaked and mottled with opaque white ..... **Orthalicidae**
10b. Shell smaller, height much less than 17 mm; color variable, but without streaked or mottled pattern..... **11**

11a. Shape somewhat parallel sided to oval, apex broadly rounded; size smaller, shell height less than 3 mm..... **Vertiginidae in part** *(Columella)*
11b. Shape elongate conic, apex acute; size larger, shell height 6 mm or greater..... **12**

12a. Color brownish; usually found in or very near aquatic habitats; size usually less than 7 mm ..... **Pomatiopsidae**
12b. Color white or light yellowish brown; not associated with aquatic habitats; size usually greater than 7 mm ..... **Subulinidae**

13a. Combination of aperture with only 2 lamellae and shell height 2 mm or less; shell very elongate and slender; color whitish..... **Carychiidae**
13b. Aperture either with more than 2 lamellae, or if aperture has 2 lamellae then shell height is greater than 2.5 mm; shell less slender; color variable..... **14**

14a. Combination of shell height greater than 3 mm, and brownish coloration.....**Pupillidae**
14b. Shell height either smaller than 3 mm (including many brownish colored species), or if size is larger than 3 mm, then color is grayish white ..... **Vertiginidae**

15a. Mature shell with reflected or thickened lip **16**
15b. Mature shell without reflected or thickened lip..... **19**

16a. Combination of shell surface with coarse, regularly spaced ribs, color reddish to yellowish brown, and shell diameter less than 3 mm .....**Strobilopsidae**
16b. Not fitting above combination of characters..... **17**

17a. Size smaller, diameter less than 3 mm; color of fresh shells grayish white....**Valloniidae**
17b. Size larger, diameter greater than 5 mm, many shells much larger; color of fresh shells variable, but usually not grayish white..... **18**

18a. Shape globose; size less than 8 mm; umbilicus covered; shell very solid; lip thickened and only partially reflected; aperture without lamellae; animal with an operculum .....**Helicinidae**
18b. Shape variable, but if size is less than 8 mm, then aperture has lamellae; shell often less solid; lip usually more clearly reflected; animal without operculum..... **Polygyridae**

19a. Shell discoidal; surface with raised spiral threads, usually beginning on the embryonic whorl ..... **Helicodiscidae in part** *(Helicodiscus)*
19b. Shell globose to depressed; surface sculpture variable, but not with raised threads on embryonic whorl **20**

20a. Colored with dark bands, or bands of irregular dark blotches; shell diameter of mature individuals larger than 15 mm ..... **Discidae in part** *(Anguispira)*
20b. Color uniform light yellowish brown or white, without bands; size variable **21**

21a. Size larger, diameter 9 mm or greater **22**
21b. Size smaller, diameter less than 9 mm **24**

22a. Aperture with thickened area within, often visible on base of shell as whitish, opaque area ..... **Gastrodontidae in part** *(Ventridens)*
22b. Aperture without thickening, color of base uniform..... **23**

23a. Umbilicus very wide, contained about 3 times within diameter of shell ..... **Haplotrematidae**
23b. Umbilicus narrower, contained about 6 times or more within diameter of shell ..... **Oxychilidae in part** *(Mesomphix, Oxychilus)*

24a. Surface with distinct axial grooves, often very regularly spaced; shells thin and nearly transparent when fresh; diameter 3.5 mm or greater ..... **Oxychilidae in part** *(Glyphyalinia, Nesovitrea, Paravitrea)*
24b. Surface either smooth, or with irregular growth wrinkles, or with more distinct ridges, but without distinct regularly spaced axial grooves; diameter and thickness variable **25**

25a. Shell surface crowded with many regularly spaced axial and radial lines; axial lines consisting of major and minor riblets; shell diameter less than 2 mm ..... **Punctidae**
25b. Shell surface either nearly smooth, or with axial ridges not consisting of major and minor ribs; shell diameter variable **26**

26a. Surface of embryonic whorls with distinct spiral grooves, later whorls with the axial ridges cut by the spiral grooves, giving the ridges a coarse granular appearance; size less than 2 mm ..... **Gastrodontidae in part** *(Striatura)*
26b. Spiral grooves on embryonic whorls indistinct, axial ridges, if present, not granulate **27**

27a. Shell shape globose; umbilicus open, but very narrow; surface with very fine striae, giving shells a dull luster ..... **Euconulidae in part** *(Euconulus)*
27b. Shell depressed to discoidal; umbilicus either closed, or very widely open; surface variable, shiny to coarsely sculptured **28**

28a. Size smaller, diameter less than 3 mm **29**
28b. Size larger, diameter greater than 4 mm..... **31**

29a. Umbilicus closed; surface with closely spaced, microscopic spiral lines; axial growth wrinkles fine and irregularly spaced; one of the smallest land snails in Missouri, shell diameter about 1.3 mm..... **Euconulidae in part** *(Guppya)*
29b. Umbilicus wide open; surface variable; size larger, usually greater than 2.0 mm **30**

30a. Surface dull, with distinct though fine and uneven growth lines .... **Vitrinidae** *(Hawaiia)*
30b. Surface glossy, with growth lines weak and irregular.... **Helicodiscidae in part** *(Lucilla)*

31a. Surface with coarse, regular and widely spaced ribs, or if sculpture is finer, then the species are known in Missouri only from fossils ..... **Discidae in part** *(Discus)*
31b. Surface with weak and irregular growth lines or with somewhat irregular and very closely spaced ridges..... **Gastrodontidae in part** *(Zonitoides)*

SPECIES ACCOUNTS

Each species account contains the description of a snail or slug, its size, shape, features, color, and other pertinent data. Unless otherwise noted, the names used herein follow Turgeon et al. (1998), and the classification follows that of Bouchet and Rocroi, 2005. Below the genus level the species are generally presented alphabetically.

The species descriptions rely heavily on other authors, especially Pilsbry (1940, 1946, 1948), Burch (1962), and Hubricht (1985).

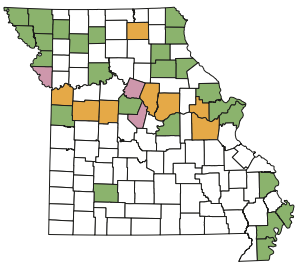
Distribution Maps

The distributional maps are based upon collections made from 1990 to 2010 at more than 800 localities and from all counties of the state. (See Appendix A for site names). Most of the historic distribution records are from Hubricht (1985). Fossil information is primarily from Hubricht (1964a) and Greger (1933), with older publications summarized by Hambach (1890) and Swallow (1855). Order of precedence for map colors is as follows: 1) recent collections (green), 2) historic records (gold), and 3) fossil records (purple). Since many fossil records are from the same counties as recent collections and do not show on the maps, Missouri fossil records are summarized in the remarks for each species.

Distribution comments are limited to ranges within the eastern United States, and are summarized from Hubricht (1985). Some of the eastern United States species also occur in western states, Canada, Mexico, or elsewhere. These extended ranges are not included in the text.

Distribution maps are color-coded as follows:

Green—collected by the authors (LW, RO)
Gold—historic records
Purple—fossil records



Helicina orbiculata (Say 1818)

Globular Drop

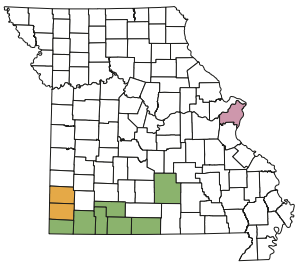
DESCRIPTION: ***Shell***: medium, diameter 5.4 to 7.5 mm, height 4.6 to 6.6 mm; shell very solid; shape globose, with low conic spire; whorls usually 4½, first 3 nearly flat, 4th very slightly convex, body whorl large and rounded, suture not impressed on early whorls, slightly impressed on body whorl; shell imperforate. ***Aperture:*** oval, somewhat tear-drop shaped; peristome thickened with a slight sulcus (shallow furrow) behind the lip; operculum with shallow concentric ridges; lip of shell with forwardly projecting angle at the junction of the columella and basal margin; parietal callus thin, transparent, leading edge barely discernable, convex, extending well beyond the lip margins. ***Surface:*** dull; growth wrinkles faint and widely spaced; spiral striae absent to few and poorly defined. ***Color:*** variable with colors ranging from pale yellow to tan, orange, cinnamon red to brownish red, and combinations of the above, with a white peripheral band on some shells.

REMARKS: The globular drop is a common snail on glades in the southwestern part of the state. *Helicina orbiculata* is one of only three prosobranch land snails in Missouri, which differ from the pulmonate snails in having an operculum, separate male and female sexes, one pair of sensory tentacles rather than two and eyes at the base of the tentacles rather than at the tips.

Missouri fossils of the globular drop have been recovered from Pleistocene age talus in St. Louis County (Hubricht 1964a).

Fig. 8. *Helicina orbiculata*, diameter 7.1 mm, Barry County.

Fig. 9. *Helicina orbiculata* operculum.



DISTRIBUTION: *Helicina orbiculata* occurs mainly in the southwestern and southern part of the Ozark Natural Division, northeast to Texas County. Elsewhere, it ranges from Texas east to Kentucky and south to Florida.

TYPE LOCALITY: Oyster hummocks near the mouth of River St. Johns, Fla.

Hendersonia occulta (Say 1831)

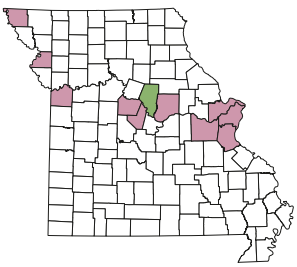
Cherrystone Drop

DESCRIPTION: ***Shell:*** small, diameter 5.6 to 7.7 mm, height 4.0 to 6.0 mm, solid; shape globose, somewhat depressed, with a low conic spire; whorls 4½ to 5, early whorls flattened, body whorl large and convex, suture not impressed except for last one-half of body whorl; shell imperforate. ***Aperture:*** subtriangular; peristome thickened with a deep sulcus behind the basal portion of lip; operculum with faint spiral sculpture; aperture without lamellae; parietal callus wraps around axial callus, transparent, very thin and difficult to see in young shells, in mature shells becoming thicker and finally whitish opaque, surface finely granular. ***Surface:*** dull; growth ridges disappearing around the umbilicus, sometimes present on the thickened lip. ***Color:*** brownish red or yellow.

REMARKS: The cherrystone drop has primitive characteristics, including an operculum, separate male and female sexes, one pair of sensory tentacles rather than two and eyes at the base of the tentacles rather than at the tips. Missouri fossils of *Hendersonia occulta* were found in Pleistocene age deposits of loess, talus, and silt from Atchison, Boone, Buchanan, Callaway, Cooper, Franklin, Howard, Jackson, Jefferson, Moniteau, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a, Hubricht 1985).

Fig. 10. *Hendersonia occulta*, diameter 6.2 mm, Boone County.

Fig. 11. *Hendersonia occulta* operculum.



DISTRIBUTION: In Missouri this snail has been found only in Boone County in the Ozark Border Natural Division. In other eastern states, *Hendersonia occulta* is found in Wisconsin, Iowa, and Michigan, and in the southern Appalachian region. Its present pattern of distribution suggests that modern populations may be relicts of a more continuous preglacial distribution. It has also been suggested that *Hendersonia* might have some peculiar, but as yet undefined environmental requirement that limits its range to particular sites (van der Schalie 1939). Based on fossil evidence, the species at one time had a wider distribution in Missouri.

TYPE LOCALITY: south of New Harmony, Ind. (described from a fossil)

Pomatiopsis lapidaria (Say 1817)

Slender Walker

Fig. 12. *Pomatiopsis lapidaria*, length 6 mm, Franklin County.

DESCRIPTION: ***Shell:*** small, length 6 to 7 mm, moderately solid; shape elongate, with tall conic spire; whorls 7, convex, suture moderately impressed; shell umbilicate. ***Aperture:*** oval; peristome slightly thickened within; aperture without lamellae; operculum corneous, translucent, with a few spiral striae. ***Surface:*** dull; two apical whorls smooth, granulose, later whorls with irregular growth wrinkles. ***Color:*** light greenish brown to tan, with growth wrinkles often colored from whitish to dark brown.

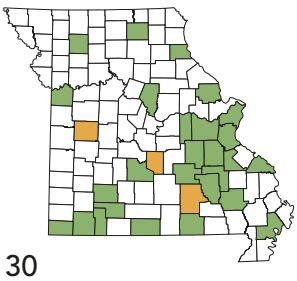
Fig. 13. *Pomatiopsis lapidaria* operculum.

REMARKS: This is a snail that lives in the water or on land, in wet to moist environments such as stream banks, fens, and lowlands. Older individuals are more aquatic than younger ones (van der Schalie & Getz 1961). While searching for land snails this species was discovered in only seven counties. In a previous study of the aquatic snails in Missouri, it was found in aquatic habitats in 21 counties (Wu et al. 1997: 23–24). It lays its eggs along moist stream banks, disguising them in the substrate with sand and fecal matter.

Pomatiopsis lapidaria is one of only three prosobranch land snails in Missouri, and it differs from pulmonate snails in having an operculum, separate male and female sexes, one pair of sensory tentacles rather than two and eyes at the base of the tentacles rather than at the tips. *P. lapidaria* has an unusual method of locomotion. The foot is divided longitudinally down the middle and when moving, it uses the right and left side alternatively, so that the animal appears to "walk," swaying slightly from side to side.

The slender walker is the intermediate host of a parasite, the North American lung fluke (*Paragonimus kellicotti*), which can infect a wide variety of carnivorous mammals, and occasionally humans (Ameel 1938). The simplified life cycle of the lung fluke is as follows: 1) Eggs hatch and miracidium larva penetrates a snail, reproducing asexually in the snail to produce cercaria larvae. 2) Cercaria larvae exit snail, enter a crayfish and form cysts. 3) Crayfish is eaten by mammal host, where the larval fluke bores through the gut wall and eventually penetrates the lung. 4) Adult flukes encyst in pairs in the lungs and produce eggs, which are coughed up, then swallowed, and eventually exit with host feces. If the eggs land in snail habitat, the life cycle continues.

Missouri fossil shells of *Pomatiopsis lapidaria* were found in Pleistocene age deposits of loess and silt in St. Louis County (Swallow 1855, Hambach 1890, Greger 1933, Hubricht, 1964a).



DISTRIBUTION: *Pomatiopsis lapidaria* occurs in the Glaciated Plains, Ozark, Ozark Border, and the Mississippi Lowlands natural divisions; however, it is most common in the southeastern half of Missouri. In the eastern United States, it is widespread from Texas to South Dakota, east to Vermont, and south to northern Florida.

TYPE LOCALITY: Delaware River

Carychium exile H. C. Lea 1842

Ice Thorn

Fig. 14. *Carychium exile*, long form, length 1.85 mm, Oregon County.

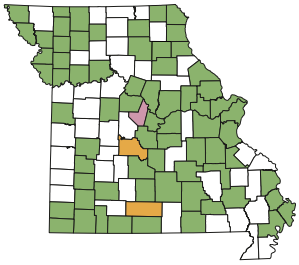
DESCRIPTION: ***Shell:*** micro to minute, length 1.6 to 2.2 mm, diameter 0.6 to 0.7 mm, solid; shape elongate and slender; whorls 5¼ to 5¾, with suture moderately impressed; umbilicus rimate. ***Aperture:*** oval; peristome greatly thickened; lamellae consisting of small parietal and columellar lamellae, the columellar lamella can be seen on the inner margin of the lip when the shell is rotated in oblique view (Fig. 15). Within the shell, "At the junction of the columellar and parietal margin there is a small horizontal lamella, which one whorl within expands into a broad warped plate which ascends almost vertically" (Pilsbry 1948: 1058). The shell must be broken open to view the internal lamella and warped plate (Fig. 16). ***Surface:*** of early whorls nearly smooth, last two whorls with close-spaced distinct axial ridges. ***Color:*** of shell whitish or clear corneous; ***Animal:*** whitish and semi-transparent.

Fig. 15. *Carychium exile*, aperture rotated to view columellar lamella.

Fig. 16. *Carychium exile*, short form, Oregon County.

REMARKS: The ice thorn is found under leaf litter in wooded areas and in other mesic habitats. It is sometimes very abundant in fens.

Fossils of *Carychium exile* in Missouri were found in Pleistocene age deposits of loess and talus from Boone, Callaway, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Carychium exile* is widespread in Missouri, and occurs in all of the natural divisions. Elsewhere, it is found from Oklahoma to North Dakota, and throughout most of the eastern states.

TYPE LOCALITY: unknown

Clade Stylommatophora
Subclade Elasmognatha (=Heterurethra)
> Family Succineidae Beck 1837

An unusual form of parasitism occurs in snails of the Family Succineidae. The parasite is *Leucochloridium paradoxum*, a flatworm (*Platyhelminthes*). After ingesting fecal material from an infected bird, a snail becomes infected with parasite eggs. The eggs hatch and develop into sporocysts (the second larval stage) within the digestive tract of the snail. The sporocysts morph into long tubes called broodsacs, which contain up to hundreds of individual larvae. The sporocysts then invade the tentacles of the snail and cause the tentacle to swell in size, and transform into colorful, pulsating structures resembling caterpillars or grubs. The "grubs" have color bands of green, red or yellow with black pigment spots forming bands and "eyespots." The parasite disrupts part of the snail's nervous system, and changes its perception of light. This causes the snail to seek more intense light where it is more likely to be noticed by birds. Birds are then tempted to make a meal of the pulsating, grub-like tentacles. Upon biting off the tentacle(s), the birds become infected. The parasite in the rectum of the bird matures into adult flatworms. The flatworms then lay eggs, which will be spread about in the environment as the bird defecates. Hungry snails ingesting feces from infected birds repeat the cycle. Neither the snail nor the bird is greatly harmed by this unusual parasite. The snail usually regrows its lost tentacle (Roberts & Janovy 2000).

Oxyloma retusa (I. Lea 1834)

Blunt Ambersnail

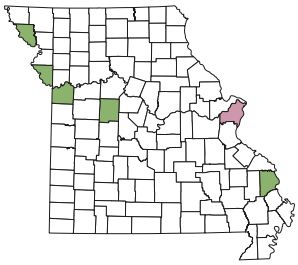
DESCRIPTION: ***Shell:*** medium, length 17 to 20 mm, width about 7.5 mm, very thin and fragile; shape elongate-oval, spire short, body whorl very large and long; whorls about 3; shell imperforate. ***Aperture:*** oval, large and long, about 0.7 times total length of shell, and about 0.6 times as wide as long, dilated below, receding in lateral view; peristome thin; lip not reflected or thickened; aperture without lamellae; parietal callus very thin, transparent and nearly straight along outer edge. ***Surface:*** with irregularly spaced and shallow growth ridges; spiral lines not visible. ***Color:*** light amber, translucent.

a b c d

Fig. 17. *Oxyloma retusa*, a–c: length 13 mm, Holt County; b–d: length 13 mm, Washington County.

REMARKS: This snail lives in low, wet places and can be found crawling on mud or plants near margins of lakes and swamps.

Missouri fossils of *Oxyloma retusa* were found in Pleistocene age silt deposits in St Louis County (Greger 1933, Hubricht 1964a).



DISTRIBUTION: New State Record. *Oxyloma retusa* is found in scattered counties in southeastern and northwestern Missouri, in the Glaciated Plains, Ozark, and Ozark Border natural divisions. Outside of Missouri it is a northern species, ranging from Nebraska to North Dakota, east to New Hampshire.

TYPE LOCALITY: near Cincinnati, Ohio

Live *Succinea* have been found among the feathers of birds (Ramsden 1913). Ramsden stated that he took two shells, later identified as *Succinea riisei*, from the feathers of bobolinks. The birds were shot at San Carlos Estate, Guantanamo, Cuba; the snails are native to St. Croix and Puerto Rico. Another record of hitchhiking snails was reported by Huey (1936). He and a team were collecting at Gila Bend, Arizona; a *Succinea* was found among the feathers of a western vesper sparrow.

Succinea forsheyi I. Lea 1864

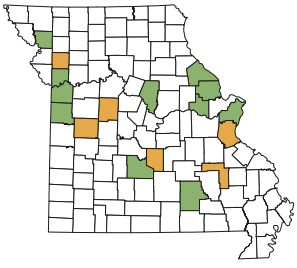
Spotted Ambersnail

Fig. 18. *Succinea forsheyi*, length 12.4 mm, Warren County

Fig. 19. *Succinea forsheyi*, St. Louis County

DESCRIPTION: ***Shell:*** medium, length 15.8 to 16.8 mm, diameter 8.0 to 9.0 mm, very thin and fragile; shape elongate-oval; whorls 3.5, body whorl very large, somewhat flattened above the periphery, suture moderately deep; shell imperforate. ***Aperture:*** oval, large, about 0.7 times total length of shell, and about 0.6 times as wide as long; peristome thin; aperture without lamellae; parietal callus convex, relatively large, extending beyond edge of lip at columella. ***Surface:*** with irregular and shallow growth ridges; spiral striae not evident. ***Color:*** pale honey-yellow, apical whorls are slightly darker, reddish orange. ***Animal:*** mantle intensely black, dappled throughout with rounded golden-yellow spots. Those towards the edge of the mantle large and elongate; foot, including head and eyestalks, pale grayish white, speckled with irregular grayish black spots; sole yellow. The black color of the mantle preserves well in alcohol (Pilsbry 1948: 835).

REMARKS: Live spotted ambersnails are remarkably different from any other species in this family in Missouri, and are easily recognized by their yellow spotted black mantle. This species is found around the edges of lakes, swamps, and springs, and on algae-covered stones along streams.



DISTRIBUTION: *Succinea forsheyi* is widely scattered in Missouri and is found in the Glaciated Plains, the Osage Plains, Ozark, and Ozark Border natural divisions. Elsewhere, it is found from Texas to Nebraska, east to North Carolina, and south to Florida.

TYPE LOCALITY: Lake Concordia, La.

Novisuccinea ovalis (Say 1817)

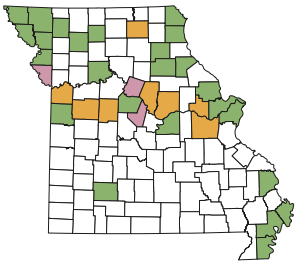
Oval Ambersnail

DESCRIPTION: ***Shell:*** medium, length 13.8 to 16.5 mm, diameter 9.8 to 12.2 mm, thin, fragile; shape oval, inflated; whorls about 2.5, convex, suture moderately impressed; shell imperforate. ***Aperture:*** oval, about 0.8 times total length of shell, and about 0.7 times as wide as long; peristome thin; aperture without lamellae; parietal callus convex, transparent, extends beyond lip at columellar end. ***Surface:*** with irregular, shallow growth ridges; spiral striae not evident. ***Color:*** dull yellowish-brown with greenish tint, translucent. ***Animal:*** orange or yellowish along sides; back grayish to blackish, with a black spot on dorsal surface of tail; sole bluish gray; tentacles dark gray.

REMARKS: The oval ambersnail is a snail of wet lowlands and river valleys. It will climb up tree trunks, as will *Webbhelix multilineata*, to stay above rising floodwaters.

In Missouri, fossils of the *Novisuccinea ovalis* have been found in Pleistocene age talus in Howard, Moniteau, Platte, and St. Louis counties (Swallow 1855, Greger 1933, Hubricht, 1964a).

Fig. 20. *Novisuccinea ovalis*, length 13.8 mm, St. Charles County.



DISTRIBUTION: *Novisuccinea ovalis* is a northern species, found primarily in the northern half of Missouri. Nevertheless, with a few isolated populations, it occurs in all of the natural divisions of the state. It ranges from Arkansas to North Dakota, and east in the states north of Mississippi.

TYPE LOCALITY: Philadelphia, Pa.

Catinella avara (Say 1824)

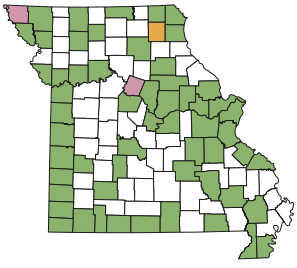
Suboval Ambersnail

Fig. 21. *Catinella avara*, length 9.2 mm, St. Charles County.

DESCRIPTION: ***Shell:*** small to medium, length 7.0 to 11.0 mm, diameter 4.0 to 6.8 mm size, thin and fragile; shape oval; whorls 2.5 to 3.5, strongly convex, suture deep; shell imperforate. ***Aperture:*** oval, large, about 0.6 times as long as total length of shell, and about 0.7 times as wide as long; peristome thin and fragile; aperture without lamellae; parietal callus thin, connects to each lip edge and is uniformly convex across the leading edge. ***Surface:*** with irregular, shallow growth wrinkles; spiral striae not evident. ***Color:*** pale yellowish brown, sometimes with greenish tint, translucent. ***Animal:*** "The mantle under the shell is beautifully spotted with opaque white and black on a pale gray background; tentacles black. The sole is either of uniform pale tint or peppered with black" (Pilsbry 1948: 837).

REMARKS: The suboval ambersnail is "usually found on wet ground in low, wet places, floodplains, margins of ponds, marshes and swamps in both shady and sunny situations" (Hubricht 1985: 16). Due to habitat preferences, some snails reported here (those found on dry sunny places) may be *Succinea indiana*.

In Missouri, fossils shells of *Catinella avara* were found in Pleistocene age deposits from Howard County (Greger 1933), and a loess deposit in Atchison County (collected by Nels Holmberg).



DISTRIBUTION: *Catinella avara* is widespread in the state, and is known from all of the natural divisions. It is also found from Texas to Minnesota, and in most states to the east.

TYPE LOCALITY: Northwest Territory, Minnesota.

The species in this genus have been published by other authors under the genus name *Cionella* and family Cionellidae. *Cochlicopa* is the older genus name, and *Cionella* is a junior synonym (Roth 2003). For the family name, Cochlicopidae is in prevailing usage, and is considered the valid name (Bouchet & Rocroi 2005).

Cochlicopa lubrica (Müller 1774)

Glossy Pillar

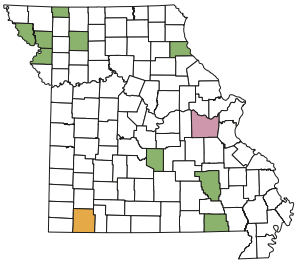
Fig. 22. *Cochlicopa lubrica*, length 4.9 mm, Caldwell County.

DESCRIPTION: ***Shell:*** small, length 4.9 to 5.5 mm, diameter 2.2 to 2.5 mm, moderately solid; shape elongate, somewhat conic; whorls 5½ to 6, somewhat flattened, suture shallow; imperforate. ***Aperture:*** ovate, lip not reflected, without lamellae, peristome thickened forming a callus within; parietal callus thin, transparent. ***Surface:*** smooth, very glossy. ***Color:*** yellowish corneous, the lip colored yellow or red on the outside.

REMARKS: *Cochlicopa lubrica* is reported from wet grassy environments (Hubricht 1985: 6).

This species closely resembles *C. morseana* except for its smaller size, and more conic form, and is nearly indistinguishable from *C. lubricella*. "It should be noted that individual shells may be very difficult to assign to either *C. lubrica* or *C. lubricella* and some populations may show anomalous features" (Kerney & Cameron 1979). Some European authors recognize a third species (*C. repentina* Hudec), intermediate between *C. lubrica* and *C. lubricella* (Cameron 2008). Allozymic marker studies (Armbruster & Schlegel 1994) indicate *C. lubrica* and *C. lubricella* are distinct, but *C. repentina* should be treated as a synonym of C. lubrica.

Fossils of *Cochlicopa lubrica* were found in Missouri from Pleistocene age talus in Franklin County (Hubricht 1964a).



DISTRIBUTION: *Cochlicopa lubrica* occurs in scattered counties throughout the Glaciated Plains and Ozark natural divisions of Missouri, and is the predominant species of the genus in the northern part of the state. Its national range is from central Kansas north to Minnesota, and east to Virginia and Maine.

TYPE LOCALITY: Denmark

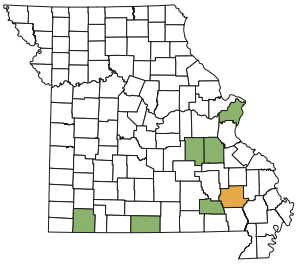
Cochlicopa morseana (Doherty 1878)

Appalachian Pillar

DESCRIPTION: ***Shell:*** small, length 6.5 to 7.2 mm, diameter 2.3 to 2.5 mm, moderately solid; shape elongate; whorls 5½, slightly convex, body whorl slightly flattened, suture not deeply impressed; shell imperforate. ***Aperture:*** elongate oval, truncated at columella and at body whorl; peristome thickened; aperture without lamellae; parietal callus thin, leading edge nearly straight from lip to lip. ***Surface:*** smooth and very shiny, growth lines extremely faint or absent. ***Color:*** light yellowish brown to reddish brown, transparent, lip margin darker. ***Animal:*** light gray, foot whitish, tentacles relatively short.

REMARKS: The Appalachian pillar is found in moist upland woods.

Fig. 23. *Cochlicopa morseana*, length 6.5 mm, Washington County.



DISTRIBUTION: *Cochlicopa morseana* occurs in the Ozark and Glaciated Plains natural divisions of Missouri. It is known from Arkansas and Alabama north to Minnesota, and east to Maine.

TYPE LOCALITY: Hamilton County, Ohio.

Pupoides albilabris (C. B. Adams 1841)

White-lip Dagger

DESCRIPTION: ***Shell:*** minute to small, length 4.2 to 5.1 mm, diameter 2.2 mm, solid; shape elongate, spire conic; whorls 6, strongly convex, suture moderately impressed; umbilicus minute. ***Aperture:*** oval; peristome reflected and thickened within, face flattened; lamellae consisting of a low tubercle on the parietal wall near the outer lip (Fig. 24, lower); parietal callus thick, gold or brassy and shining. ***Surface:*** with axial growth ridges poorly to moderately developed. ***Color:*** of the shell cinnamon to dark cinnamon; lip white.

REMARKS: The preferred habitat of the white-lip dagger is grassy areas, including limestone/dolomite glades, roadsides, and waste ground. It is also found in urban and suburban lawns.

This species forms a complex brown epiphragm to close the aperture during seasonal dormancy (Barnhart 1979).

Missouri fossils of *Pupoides albilabris* were found in Pleistocene age talus in Boone and St. Louis counties (Greger 1933, Hubricht, 1964a).

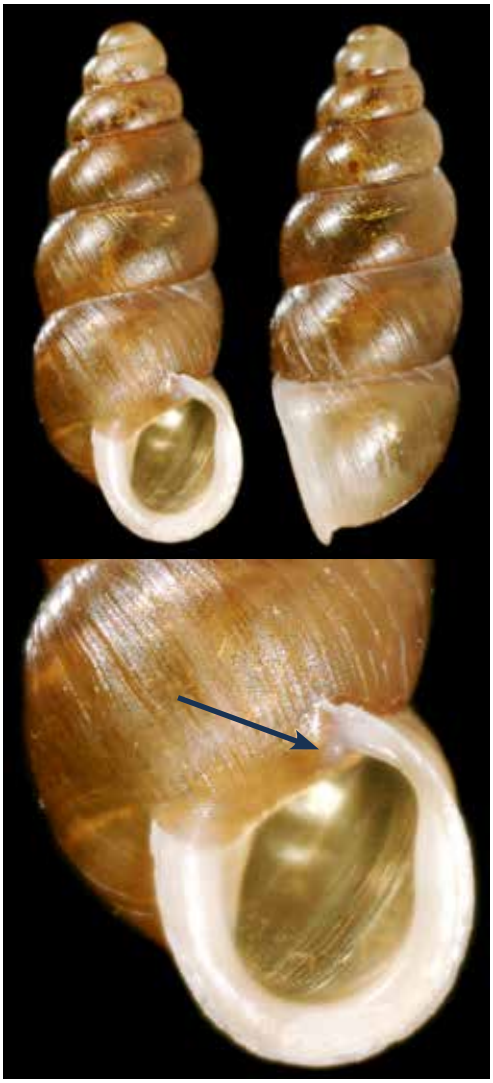
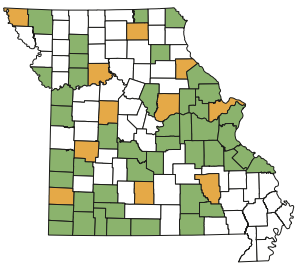


Fig. 24. *Pupoides albilabris*, length 5 mm, Barry County.



DISTRIBUTION: *Pupoides albilabris* is widespread throughout Missouri. It occurs in all the Missouri natural divisions except the Mississippi Lowlands. It is very widespread in the eastern United States, occurring from Texas to South Dakota, east to Vermont, and south to Florida and the Gulf coastal states.

TYPE LOCALITY: northern Missouri.

Whitish translucent snails having the angular and parietal lamellae curved towards the periphery.

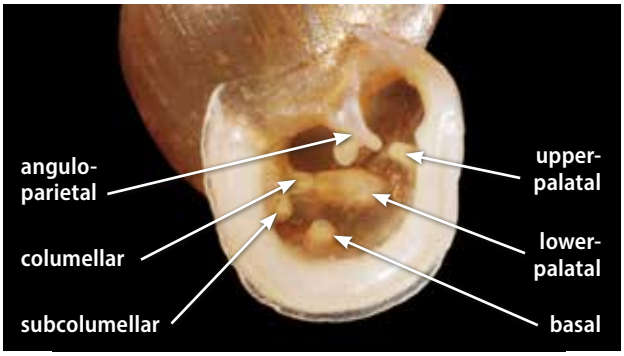


Fig. 25. *Gastrocopta procera*, aperture view with lamellae labeled.

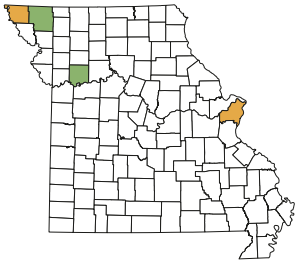
Gastrocopta abbreviata (Sterki 1909)

Plains Snaggletooth

Fig. 26. *Gastrocopta abbreviata* (Sterki), length 3.6 mm, Nodaway County.

DESCRIPTION: ***Shell:*** minute, length 3.3 to 4.2 mm, diameter 1.8 to 2.2 mm, solid; shape elongateoval; whorls about 7½, body whorl of lesser diameter and compressed from side to side as the snail reaches maturity; suture moderately impressed; umbilicus small, rimate. ***Aperture:*** nearly circular; peristome thin, narrowly reflected; angulo-parietal lamella large, extending to the lip margin; columellar lamella smaller than in *Gastrocopta armifera* and *G. similis*, horizontal "U"-shaped and sometimes reduced to a narrow horizontal lamella; basal lamella well-developed; upper and lower palatal lamellae large, positioned on a white callus and a much smaller suprapalatal usually present; parietal callus granulose, relatively thick, leading edge nearly straight. ***Surface:*** with irregular, weak growth wrinkles. ***Color:*** grayish white, translucent; columella can be seen through fresh shells.

REMARKS: The plains snaggletooth is reported from the same habitats as *G. armifera* (Hubricht 1985). In Missouri, it was found only in prairie/savanna areas in the northwestern part of the state.



DISTRIBUTION: This is an uncommon species in Missouri, and was found only in Nodaway and Ray counties in the Glaciated Plains Natural Division. Elsewhere in the Midwest, it ranges from North Dakota to Texas, east to Illinois and Alabama.

TYPE LOCALITY: Bismarck, N.D.

Gastrocopta armifera (Say 1821)

Armed Snaggletooth

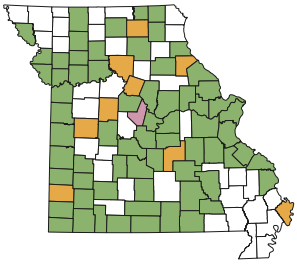
Fig. 27. *Gastrocopta armifera*, length 4.8 mm, Washington County.

DESCRIPTION: ***Shell:*** minute, length 3.0 to 4.8 mm, diameter about 2.2 mm, solid; shape elongateoval; whorls about 6½, body whorl narrower than penultimate whorl; suture moderately impressed; umbilicus small, rimate. ***Aperture:*** nearly circular; peristome thin, narrowly reflected; angulo-parietal lamella large, extending to the lip margin; columellar lamella large; basal lamella low or wanting; upper and lower palatal lamellae large, positioned on a white callus and a much smaller suprapalatal usually present; parietal callus granulose, relatively thick, leading edge convex. ***Surface:*** with irregular, weak growth wrinkles. ***Color:*** grayish white to bluish white, translucent; columella can be seen through fresh shells.

REMARKS: This is the largest *Gastrocopta* in Missouri. The armed snaggletooth is most commonly found in xeric locales such as dry stony pastures or on glades, however it is also found in mesic woodlands.

Gastrocopta armifera is very similar to *G. similis* and *G. abbreviata*. See Appendix C: Key Identifications for distinguishing features.

In Missouri, fossils of *Gastrocopta armifera* have been found in Pleistocene age deposits of loess and talus from Boone, Callaway, Franklin, Moniteau, Platte, St. Charles, and St. Louis counties (Hambach 1890, Greger 1933, Hubricht 1964a).



DISTRIBUTION: This is a widespread species, occurring in all Missouri natural divisions. Elsewhere, it is found from Texas to North Dakota, east to Vermont, and south to Florida.

TYPE LOCALITY: Germantown, Pa.

Gastrocopta contracta (Say 1822)

Bottleneck Snaggletooth

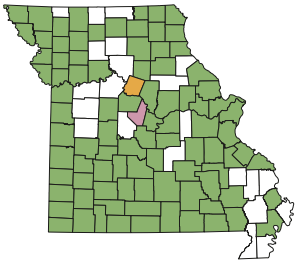
Fig. 28. *Gastrocopta contracta*, length 2.5 mm, Oregon County.

DESCRIPTION: ***Shell:*** minute, length 2.2 to 2.5 mm, diameter 1.3 to 1.4 mm, solid; shape conic, regularly tapering from body whorl to apex; whorls 5½, convex, body whorl greatly compressed; suture deeply impressed; umbilicus small, oval. ***Aperture:*** triangular; peristome thin, expanded, sulcate behind lip; lamellae large, angulo-parietal lamella attached to outer lip, curved, nearly occluding aperture, columellar lamella large, deeply set, partly occluded by a callus, lower palatal lamella peg-like and blunt, upper palatal lamella small. ***Surface:*** of first two whorls smooth, granulose, later whorls with very fine growth lines. ***Color:*** grayish white, translucent.

REMARKS: The bottleneck snaggletooth is one of the easiest *Gastrocopta* to identify. The combination of its size, shape, and unusual aperture is unlike any other.

It is found in a wide variety of habitats from glades to mesic forests, but does not occur in perennially wet areas.

Missouri fossils of *Gastrocopta contracta* were found in Pleistocene age talus and silt deposits from Boone, Callaway, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a).



DISTRIBUTION: This is one of the most common land snails in the state; it occurs in all Missouri natural divisions. It is found from Texas to Minnesota, east to Vermont, and south to Florida.

TYPE LOCALITY: Occoquan, Va.

Gastrocopta holzingeri (Sterki 1889)

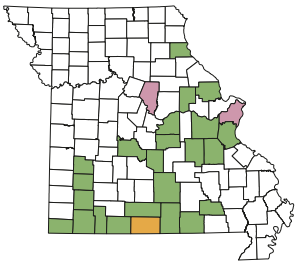
Lambda Snaggletooth

Fig. 29. *Gastrocopta holzingeri*, length 1.5 mm, Barry County.

DESCRIPTION: ***Shell:*** micro, length 1.5 to 1.7 mm, diameter about 0.8 mm, solid; shape elongateoval, evenly tapered to blunt apex; whorls 5, body whorl large, convex, broadly rounded, suture moderately impressed; umbilicus small, rounded. ***Aperture:*** somewhat triangular; peristome thin, expanded; lamellae nearly filling aperture; angulo-parietal lamella, with branch approaching outer lip, appearing like a reversed letter "y" when viewed from the base; columellar lamella thin, high; basal and lower palatal large; upper palatal thin and peg-like; suprapalatal small and thin; basal and upper palatal on a callus; lower palatal more deeply recessed; parietal callus moderately thick. ***Surface:*** with fine axial growth ridges. ***Color:*** grayish white, translucent.

REMARKS: The lambda snaggletooth occupies a variety of habitats including glades, mesic forests, and bluffs.

Missouri fossils of *Gastrocopta holzingeri* were found in Pleistocene age talus from Boone, Jefferson, and St. Louis counties (Hubricht 1964a, Hubricht 1985).



DISTRIBUTION: *Gastrocopta holzingeri* has an unusual distribution pattern in Missouri, and appears limited to the areas with limestone and dolomite rock formations and soils. It has not yet been found in the northwestern part of the state or from the Mississippi Lowlands. It is found in the Glaciated Plains, Ozark, and Ozark Border natural divisions of Missouri. Elsewhere, it occurs from Texas to North Dakota, and east to Virginia.

TYPE LOCALITY: Will County, Ill.

Gastrocopta similis (Sterki 1909)

Great Lakes Snaggletooth

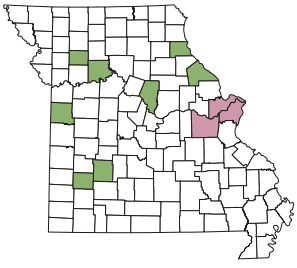
Fig. 30. *Gastrocopta similis* (Sterki), length 3.7 mm, Polk County.

DESCRIPTION: ***Shell:*** minute, length 3.2 to 4.3 mm, diameter 1.7 to 2.0 mm, solid; shape elongateoval; whorls about 5½, body whorl equal to or slightly wider than penultimate whorl; suture moderately impressed; umbilicus small, rimate. ***Aperture:*** nearly circular; peristome thin, narrowly reflected; angulo-parietal lamella large, extending to the lip margin; columellar lamella large, rounded and thin, without forward projecting lobe at middle, growth lines often clearly visible through the thin plate; basal lamella very small or absent; upper and lower palatals large, lower more deeply set, other palatals positioned on a white callus, and a much smaller suprapalatal usually present; parietal callus granulose, relatively thick, leading edge nearly straight. ***Surface:*** with irregular, weak growth wrinkles. ***Color:*** grayish white, translucent; columella can be seen through fresh shells.

REMARKS: This species is reported from the same habitats as *G. armifera* (Hubricht 1985). In Missouri, it has been found in glade, prairie, and woodland habitats.

Gastrocopta similis is very similar to *G. armifera* and *G. abbreviata*; see Appendix C: Key Identifications for distinguishing features.

Fossil shells of *Gastrocopta similis* have been reported from Missouri in Franklin, St. Charles, and St. Louis counties, Hubricht (1985).



DISTRIBUTION: New State Record. *Gastrocopta similis* was found in the Osage Plains and Glaciated Plains natural divisions of Missouri. It occurs from North Dakota to Kansas, and east to New York.

TYPE LOCALITY: Rose Hill, Ontario

Angular lamella small or missing, parietal lamella short and simple.

Gastrocopta pentodon (Say 1821)

Comb Snaggletooth

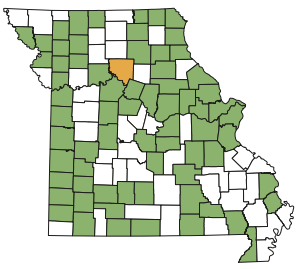
Fig. 31. *Gastrocopta pentodon*, left and middle, infrequently encountered form with infraparietal lamella, length 1.5 mm, St. Louis County; right, common form with five lamellae, length 1.7 mm, Barry County.

DESCRIPTION: ***Shell:*** micro, length 1.5 to 1.8 mm, diameter 0.8 to 1.1 mm, solid; shape elongateoval; whorls about 5½, convex, suture deeply impressed; umbilicus oval to teardrop-shaped. ***Aperture:*** rounded, truncated at the body whorl, and slightly flattened on the right side; peristome thin and slightly expanded, with a prominent white ridge behind the lip; parietal lamella simple and thin, columellar lamella thin and horizontal; basal lamella small and two palatal lamellae present. Some specimens have an infraparietal lamella, subcolumellar lamella, and other small lamellae along the palatal row; basal and palatal lamellae sit on a low callus, with the lower palatal more deeply recessed; a white crest is visible on the outer surface of the shell parallel to and behind the lip. Unlike the other *Gastrocopta* in Missouri, *G. pentodon* has nearly uniformly sized lamellae. Parietal callus thin, granulose and transparent to semi-opaque. ***Surface:*** smooth, granulose, with a few faint growth lines. ***Color:*** grayish white, translucent; columella can often be seen through the shell.

REMARKS: The comb snaggletooth occupies almost every niche in the state, from xeric glades to prairies, forests, and river valleys.

Pearce et al. (2007) distinguish *Gastrocopta pentodon* and *G. tappaniana* by length of the upper whorls relative to the penultimate whorl, and to the total shell length, by length of the body whorl and by the number of lamellae. However, the measured characters are rather subtle, and not obvious by direct observation. In our review of the Missouri fauna, these measurements correlate well with overall shell size, structure of the apertural lamellae and habitat.

Missouri fossils of *Gastrocopta pentodon* were reported in Pleistocene age talus in Boone and St. Louis counties (Hubricht 1964a).



DISTRIBUTION: *Gastrocopta pentodon* is another very common and widespread species in Missouri. It occurs in all natural divisions of the state. Elsewhere, it is found from Texas to South Dakota, east to Vermont, and south to Florida.

TYPE LOCALITY: Pennsylvania

Gastrocopta tappaniana (C. B. Adams 1842)

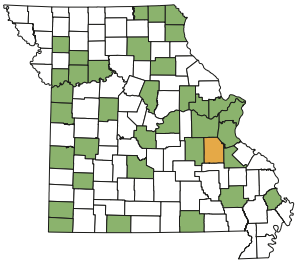
White Snaggletooth

Fig. 32. *Gastrocopta tappaniana*, length 2.2 mm, Warren County.

DESCRIPTION: ***Shell:*** micro to minute, length 1.8 to 2.2 mm, diameter 1.1 to 1.2 mm, solid; shape elongate-oval; whorls about 5½, strongly convex, suture deeply impressed, body whorl large; umbilicus small. ***Aperture:*** rounded, truncated at body whorl; peristome slightly reflected; parietal lamella simple; columellar lamella present; small basal lamella, upper and lower palatal lamellae, and three smaller lamellae are interspersed along the palatal row; basal and palatal lamellae sit on an elevated ridge parallel to the lip; the ridge is evident on the outside of the body whorl as a white band, or sometimes as a thickened crest; parietal callus thin and granulose. ***Surface:*** with fine growth lines. ***Color:*** grayish white, translucent.

REMARKS: The white snaggletooth is found in wet habitats associated with bottomlands, margins of streams, and lakes, fens, and seeps within other areas. It is most easily confused with *Gastrocopta pentodon*, especially specimens of the latter having more than five lamellae. *G. tappaniana* is usually larger than *G. pentodon* (see *G. pentodon* Remarks, Page 45).

Fossils of *Gastrocopta tappaniana* were found in Pleistocene age deposits of loess in St. Louis County (Hubricht 1964a).



DISTRIBUTION: The species is widespread in Missouri, and occurs in all natural divisions. Elsewhere, it is found from Texas to South Dakota, east to Maine, and south to Florida.

TYPE LOCALITY: Roscoe, Ohio (Clench 1965: 107).

Whitish shell, angulo-parietal lamella small and straight; palatal lamella absent; columellar lamella minute.

Gastrocopta corticaria (Say 1816)

Bark Snaggletooth

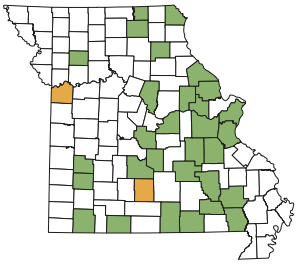
Fig. 33. *Gastrocopta corticaria*, length 2.6 mm, Washington County.

DESCRIPTION: ***Shell:*** minute, length about 2.5 mm, diameter about 1.0 mm, solid; shape elongateoval; whorls 5½, convex, suture rather deeply impressed; umbilicus rimate. ***Aperture:*** oval, truncated at the body whorl; peristome thin, lip reflected, without crest or sulcus behind the lip; angulo-parietal lamella small and thin and appearing bilobed in lateral view, in sub-adults the angulo-parietal lamella are seen as two small knobs; columellar lamella small. Some Missouri specimens (Crawford County) have a small upper-palatal lamella; parietal callus finely granulose. The bark snaggletooth has fewer lamellae than any other *Gastrocopta* species in Missouri. ***Surface:*** with fine but sparse growth lines. ***Color:*** grayish white, translucent; columella visible through the thin shell.

Fig. 34. *Gastrocopta corticaria*, unusual form with upper palatal lamella, length 2.7 mm, Crawford County.

REMARKS: The bark snaggletooth, as its common and species name implies, has been observed on tree trunks several feet above the ground (Pilsbry 1948). Our collecting in Missouri has not confirmed this observation; all of our specimens were found in leaf litter and soil samples. Habitat preference appears to be bluffs with wooded hillsides along mesic valleys; however, a few were found in mature upland forests and glades.

In Missouri, Pleistocene age fossils of this species were found in talus from Jefferson and St. Louis counties (Hubricht 1964a, Hubricht 1985).



DISTRIBUTION: *Gastrocopta corticaria* is found primarily in the eastern half of Missouri. It was found in all of the natural divisions of the state except the Mississippi Lowlands. Nationally it is found from Oklahoma north to Minnesota, east to Maine, and south to Florida.

TYPE LOCALITY: Philadelphia, Pa.

Subclade Orthurethra
> **Family Vertiginidae Fitzinger 1833**
>> Genus *Gastrocopta* Wollaston 1878
>>> Subgenus *Gastrocopta* s. str.

Angular and parietal lamella fused into a sinuous or bifid lamella; palatal lamellae not on callused ridge; basal lamella when present located in the base of aperture not in the subcolumellar position.

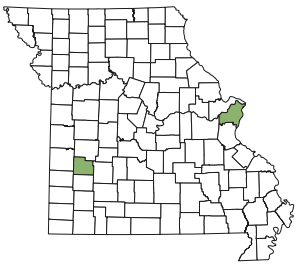
Gastrocopta cristata (Pilsbry & Vanatta 1900)

Crested Snaggletooth

Fig. 35. *Gastrocopta cristata*, length 2.5 mm, Cedar County.

DESCRIPTION: ***Shell:*** minute, length 2.5 to 2.8 mm, diameter about 1.2 mm, solid; shape elongate, middle whorls somewhat parallel-sided; whorls 5½, convex; suture deeply impressed; umbilicus rimate. ***Aperture:*** somewhat rectangular, oblique; peristome reflected, with a thin and fragile margin, thickened within, body whorl behind the lip with a shallow sulcus and a prominent white crest that parallels the lip margin; angulo-parietal lamella simple and undivided in frontal view; columellar lamella thin and horizontal; subcolumellar lamella small; basal and upper palatal lamellae small; lower palatal lamella deeply set and elongate, though shorter than in *Gastrocopta procera*. ***Surface:*** of first 1½ whorls smooth and finely granular, later whorls with fine growth lines. ***Color:*** light to medium brown with a red-gold luster; the first two whorls are much lighter.

REMARKS: Missouri specimens were found in grassy woodland along a xeric bluff top; some of these specimens were captured live. Most other known specimens are from river drift or fossils (Hubricht 1985).



DISTRIBUTION: New State Record. One of the rarest species in Missouri, *Gastrocopta cristata* is found in only two counties, one each in the Osage Plains and the Ozark Border natural divisions. It has been reported from Kansas to Texas west to Arizona, with disjunct populations in Maryland and Delaware. The latter populations appear to be introduced (Hubricht 1985: 10). Given the localities and habitats in Missouri, the western Missouri (Cedar County) record is likely to be a range extension for the natural distribution of the species, while the St. Louis City record may be an introduction.

TYPE LOCALITY: Cape Verde, Ariz.

Gastrocopta procera (Gould 1840)

Wing Snaggletooth

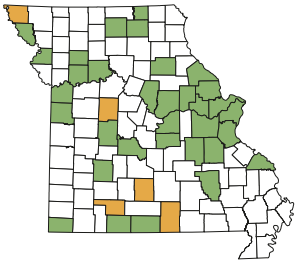
Fig. 36. *Gastrocopta procera*, length 2.7 mm, Pike County.

DESCRIPTION: ***Shell:*** minute, length 2.2 to 2.7 mm, diameter 1.0 to 1.1 mm, solid; shape elongate, slender; whorls about 6, strongly convex, suture deeply impressed; umbilicus elongate-oval. ***Aperture:*** rounded, truncate at the body whorl; peristome thickened within, body whorl behind lip with a narrow sulcus and raised crest parallel to lip; angulo-parietal lamella bifurcate, lobes joined in the middle, and appearing "crossed" or "X"-shaped in aperture view; columellar lamella relatively short; subcolumellar lamella small, and sometimes not visible in aperture view; basal lamella short, peg-like; lower palatal lamella elongate and deeply recessed; upper palatal lamella small and located opposite the angular spur of the angulo-parietal lamella. ***Surface:*** covered with fine granules and faint irregular growth lines. ***Color:*** cinnamon to brown, the first whorls lighter.

REMARKS: The wing snaggletooth is found in woodlands, prairies, river valleys, and glades. It also thrives in urban and suburban areas in lawns and gardens.

No other *Gastrocopta* known from Missouri has an angulo-parietal lamella appearing "crossed" or "X"-shaped in the manner of *G. procera*. It is a quick and easy clue to a correct identification. *G. sterkiana* is similar to *G. procera* in the form the angulo-parietal lamella, and has been reported from northwestern Arkansas; however, it has not yet been found in Missouri. See the description for *G. sterkiana* for characters distinguishing these species.

Fossils of *Gastrocopta procera* were found in Pleistocene age talus in Boone and St. Louis counties (Hubricht 1964a).



DISTRIBUTION: This species is relatively widespread in Missouri, and occurs in all natural divisions except the Mississippi Lowlands. It is widely distributed from Texas to South Dakota, east to Maryland, and south to Florida.

TYPE LOCALITY: Baltimore, Md.

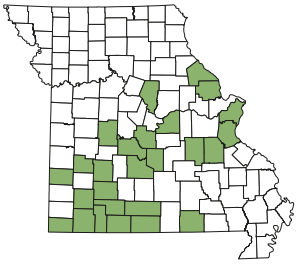
Gastrocopta rogersensis Nekola & Coles 2001

Midland Snaggletooth

Fig. 37. *Gastrocopta rogersensis*, length 2.1 mm, Barry County.

DESCRIPTION: ***Shell:*** minute, length about 2.3 mm, diameter about 1.0 mm, solid; shape elongate, slender; whorls 6, moderately convex, suture deeply impressed; umbilicus rimate. ***Aperture:*** squarish round; peristome reflected, thickened within; angulo-parietal lamella with lobes separated by a well defined groove, and not appearing "crossed" or "X"-shaped in aperture view, parietal portion of lamella very thick; columellar lamella thin and horizontal, subcolumellar lamella small, basal lamella small, lower palatal deeply recessed and elongate, upper palatal lamella small and located opposite the angular spur of the angulo-parietal lamella. In one lot from Barry County, Missouri, a small suprapalatal was present. ***Surface:*** of first 1½ whorls smooth and finely granulose, later whorls with fine growth lines. ***Color:*** cinnamon to brown, early whorls lighter.

REMARKS: This species is widespread in xeric glades and woodlands near bluffs and rock outcrops.



DISTRIBUTION: In Missouri *Gastrocopta rogersensis* is found in all the natural divisions of the state except the Mississippi Lowlands. In the Glaciated Plains Natural Division it is limited to limestone outcrops in the Lincoln Hills subdivision of Lincoln and Pike counties. Nationally it is known from Arkansas to Wisconsin.

TYPE LOCALITY: Fults Hill Prairie Nature Preserve, Monroe County, Ill.

Vertigo gouldii (A. Binney 1843)

Variable Vertigo

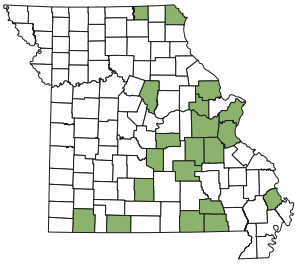
Fig. 38. *Vertigo gouldii*, length 1.9 mm, Warren County; unusual basal lamella appearing divided.

DESCRIPTION: ***Shell:*** micro, length 1.5 to 1.9 mm, diameter about 1.0 mm, solid; shape oval; whorls 4½ to 5½, convex, suture impressed; umbilicus rimate. ***Aperture:*** small, subtriangular, with outer lip slightly indented; peristome slightly reflected, with sharp crest behind outer lip; aperture with five lamellae (parietal and columellar lamellae; basal, lower and upper palatal lamellae); angular lamella absent; parietal lamella oriented toward the space between the two palatals; lower palatal lamella not more deeply placed than upper. ***Surface:*** with distinct axial ridges, less so on the body whorl; spiral striae poorly developed; outside of body whorl with white streaks over palatal lamellae, but not impressed. ***Color:*** light chestnut.

REMARKS: The variable vertigo closely resembles *Vertigo meramecensis* (see *V. meramecensis* Remarks, Page 52). Both species may be found in similar habitats, and often occur together. Their preferred habitat is mesic forests around limestone/dolomite outcrops or bluffs.

For many years, this species was poorly known in Missouri and was listed as a species of conservation concern. This appears to be a result of under-sampling rather than actual low population numbers. The variable vertigo is common and sometimes locally abundant in Missouri.

Missouri fossils of *Vertigo gouldii* were found in Pleistocene age talus in Jefferson and St. Louis counties (Hubricht 1964a, Hubricht 1985).



DISTRIBUTION: *Vertigo gouldii* occurs in all the natural divisions of Missouri, except the Osage Plains. Elsewhere, it occurs from Tennessee to Upper Michigan, and east to Maine. The western limit of this species is Missouri and eastern Iowa.

TYPE LOCALITY: unknown

Vertigo meramecensis Van Devender 1979

Bluff Vertigo

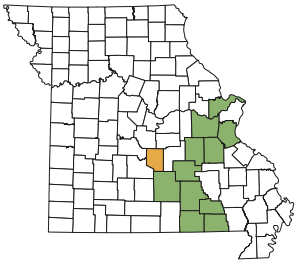
Fig. 39. *Vertigo meramecensis*, length 1.9 mm, Crawford County.

DESCRIPTION: ***Shell:*** micro, length 1.7 to 2.0 mm, diameter 1.0 to 1.2 mm, solid; shape oval; whorls 5, convex, suture deeply impressed; umbilicus compressed-oval. ***Aperture:*** sub-triangular; peristome only slightly indented opposite the upper palatal lamella; without distinct crest behind lip; aperture with four prominent lamellae (parietal, columellar, lower palatal, and upper palatal), and a small basal lamella; parietal and lower palatal lamellae are in line with each other. ***Surface:*** with very prominent axial ridges on the penultimate whorl and the whorl preceding it, ridges on body whorl less prominent; spiral striae indistinct; embryonic whorls smooth granular. ***Color:*** chestnut, sometimes dark.

REMARKS: The bluff vertigo, *Vertigo meramecensis*, was previously known from only two counties in Missouri, but is now known from an additional ten counties.

It lives on mesic wooded hillsides usually with significant limestone bluffs or rock outcrops along creeks and rivers.

Vertigo meramecensis is distinguished from *V. gouldii* by parietal lamella and lower palatal lamella in line with each other, by more prominent axial ridges and by its greater bulk. In addition, the aperture is larger, more rounded and more open.



DISTRIBUTION: *Vertigo meramecensis* has an interesting distribution in the state: it occurs from east central Missouri, in a contiguous line of counties, to the Arkansas border. Outside of Missouri this species is known only from a few counties in Iowa (Frest & Fay 1981: 34) and in Minnesota (MDNR 2006).

TYPE LOCALITY: wooded limestone bluffs above Huzzah Creek, Crawford County, Mo. (Van Devender 1979: 70)

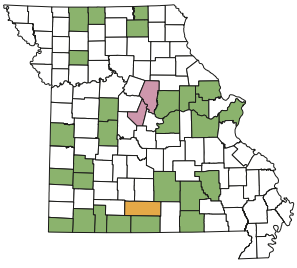
Vertigo milium (Gould 1840)

Blade Vertigo

Fig. 40. *Vertigo milium*, length 1.4 mm, Franklin County.

DESCRIPTION: ***Shell:*** micro, length 1.4 to 1.9 mm, diameter 0.8–1.0 mm, solid; shape oval; whorls 4½ to 5, convex, suture impressed; umbilicus rimate. ***Aperture:*** moderately large, somewhat triangular; peristome reflected, sharply indented at upper palatal lamella, body whorl with a deep sulcus behind the lip, and a low crest; parietal and angular lamellae distinct; columellar lamella large; basal lamella small; lower palatal lamella very long and curved, extending behind parietal and columellar lamellae; upper palatal lamella thin and tall, directed between the parietal and angular lamellae; parietal callus thin, transparent, difficult to see. ***Surface:*** with weak axial lines. ***Color:*** brown to cinnamon, translucent.

REMARKS: The blade vertigo is found in a wide variety of habitats, including prairies, fens, glades, xeric to mesic forests, and bluffs along river corridors. The blade vertigo is easily recognized by the pair of lamellae on the parietal wall and by the long, ribbon-like lower palatal lamella. Missouri fossil shells of *Vertigo milium* were found in Pleistocene age talus in Boone, Moniteau, and St. Louis counties (Hubricht 1964a).



DISTRIBUTION: *Vertigo milium* is widespread in Missouri and occurs in all but the Mississippi Lowlands Natural Division. Elsewhere in the eastern United States, it is widespread but scattered. It is found from Texas to South Dakota, east to Massachusetts, and south to Florida and the Gulf states.

TYPE LOCALITY: Oak Island, Chelsea, near Boston.

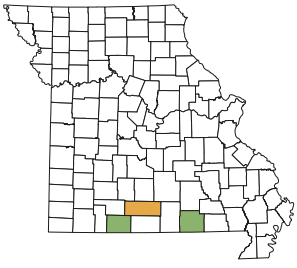
Vertigo oscariana Sterki 1890

Capital Vertigo

Fig. 41. *Vertigo oscariana*, with unusual extra lamella (upper palatal), length 1.65 mm, Oregon County.

DESCRIPTION: ***Shell:*** micro, length 1.4 to 1.7 mm, diameter about 0.8 mm, moderately solid; shape oval; whorls 4½ to 5, suture moderately impressed; umbilicus oval. ***Aperture:*** small, subtriangular; peristome thin, not reflected, without distinct crest behind lip; aperture with three or rarely four lamellae; parietal lamella small and thin; columellar lamella thick and blunt; lower palatal lamella recessed; upper palatal lamella usually small or absent; parietal callus slightly convex, granulose. ***Surface:*** with faint growth lines. ***Color:*** pale cinnamon, with lighter apical whorls; shell translucent, columella visible through the shell.

REMARKS: *Vertigo oscariana* is a rare species in Missouri. Hubricht (1985) states that it may be found in leaf litter and talus in mesic woods.



DISTRIBUTION: Historically *Vertigo oscariana* was known in Missouri only from Douglas County. In this study it was found in nearby Oregon and Taney counties. These counties are within the Ozark Natural Division. Elsewhere, this species ranges from Texas east to Maryland, and south to Florida. Southern Missouri is the northernmost locality for this species west of the Mississippi River.

TYPE LOCALITY: Mosquito Island, Volusia County, Fla.

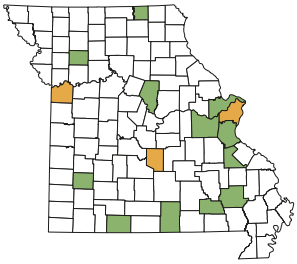
Vertigo ovata Say 1822

Ovate Vertigo

Fig. 42. *Vertigo ovata*, length 2.0 mm, Wayne County.

DESCRIPTION: ***Shell:*** micro to minute, length 1.9 to 2.3 mm, diameter about 1.4 mm, solid; shape broadly oval; whorls 4½ to 5, suture impressed; umbilicus oval. ***Aperture:*** large, subtriangular; peristome thin, bent inward along the outer margin, body whorl in mature shells with a sulcus and crest behind lip; parietal lamella large; angular lamella small; infraparietal lamella sometimes present; columellar lamella strong; upper and lower palatal lamellae large, the latter positioned on a tinted callus ridge; basal lamella small, thin, and placed in the subcolumellar position; small infrapalatal and interpalatal lamellae sometimes present; parietal callus slightly convex, very thin, granulose, sometimes shining. ***Surface:*** with faint growth lines, except the first 1½ whorls, which are smooth and granular. ***Color:*** dark brown, apex a little lighter, semitransparent.

REMARKS: The ovate vertigo prefers mesic shaded forested slopes near streams and wet pond margins. It also thrives in drift material along big rivers.



DISTRIBUTION: *Vertigo ovata* occurs in all natural divisions of the state except the Glaciated Plains and the Mississippi Lowlands. It occurs from Texas to North Dakota, and in most of the states to the east.

TYPE LOCALITY: Philadelphia, Pa.

Vertigo pygmaea (Draparnaud 1801

Crested Vertigo

Fig. 43. *Vertigo pygmaea*, length 2.0 mm, St. Louis County.

DESCRIPTION: ***Shell:*** micro, length 1.8 to 2.0 mm, diameter about 1 mm, solid; shape broadly oval; whorls 5, uniformly convex, suture moderately impressed; umbilicus compressed-oval. ***Aperture:*** somewhat triangular; peristome slightly reflected; palatal side only slightly indented; crest behind lip prominent, pale-colored; aperture with four prominent lamellae; angular lamella absent; parietal and columellar lamellae present; upper and lower palatal lamellae bold, lower palatal longer, outer edges of palatal lamellae resting on a low callus; parietal lamella points to the space between the palatals; basal lamella small; interpalatal and suprapalatal lamellae sometimes present; parietal callus with leading edge straight between the lip insertions. ***Surface:*** with first 1½ whorls smooth, granulose, later whorls with fine growth lines. ***Color:*** dark cinnamon, semitransparent, glossy, first 1½ whorls light then darkening progressively; peristome color same as shell.

REMARKS: The only records in Missouri are from suburban lawn and garden habitat, and it is known elsewhere from culverts and low grassy areas.

DISTRIBUTION: New State Record. To date, *Vertigo pygmaea* has been found in Missouri only in St. Louis County, Ozark Border Natural Division. It occurs elsewhere from Indiana to Massachusetts, south to Virginia.

TYPE LOCALITY: France

Vertigo tridentata Wolf 1870

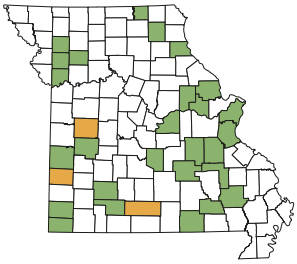
Honey Vertigo

Fig. 44. *Vertigo tridentata*, length 2.0 mm, Oregon County.

DESCRIPTION: ***Shell:*** micro to minute to very small, length 1.8 to 2.3 mm, diameter about 1.1 mm, solid; shape oval; whorls about 5, convex, suture moderately impressed; umbilicus oval. ***Aperture:*** sub-triangular; peristome very slightly reflected, with shallow indentation along outer margin, crest behind lip shallow to indistinct, sometimes visible as just a pale band; aperture with three prominent lamellae (parietal and columellar lamellae, lower palatal lamella) and small upper palatal lamella usually present; angular lamella and basal lamella absent. ***Surface:*** smooth, glossy; axial lines moderate to poorly developed. ***Color:*** light yellowish brown, sometimes pale near the apex; translucent.

REMARKS: The honey vertigo is often found on green plants above ground level, including mint plants. Mr. Wolf stated "I collected 12,000 from standing weeds and not one from the ground" (Pilsbry 1948: 966). In Missouri, this species is commonly collected by sweeping nettles and other low vegetation in moist woodlands with an insect sweep net.

Missouri fossils of this species were found in Pleistocene age talus from St. Louis County, Missouri (Hubricht 1964a).



DISTRIBUTION: Spotty in distribution, *Vertigo tridentata* is found in all the natural divisions in Missouri except the Mississippi Lowlands. It ranges from Texas to Iowa, and east to Massachusetts.

TYPE LOCALITY: Canton, Ill.

Columella simplex (Gould 1841)

Toothless Column

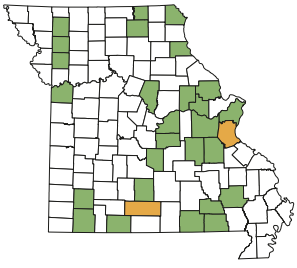
DESCRIPTION: ***Shell:*** minute, length 2 to 2.5 mm, diameter about 1.3 mm, moderately solid; shape elongate-oval, or in some shells with middle 2 whorls nearly equal in diameter, apex broadly rounded; whorls 5½ to 6½, convex, suture strongly impressed; umbilicus small, circular to oval. ***Aperture:*** squarish to rounded, truncated at body whorl; peristome thin, not reflected; aperture without lamellae; parietal callus thin, set back from outer lip, nearly straight to the columellar lip, granulose. ***Surface:*** of embryonic whorl granulose; later whorls with fine irregular growth lines or wrinkles. ***Color:*** pale cinnamon, apical whorls lighter.

Fig. 45. *Columella simplex*, left: length 2.4 mm, Warren County; right: length 2.5 mm, Washington County.

REMARKS: The toothless column is primarily a creature of mesic hardwood forests and river valleys, but occasionally occurs in fens, prairies and urban areas.

A few Missouri specimens from Washington and Carter counties are unusually elongate and parallel-sided (Fig. 45 right). These resemble *Columella columella alticola*, fossils that have been found in Missouri and other midwestern and eastern states (Kansas, Nebraska, Mississippi, Indiana, Kentucky, and Ohio). However, living *C. columella alticola* are western, ranging from southwestern Texas, New Mexico, and Arizona north to southern Canada. It seems unlikely the elongate, parallel-sided form from Missouri is *C. columella alticola*. Also, Hubricht postulated that *C. simplex* might be a complex of two or three species (Hubricht 1985). Identification of the elongate, parallel-sided form found in Missouri is uncertain; we are treating it here as a variation of *C. simplex*.

Fossils of *Columella simplex* have been found in Pleistocene age talus deposits from St. Louis County (Hubricht 1964a).



DISTRIBUTION: In this study, *Columella simplex* was found in the Glaciated Plains, Ozark Border, and Ozark natural divisions of the state. The elongate, parallel-sided form (Fig. 45, right) was found in Washington and Carter counties. It ranges from northeastern Oklahoma to upper Michigan, east to Maine, and south to Alabama.

TYPE LOCALITY: France

Fossil record: Fossils of *Vallonia* are known from the Paleocene, Eocene, Miocene, and Pliocene of Europe and Pleistocene age of Europe and America. "It is an old group, which was apparently evolved in Mesozoic time, and has changed very little since the Eocene" (Pilsbry 1948: 1021). Other fossil records for individual species are given in the species accounts that follow.

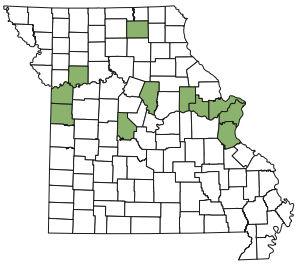
Vallonia excentrica Sterki 1893

Iroquois Vallonia

Fig. 46. *Vallonia excentrica*, diameter 2.4 mm, St. Louis County.

DESCRIPTION: ***Shell:*** minute, diameter about 2.3 mm, height about 1.1 mm, solid; shape depressed; whorls 3 to 3½, convex, suture rather deep; umbilicus contained about four times in diameter of shell. ***Aperture:*** rounded-oval, peristome thickened within, not reflected at the periphery, however basal portion is slightly reflected; aperture without lamellae; parietal callus slightly concave along outer edge, thin, translucent. ***Surface:*** smooth, without ribs, but with fine irregular growth lines, more pronounced within the umbilicus; embryonic whorl smooth. ***Color:*** pale corneous to grayish white, translucent.

REMARKS: *Vallonia excentrica* resembles *V. pulchella* in shape, surface texture and color, but is distinguished by the straight apertural lip at the periphery. It is found in grassy areas, meadows, lawns, and roadsides.



DISTRIBUTION: *Vallonia excentrica* is known in Missouri from the northern half of the state. It was found in the Glaciated Plains, Osage Plains, Ozark, and Ozark Border natural divisions. Elsewhere, it occurs south to Georgia, and north to Wisconsin and Maine.

TYPE LOCALITY: Staten Island, N.Y.

Vallonia gracilicosta Reinhardt 1883

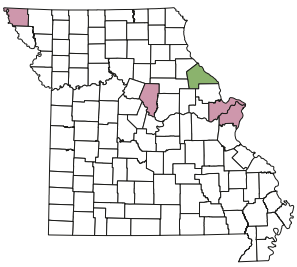
Multirib Vallonia

DESCRIPTION: ***Shell:*** minute, diameter 2.3 to 2.9 mm, height about 1.0 mm, solid; shape strongly depressed; whorls 3½ to 3¾, convex, suture deeply impressed, whorls convex; umbilicus widely open, contained about 3¼ times in diameter. ***Aperture:*** nearly round, discontinuous at body whorl; peristome reflected, thickened within; aperture without lamellae; parietal callus is slightly concave, clear and thin to moderately thick. ***Surface:*** of the embryonic whorl smooth and shining, later whorls with moderate-sized axial ribs and smaller irregular lines in between; body whorl with 45 to 55 ribs. ***Color:*** grayish white, translucent; lip similarly colored.

REMARKS: The multirib vallonia was found at a limestone bluff with associated glade habitat along Peno Creek.

Missouri fossils of *Vallonia gracilicosta* were found in Pleistocene age deposits of loess and talus in Atchison, Boone, St. Charles, and St. Louis counties (Hubricht 1964a).

Fig. 47. *Vallonia gracilicosta*, diameter 2.3 mm, Pike County.



DISTRIBUTION: New State Record. So far we have found *Vallonia gracilicosta* in only one county in the state (Pike County), in the Glaciated Plains Natural Division (Lincoln Hills Subdivision). In other eastern states, it is also rare, being reported in one county each in Oklahoma, Iowa, Minnesota, New York, Massachusetts, and Maine and in several counties in both of the Dakotas. The number of counties where it has been found as fossils greatly exceeds the counties where it still lives. It was previously known in Missouri only from fossils.

TYPE LOCALITY: Medora, Billings County, N.D.

Vallonia parvula Sterki 1893

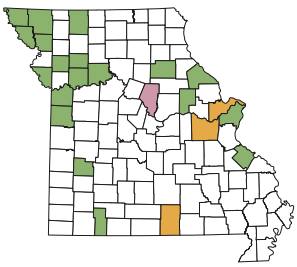
Trumpet Vallonia

DESCRIPTION: ***Shell:*** micro to minute, diameter 1.6 to 2.1 mm, height about 0.8 mm, solid; shape strongly depressed; whorls about 3¼, convex, suture deeply impressed, body whorl expanded and descending at the aperture; umbilicus widely open, contained about three times within diameter. ***Aperture:*** nearly circular, interrupted at body whorl; peristome slightly reflected, thickened within; aperture without lamellae; parietal callus transparent. ***Surface:*** of embryonic whorls smooth, later whorls with prominent axial ribs and smaller irregular lines in between; body whorl with about 30 to 38 ribs. ***Color:*** grayish white, translucent; peristome similarly colored.

REMARKS: The trumpet vallonia is known in Missouri from a small number of sites; still, it occurs in a variety of habitats including upland woodland, glade, and prairie.

In Missouri, fossils of *Vallonia parvula* have been found in Pleistocene age talus from Boone, Franklin, St. Charles, and St. Louis counties (Hubricht, 1964a).

Fig. 48. *Vallonia parvula*, diameter 1.9 mm; Pike County.



DISTRIBUTION: The majority of these snails were found in the Glaciated Plains, with a few in the Ozark Border, Osage Plains, and Ozark natural divisions. It is found from Texas to South Dakota, east to New York, and south to Virginia.

TYPE LOCALITY: Joliet, Ill.

Vallonia perspectiva Sterki 1893

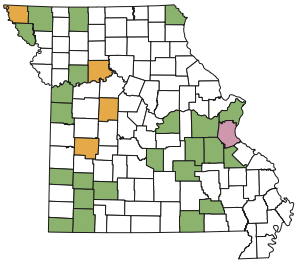
Thin-lip Vallonia

Fig. 49. *Vallonia perspectiva*, diameter 2.1 mm, Washington County.

DESCRIPTION: ***Shell:*** micro to minute, diameter about 2.0 mm, height about 0.7 mm, somewhat fragile; shape strongly depressed; whorls 3¼, descending towards aperture; suture deep; umbilicus widely open, contained less than three times within diameter. ***Aperture:*** rounded, continuous at body whorl; peristome reflected, thin; aperture without lamellae; parietal callus translucent. This is the only Missouri species of Vallonia with the peristome continuous and free from the body whorl, although some specimens, possibly immature, have the peristome reflected yet very closely attached to the body whorl and slightly discontinuous. ***Surface:*** of embryonic whorls smooth, finely granulose; later whorls with prominent axial ribs, and fine irregular growth lines in between; body whorl with about 35 ribs. ***Color:*** grayish white, translucent.

REMARKS: This snail occurs in mesic woodland bluffs along river corridors, as well as upland woodland, glade, prairie, and urban habitats.

Missouri fossil shells of *Vallonia perspectiva* have been reported from Jefferson County (Hubricht 1985).



DISTRIBUTION: *Vallonia perspectiva* is present in all the natural divisions of Missouri, except the Mississippi Lowlands, although its distribution is quite patchy. It is reported from Texas and Arkansas north to North Dakota and Minnesota; it is absent from most of the northeastern and southeastern states, but occurs in a narrow band of localities from Alabama and Kentucky east to Delaware.

TYPE LOCALITY: Woodville, Jackson County, Ala.

Vallonia pulchella (Müller 1774)

Lovely Vallonia

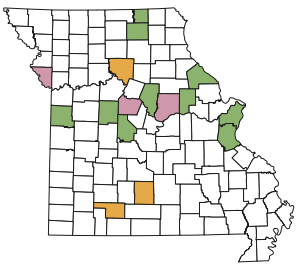
Fig. 50. *Vallonia pulchella*, diameter 2.3 mm, Montgomery County.

DESCRIPTION: ***Shell:*** minute, diameter 2.0–2.5 mm, height about 1.2 mm, solid; shape depressed; whorls 3 to 3½, whorls convex, suture rather deep; umbilicus relatively narrow, contained about four times in the diameter. ***Aperture:*** rounded, interrupted at the body whorl; peristome thickened within, reflected at the periphery; aperture without lamellae; parietal callus slightly concave along outer edge, thin translucent. ***Surface:*** smooth, without ribs, but with fine irregular growth lines, more pronounced within the umbilicus, embryonic whorl smooth. ***Color:*** pale corneous to grayish white, translucent.

REMARKS: We found this snail in urban areas as well as in woodlands, glades, prairies, and bluffs along river corridors.

Missouri fossil shells of *Vallonia pulchella* were found in Pleistocene age deposits in Boone, Callaway, Cooper, and Platte counties (Swallow 1855, Hambach 1890, Greger 1933).

Fig. 51. *Vallonia pulchella* on a penny.



DISTRIBUTION: In Missouri, *Vallonia pulchella* is found in the Glaciated Plains, Osage Plains, Ozark, and Ozark Border natural divisions. Nationally it is reported from Texas to Minnesota, east to Maine, south to Kentucky and North Carolina.

TYPE LOCALITY: Denmark

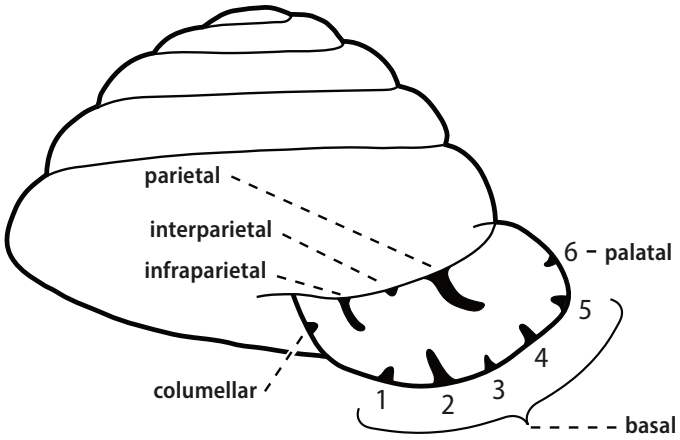


Fig. 52. Terminology of lamellae for *Strobilops*. These structures are found in the last whorl of the shell. Most of them do not extend to the aperture; basal lamellae are visible through the bottom of the shell.

Fig. 53. Basal lamellae of *Strobilops affinis* (above left), *S. aeneus* (above right), *S. labyrinthicus* (lower left) and *S. texasianus* (lower right).

Strobilops aeneus Pilsbry 1926

Bronze Pinecone

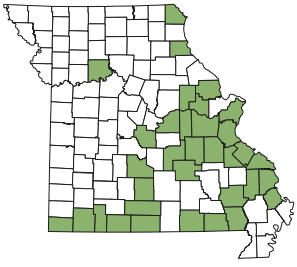
DESCRIPTION: ***Shell:*** minute, diameter 2.4 to 2.8 mm, height 1.5 to 2.0 mm, solid; shape globose to low conic, base somewhat flattened below the periphery; whorls 5.5, convex, periphery bluntly angular, suture deeply impressed; umbilicus narrow, contained about 6½ times in the diameter. ***Aperture:*** flattened-oval, semi-lunate; peristome slightly reflected, thickened within; parietal lamella large, emerging to the leading edge of the parietal callus; infraparietal lamella weakly emerging, placed about midway between parietal lamella and columella; interparietal lamella low, deeply placed, usually not visible in aperture view; lamellae with minute, prickly nodes deep within; base of shell with 3–4 basal lamellae, not visible from the aperture, but often visible through the shell (Fig. 53, Page 64); first basal lamella short, second and fourth long, third short or absent, lamellae not arranged in oblique axial series; columellar lamella not visible from the aperture or through the base; parietal callus nearly straight, terminal edge sometimes thickened, transparent. ***Surface:*** of embryonic whorls smooth, others with evenly spaced and prominent axial ridges, base smooth in front of the aperture and distinctly ridged behind; smooth portion of the base with fine, barely visible spiral striae. ***Color:*** dark brown with a reddish golden luster.

Fig. 54. *Strobilops aeneus*, diameter 2.5 mm, St. Louis County.

REMARKS: The bronze pinecone's preferred habitat is on rotten logs, under bark and in leaf litter in moist woodlands.

This species is similar to other members of *Strobilops*, but differs by the low conic shape of the shell, and basal lamellae as seen through the base of the shell (Fig. 53, Page 64).

Missouri fossils of the *Strobilops aeneus* were found in Pleistocene age talus from St. Louis County, Missouri (Hubricht 1964a).



DISTRIBUTION: *Strobilops aeneus* is widely distributed in southern and eastern Missouri. It is found in all of the natural divisions except the Osage Plains. This species is known elsewhere from Texas to Iowa, east to Massachusetts, and south to Florida.

TYPE LOCALITY: Cazenovia, N.Y.

Strobilops affinis Pilsbry 1893

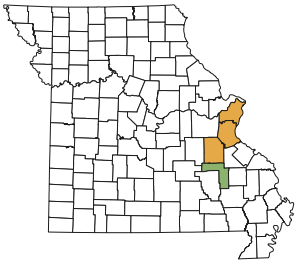
Eightfold Pinecone

DESCRIPTION: ***Shell:*** minute, diameter about 2.75 mm, height about 2.5 mm, solid; shape globose, taller and more conic than *Strobilops labyrinthicus*, base moderately convex; whorls 6, moderately convex, suture deep; umbilicus narrow, contained seven to eight times in diameter of shell. ***Aperture:*** somewhat rectangular, oblique; peristome slightly reflected, thickened within; parietal lamella emerges to edge of the parietal callus; infraparietal and interparietal lamellae low and weak, not visible in aperture view; columellar lamella short and low, not visible in aperture view or through the base of the shell; basal lamellae nearly equal in length and arranged in oblique axial series, the first four to five are visible through the base of the shell, others continue on outer wall to the suture (Fig. 53, Page 64). ***Surface:*** of embryonic whorls smooth, the remainder with prominent axial ridges, first half of base smooth; spiral striae not evident; parietal callus relatively thick, transparent. ***Color:*** light tan, with pale apex; translucent.

REMARKS: This species is larger and relatively taller than the other Strobilops species occurring in Missouri, and it is easily recognized by the large number of short basal lamellae arranged in an oblique row and extending around the periphery to the suture.

The eightfold pinecone is found in the same habitat as *Strobilops labyrinthicus*.

Fig. 55. *Strobilops affinis*, diameter 2.75 mm, Iron County.



DISTRIBUTION: *Strobilops affinis* is a rare species in Missouri, and was found only in Iron County, within the Ozark Natural Division. Elsewhere in eastern United States, it ranges north to Minnesota, and east to Rhode Island.

TYPE LOCALITY: Upper Red Hook, Dutchess County, N.Y.

Strobilops labyrinthicus (Say 1817)

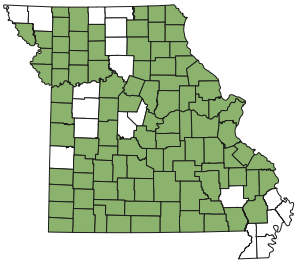
Maze Pinecone

Fig. 56. *Strobilops labyrinthicus*, diameter 2.3 mm, Pike County.

DESCRIPTION: ***Shell:*** minute, diameter 2.3 to 2.5 mm, height about 1.8 mm, solid; shape globose, periphery rounded; whorls 5½, convex, suture deep; umbilicus small, contained seven to nine times in diameter. ***Aperture:*** somewhat rectangular, semi-lunate; peristome slightly reflected, thickened within; parietal lamella emerges to edge of parietal callus, infraparietal recessed, but usually visible in basal view; interparietal lamella is deep within and not visible in aperture view; lamellae armed with nodes of minute prickles, deep within aperture; columellar lamella deeply recessed, not visible in apertural or in basal view; first and second basal lamellae elongate, next two shorter (Fig. 53, Page 64), lamellae at and above periphery longer, lamella near suture shorter; parietal callus nearly straight, often slightly convex between the parietal lamella and the umbilicus, moderately thick, granulose, translucent. ***Surface:*** of embryonic whorls smooth, later whorls with oblique axial ridges, first half of base with ridges somewhat reduced, but not smooth; spiral striae indistinct. ***Color:*** light tan, with first two whorls pale. ***Animal:*** "The back, eye-stalks and tentacles are blackish gray, darker streaks running from the collar to the eyestalks; sides of foot and the tail are clear whitish gray" (Pilsbry 1948: 855.)

REMARKS: The maze pinecone is found in a variety of habitats, including xeric to mesic woodlands, glades, bluffs along river corridors, and urban lawns and gardens.

In Missouri, fossils of *Strobilops labyrinthicus* were found in Pleistocene age talus from Boone, Callaway, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht, 1964a).



DISTRIBUTION: This widespread species has been found in all of the natural divisions of the state. In eastern United States, it occurs from Texas to South Dakota, and in almost all eastern states except Florida.

TYPE LOCALITY: Philadelphia, Pa.

Rabdotus dealbatus (Say 1821)

Whitewashed Rabdotus

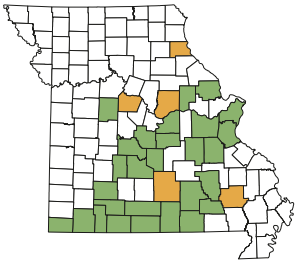
Fig. 57. *Rabdotus dealbatus*, length 18 mm; St. Louis County.

DESCRIPTION: ***Shell:*** medium, length 17 to 19 mm, diameter 10.5 to 12.6 mm, solid; shape elongate, spire conic; whorls 6 to 7, convex, suture deeply impressed; umbilicus small, partially obscured by reflected lip. ***Aperture:*** oval; peristome thin, reflected at columellar margin, otherwise simple; aperture without lamellae; parietal callus thin and translucent, outer edge nearly straight, surface granulose and shining. ***Surface:*** of embryonic whorl smooth, granulose; second whorl with coarse, regularly spaced axial ridges; later whorls with axial ridges more widely and irregularly spaced. ***Color:*** brownish gray, streaked and mottled with opaque white.

REMARKS: *Rabdotus dealbatus* is an obligate glade species in Missouri. Rarely, dead shells are found in nearby woods, but the species seems to require glade habitat to survive in Missouri. This is an indicator species for high quality glades.

This species burrows in the soil, even during the warm season. Adults are often found a few inches below the surface. One of the authors (CB) once observed several individuals excavating flask-shaped nest cavities in soil, in which egg clusters were laid. The foot of the animal acted like a conveyor belt to drag soil from the nest cavity.

In Missouri, fossil shells of *Rabdotus dealbatus* were found in Pleistocene age talus in St. Louis County (Greger 1933, Hubricht, 1964a).



DISTRIBUTION: *Rabdotus dealbatus* was found in three of the natural divisions in Missouri, the Ozark Border, Ozark, and Glaciated Plains. It occurs from New Mexico northeast to Missouri, Illinois, and southeast to Alabama.

TYPE LOCALITY: Alabama and Missouri.

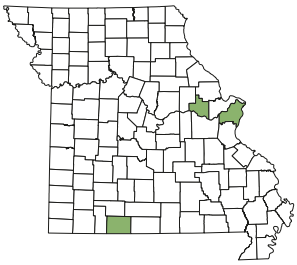
Opeas pyrgula Schmacker and Boettger 1891

Sharp Awlsnail

DESCRIPTION: ***Shell:*** small, length 7 to 8 mm, diameter about 2.2 mm, solid; shape elongate, very slender, evenly tapered from base to apex; whorls 7, convex, suture deep; umbilicus rounded, partially obscured by leading edge of lip. ***Aperture:*** narrowly oval; peristome thin, without lamellae; parietal callus thin and transparent, leading edge convex, surface finely granulose. ***Surface:*** somewhat dulled by fine microsculpture; axial growth lines nearly straight, forming crenulations along suture; spiral striae very fine. ***Color:*** yellowish white, transparent in immature shells, adults somewhat opaque. ***Animal:*** yellowish amber; tentacles lighter, eyes small and gray.

REMARKS: In Missouri this snail was found in glade and other grassy habitats, and inside fallen bamboo stalks at the Missouri Botanical Garden.

Fig. 58. *Opeas pyrgula*, length 7.5 mm, St. Louis City.



DISTRIBUTION: New State Record. *Opeas pyrgula* is found in St. Louis City and Warren and Taney counties. This is an introduced species, and occurs from Texas east to Maryland and south to Florida.

TYPE LOCALITY: Kobe, Japan

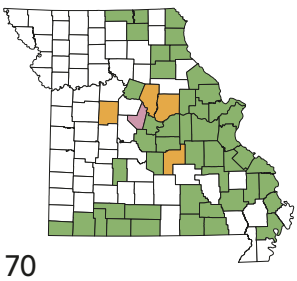
Haplotrema concavum (Say 1821)

Gray-foot Lancetooth

Fig. 59. *Haplotrema concavum*, diameter 19.5 mm, Washington County.

DESCRIPTION: ***Shell:*** medium to large, diameter 11.0 to 21 mm, height 5.3 to 9.5 mm, solid; shape strongly depressed; whorls about 5, convex, suture moderately impressed; umbilicus wide, contained about three times within diameter of shell. ***Aperture:*** obliquely oval, lunate, flattened above; peristome narrowly reflected on basal and outer margins, upper margin depressed; parietal callus thick and opaque, outer margin convex, surface coarsely granular. ***Surface:*** of embryonic whorls smooth and granulose; later whorls with fine irregularly spaced growth lines and usually with minute spiral striae. ***Color:*** light greenish yellow, lip margin usually brownish and leathery in adult shells that have stopped growing. ***Animal:*** gray raised blocks on back; sides lighter gray; tentacles gray; sole cream colored.

REMARKS: The gray-foot lancetooth lives primarily in wooded areas, and is found under leaves, in talus below bluffs, and occasionally on glades. This species is carnivorous and preys on other snails. It feeds on prey species by rasping a hole through the shell wall to consume the snail body within. It does not enter the prey shell through the aperture. *Haplotrema concavum* is also a vector in transmitting disease to white-tailed deer. The parasite in this saga is the brainworm nematode, *Parelaphostrongylus tenuis*. Adult worms inhabit the blood and tissues around the deer's brain. Eggs laid by adult worms travel in the blood to the lungs where they hatch into larvae. The larvae make their way up the deer's trachea where they are swallowed and eventually pass out of the deer in its feces. The larvae are sometimes eaten accidentally by a snail or a slug (several species are hosts) as they feed on plant material in the deer feces. If a gray-foot lancetooth eats the infected snail or slug, the parasite larvae grow inside the lancetooth, without seeming to harm the snail. If a deer ingests the snail while browsing, the life cycle of the worm will be complete. Parasitism by the nematode seems to have little or no negative consequences for any of the intermediate hosts. Other gastropod hosts are *Anguispira alternata, Arion circumscriptus, Euchemotrema fraternum Deroceras laeve, D. reticulatum, Discus whitneyi, Mesodon thyroidus, Neohelix alleni, Philomycus carolinianus, Triodopsis notata, Zonitoides arboreus* and *Z. nitidus* (Maze and Johnstone 1986; Platt 1989; Rowley et al. 1987). Missouri fossils of Haplotrema concavum were found in Pleistocene age loess, talus, and silt deposits in Boone, Callaway, Franklin, Jefferson, Moniteau, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Haplotrema concavum* was found in all of the natural divisions of the state, except the Osage Plains. It is most common in the eastern half of the state and along the southern border. Elsewhere, it occurs from Texas to Iowa, and most states eastward.

TYPE LOCALITY: Illinois and Missouri.

Punctum minutissimum (I. Lea 1841)

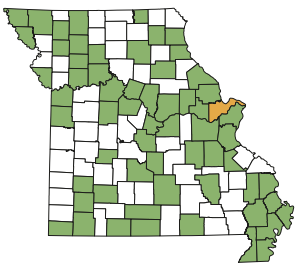
Small Spot

DESCRIPTION: ***Shell:*** micro, diameter 1.1 to 1.5 mm, height 0.7 to 0.9 mm, moderately solid; shape depressed; whorls 3½ to 4 ½, convex, last rounded, suture deeply impressed; umbilicus wide open, contained about 3.5 times in diameter. ***Aperture:*** rounded, lunate; peristome thin; aperture without lamellae; parietal callus thin and transparent to indistinct, where visible straight from outer lip to columella. ***Surface:*** with major riblets fine and closely spaced, spaces between riblets with 1–3 minor ridges, which are lightly crossed by spiral striae, not forming distinct microscopic squares. ***Color:*** light brown, with a bronze cast, translucent.

REMARKS: The small spot is found in mesic environments, in leaf litter, and soil.

Missouri fossils of *Punctum minutissimum* were found in Pleistocene age loess and talus from St. Louis County (Hubricht, 1964a).

Fig. 60. *Punctum minutissimum*, diameter 1.05 mm; Franklin County; upper: dorsal, ventral, lateral views; lower: ventral view of microsculpture.



DISTRIBUTION: *Punctum minutissimum* is widespread in Missouri and occurs in all of the natural divisions. Elsewhere, it ranges from Texas to South Dakota, east to New Hampshire, and south to Florida.

TYPE LOCALITY: vicinity of Cincinnati, Ohio

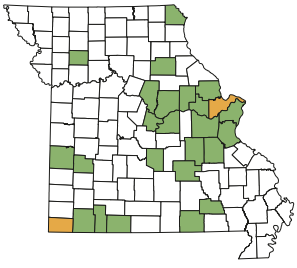
Punctum vitreum H. B. Baker 1930

Glass Spot

DESCRIPTION: ***Shell:*** micro, diameter 1.2 to 1.4 mm, height 0.8 to 0.9 mm, moderately solid, shape depressed; whorls to 4¼, convex, last rounded, suture deeply impressed; umbilicus wide open, contained about 3.4 times in diameter. ***Aperture:*** rounded, lunate; peristome thin; aperture without lamellae; parietal callus slightly convex along outer edge, thin, transparent, not visible in some specimens. ***Surface:*** with major riblets high and widely spaced; spaces between riblets with three to seven minor ridges, which are crossed by spiral striae forming distinct microscopic squares.
Color: light reddish brown with a bronze cast, vitreous, and almost transparent.

REMARKS: The glass spot and the small spot are easily distinguished from each other by differences in microsculpture (Figs. 60 lower, and 61 lower). The glass spot is found in mesic woodlands soil, under rocks, and leaf litter.

Fig. 61. *Punctum vitreum*, diameter 1.3 mm, Lincoln County; upper: dorsal, ventral and lateral views; lower: ventral view of microsculpture.



DISTRIBUTION: *Punctum vitreum* occurs in all of the natural divisions in Missouri, except for the Mississippi Lowlands. It is also known from Texas and Louisiana north to Iowa, and east to Pennsylvania.

TYPE LOCALITY: Pleasure Gardens of New Braunfels, Texas

Anguispira alternata (Say 1816)

Flamed Tigersnail

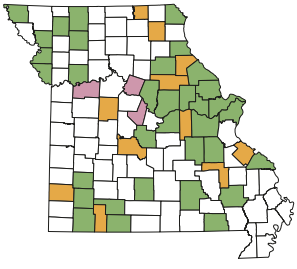
Fig. 62. *Anguispira alternata*, diameter 21 mm, Lincoln County.

DESCRIPTION: ***Shell:*** medium to large, diameter 15 to 23 mm, height 10.5 to 13 mm, moderately solid; shape depressed; whorls 4½ to 6½, convex, last whorl rounded, suture moderately impressed; umbilicus large, contained four to five times in shell diameter. ***Aperture:*** oval, lunate; peristome thin, not reflected; aperture without lamellae; parietal callus straight along outer edge, or with minor irregularities, thin, transparent, flames from whorl below show through clearly. ***Surface:*** dull, embryonic whorls with cross-hatched ridges, later whorls with regularly spaced axial ridges, (about five within 2 mm near the aperture) less coarse and more narrowly spaced than *Anguispira strongylodes*; spiral striae faint to indistinct. ***Color:*** light yellowish brown or greenish brown with rows of reddish brown blotches or flames, base with fewer and smaller markings; body whorl with three to four bands of flames. Rarely, markings are absent or nearly absent. ***Animal:*** upper surface of foot dull scarlet, becoming dusky on the back, tentacles slate gray; mantle margin bright red; sole light blue, becoming purplish toward the tail; mucus saffron-colored.

REMARKS: The flamed tigersnail occurs in a variety of habitats, including woodland soil and leaf litter, glades, and bluffs along river corridors. This species is sometimes abundant in granular loamy soil, and in or around rotten logs.

Mortality among populations of *Anguispira alternata* appears to be primarily predation by small mammals, such as mice, shrews, and chipmunks (Ewell & Ulmer 1971). The umbilicus of *A. alternata* has been found to harbor nematodes, mites, insects, small earthworms, rotifers, protozoans, and other snails, and the mantle cavity sometimes contained nematodes and protozoans. Anguispira alternata is also implicated as a host for the brainworm nematode *Parelaphostrongylus tenuis*, a parasite of deer and other ungulates (see *Haplotrema concavum* Remarks, Page 70). Like *Webbhelix multilineata, Allogona profunda, Novisuccinea ovalis* and probably others, *Anguispira alternata* climbs trees to escape floodwater. Ewell and Ulmer (1971) marked 23 snails on live trees and found that the snails estivated on the trees as conditions became dry and then proceeded upwards when the tree surface became wet again. Several snails moved out to the tips of twigs, where they estivated for days.

Fossils of this species are known in Missouri from Pleistocene age loess, talus, and silt deposits from Atchison, Boone, Callaway, Franklin, Howard, Lafayette, Moniteau, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Anguispira alternata* is widely scattered in the state, and is found in each of the natural divisions except the Osage Plains and Mississippi Lowlands. This is a northeastern species, extending from Oklahoma to South Dakota and eastward.

TYPE LOCALITY: "The area around Philadelphia has been selected as the type locality, since Say listed it vaguely as the "Middle States," although it was quite common around Say's home near Philadelphia" (Pilsbry 1948: 570).

Anguispira kochi (Pfeiffer 1845)

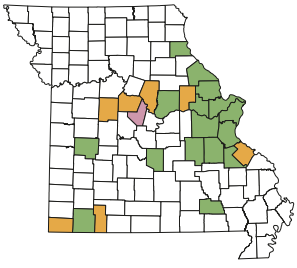
Banded Tigersnail

DESCRIPTION: ***Shell:*** medium to large, diameter 17 to 30 mm, height 14 to 21 mm; relatively solid; shape depressed globose; whorls about 6, convex, uniformly rounded; suture deeply impressed; umbilicus open, large, contained four to five times within the diameter. ***Aperture:*** large, rounded to oval, lunate; peristome thin, not reflected; aperture without lamellae; parietal callus nearly straight along outer edge, thin, granulose. ***Surface:*** of embryonic whorls smooth; later whorls with fine, irregular axial ridges; spiral striae faint. ***Color:*** honey-yellow with two brown bands, lower band at the periphery, upper band midway to suture.

REMARKS: *Anguispira kochi* is found in Missouri primarily in undisturbed forested hillsides adjacent to rivers and streams. Association with mature mesic forest habitat (Pilsbry 1948: 592) may limit its distribution in Missouri.

In Missouri, fossils of the banded tigersnail were found in Pleistocene age deposits of loess and talus from Boone, Callaway, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a).

Fig. 63. *Anguispira kochi*, diameter 21 mm; Warren County.



DISTRIBUTION: *Anguispira kochi* occurs in all the natural divisions of Missouri, except the Mississippi Lowlands. Although widespread, it is known from relatively few localities. Nationally, this species ranges from western Tennessee to Lower Michigan, and east into Pennsylvania. Missouri is the western-most limit of its range.

TYPE LOCALITY: Cincinnati, Ohio

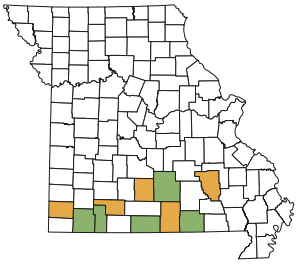
Discus nigrimontanus (Pilsbry 1924)

Black Mountain Disc

DESCRIPTION: ***Shell:*** small, diameter about 5.8 mm, height about 2.4 mm, solid; shape strongly depressed-discoidal; whorls 5½, periphery bluntly angled, convex above, flattened below; umbilicus widely open, contained about 2.5 times within shell diameter. ***Aperture:*** squarish; peristome thin. Hubricht (1963b: 63) reports, "some shells in the type lot of D. nigrimontanus have an internal tubercle"; however, this structure was not observed in Missouri shells. Parietal callus is thin, outer edge slightly concave, color whitish, translucent. ***Surface:*** of embryonic whorl smooth; later whorls with well defined ribs, surface between ribs with fine striae. ***Color:*** light brown, with a pinkish tint.

REMARKS: The black mountain disc is usually found on rocky hillsides with sparse leaf cover.

Fig. 64. *Discus nigrimontanus*, diameter 5.8 mm; Oregon County.



DISTRIBUTION: *Discus nigrimontanus* is found only in the southern and southwestern part of the state, in the Ozark Natural Division. Elsewhere, this species occurs in Arkansas, and in a disjunct area in the southern Appalachians.

TYPE LOCALITY: Potato Top, Black Mountains, N.C.

Discus patulus (Deshayes 1830)

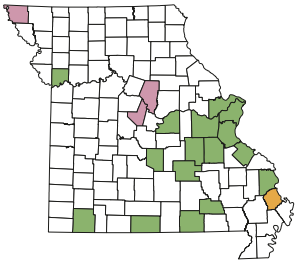
Domed Disc

DESCRIPTION: ***Shell:*** small, diameter 7.0 to 8.9 mm, height 3.3 to 4.0 mm, solid; shape strongly depressed; whorls 5½ to 6, slowly increasing in size, convex, periphery rounded; suture deeply impressed; umbilicus broad, contained about 2.5 times within diameter. ***Aperture:*** oval, lunate; peristome thin, not reflected; aperture with a recessed, blunt lamella on the columellar side of a low callus lining the inner wall; callus sometimes visible through the outer wall of the body whorl as a pale band; parietal callus with leading edge very thin, slightly convex, granulose, transparent to slightly opaque. ***Surface:*** with prominent and regularly spaced axial ridges, some ridges end or coalesce on the base; number of ridges is fewer along umbilical margin, though spacing is similar to the periphery; embryonic whorls smooth; surface between ridges with fine striae. ***Color:*** is cinnamon brown, base lighter. ***Animal:*** white, tentacles light gray.

REMARKS: The domed disc is usually found under the bark of decaying tree trunks and in leaf litter near or under fallen tree limbs. This species is often abundant where it occurs.

In Missouri, fossils of *Discus patulus* are known from Pleistocene age talus from Boone, Jefferson, Moniteau, St. Charles, and St. Louis counties (Hubricht 1964a, Greger 1933), and in Pleistocene age loess from Atchison County (collected by Nels Holmberg).

Fig. 65. *Discus patulus*, diameter 8.0 mm; Washington County.



DISTRIBUTION: *Discus patulus* is known in Missouri from the Ozark, Ozark Border, and Glaciated Plains natural divisions. Elsewhere, it ranges from Louisiana to Wisconsin, and in most states eastward.

TYPE LOCALITY: New York

Lucilla singleyanus (Pilsbry 1890)

Smooth Coil

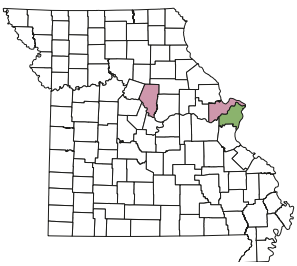
DESCRIPTION: ***Shell:*** minute, diameter about 2.4 mm, height about 0.9 mm; moderately solid; shape depressed, whorls about 3¾, convex, suture moderately impressed; umbilicus broad, contained about three times in shell diameter. ***Aperture:*** rounded-oval, lunate, peristome thin, not reflected, without lamellae. ***Surface:*** glossy, growth lines and grooves weak and irregular, spiral striae faint. ***Color:*** light yellowish, translucent.

REMARKS: Pilsbry (1948: 637) suggested that *Lucilla singleyanus* might be a burrower, since most of the shells he examined were dead shells taken from drift. Hubricht (1985: 22) reports this species from open, grassy places, roadsides, railroads, and meadows.

Lucilla singleyanus is very similar in appearance to species of *Hawaiia*, but differs by the glossy surface and weak and irregular growth lines.

Missouri fossils of *Lucilla singleyanus* were reported from Pleistocene age loess and talus in Boone, St. Charles, and St. Louis counties (Hubricht 1964a).

Fig. 66. *Lucilla singleyanus*, diameter 2.2 mm, St. Louis County.



DISTRIBUTION: New State Record. Ozark Border Natural Division. Elsewhere, it is found in widely scattered localities from Texas, north to Michigan and Maryland.

TYPE LOCALITY: New Braunfels, Comal County, Texas

Helicodiscus notius Hubricht 1962

Tight Coil

DESCRIPTION: ***Shell:*** small, diameter about 3.6 mm, height 1.6 mm, moderately solid; shape discoidal; whorls 5 to 5½, moderately convex, whorl diameter increasing very regularly and not swollen after first whorl; suture moderately impressed; umbilicus widely open, contained about two times within the diameter of the shell. ***Aperture:*** rounded, semi-lunate; peristome thin; body whorl with 2–3 pairs of lamellae, each pair on a low callus, sometimes visible within the aperture, often far back and visible through the base of the shell; parietal callus thin, transparent, and convex along the outer edge; spiral threads are clearly visible through the parietal callus. ***Surface:*** with spiral threads or ridges, beginning on embryonic whorls and continuous to aperture, later whorls with axial growth wrinkles in addition to spiral threads. ***Color:*** pale yellowish, translucent.

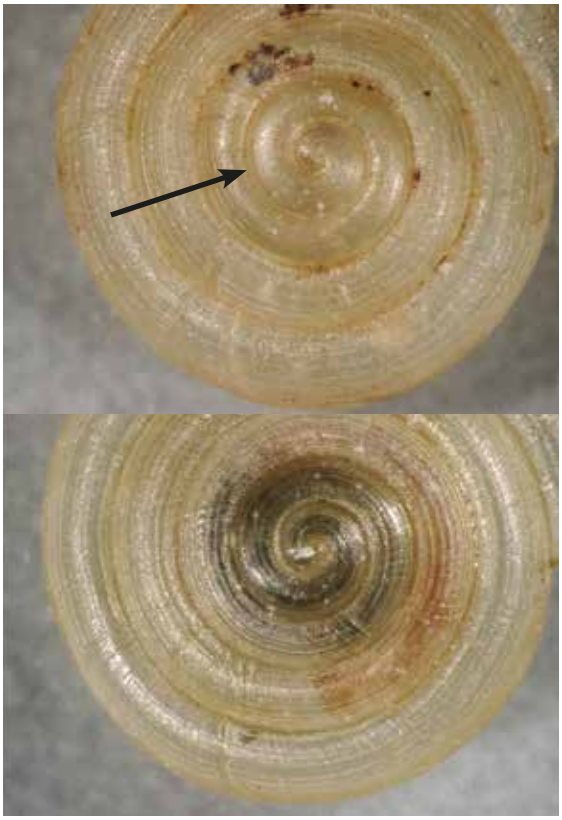
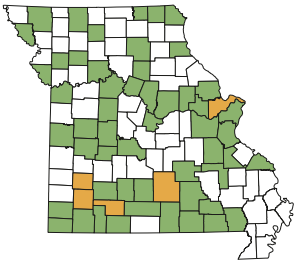


Fig. 67. Top: *Helicodiscus parallelus*, showing smooth area just after first whorl, diameter 3.4 mm, Pike County; Bottom: *Helicodiscus notius* diameter, with spiral threads distinct on embryonic whorls, 3.2 mm, St. Louis County.

REMARKS: The tight coil was first found in Missouri in 1933 by Leslie Hubricht, but it was not described until much later (Hubricht, 1962: 104). The next published record in Missouri was that by (Gardner 1986: 9), who reported it from four counties. It is found in mesic hardwood forests under leaves and logs, and occasionally in caves; usually found in drier habitats than *H. parallelus*.

Missouri fossil shells of *Helicodiscus notius* are known from Pleistocene age loess, talus, and silt deposits from Boone, St. Louis, and St. Charles counties (Hubricht 1964a).



DISTRIBUTION: In Missouri *Helicodiscus notius* occurs in all of the natural divisions except the Mississippi Lowlands. Elsewhere in the eastern United States it is primarily southern in distribution, ranging from Texas to Indiana, east to Maryland.

TYPE LOCALITY: Side of Keel Mountain, Paint Rock, Jackson County, Ala (Hubricht, 1962: 104).

Helicodiscus parallelus (Say 1817)

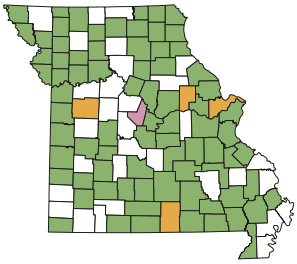
Compound Coil

DESCRIPTION: ***Shell:*** minute, diameter 3.2 to 3.5 mm, height about 1.2 mm, moderately solid; shape discoidal; whorls 4 to 5½, usually swollen just after first whorl; convex, slowly increasing in size, last whorl rounded at the periphery and base; suture moderately impressed; umbilicus widely open, contained about two times within the diameter of the shell. ***Aperture:*** rounded, semi-lunate; peristome thin; body whorl with 2–3 pair of lamellae, each pair on a low callus, sometimes visible within the aperture, often far back, or visible through the base of the shell; parietal callus thin, transparent and convex along the outer edge; spiral lines are clearly visible through the parietal callus. ***Surface:*** with spiral threads or ridges, narrower than the interval between them, embryonic whorls with spiral threads poorly developed or absent, often missing in irregular areas, later whorls with axial growth wrinkles in addition to spiral threads; surface between threads and growth wrinkles finely granular. ***Color:*** faint yellowish green.

Fig. 68. *Helicodiscus parallelus*, diameter 3.5 mm, Oregon County.

REMARKS: The compound coil can be found in mesic forests around decaying logs and leaf litter. "*Helicodiscus parallelus* is a timid creature, hard to observe, as it takes alarm when approached with a lens, though apparently blind" (Pilsbry 1948: 627).

Missouri fossils of *Helicodiscus parallelus* were found in Pleistocene age talus in Callaway, Franklin, Holt, Moniteau, Platte, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht, 1964a).



DISTRIBUTION: *Helicodiscus parallelus* occurs in all of the natural divisions of Missouri. Elsewhere, it occurs from Texas to Wisconsin, and in all the states to the east.

TYPE LOCALITY: Council Bluffs, Iowa (Pilsbry 1948: 627)

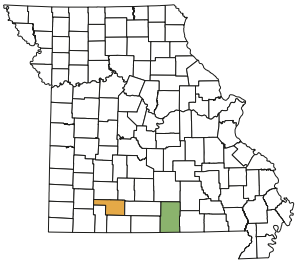
Ventridens brittsi Pilsbry 1892

Western Dome

Fig. 69. *Ventridens brittsi*, adult diameter 9.7 mm; juvenile (lower right) diameter 8.1 mm, Howell County.

DESCRIPTION: ***Shell:*** medium, diameter 9.7 to 10.8 mm, height 4.2 to 4.7 mm, moderately solid; shape depressed; whorls 6¾ to 7½, flattened, suture not deeply impressed; umbilicus varies from open to closed (Pilsbry 1946: 461), however all the Missouri specimens observed by the authors have an open umbilicus. ***Aperture:*** oval, lunate; peristome not reflected, immature shells with a deeply recessed, basal lamella, which is absorbed as the snail matures; surface within aperture with a heavy, opaque, white, calcareous layer on basal wall, sometimes extending above the periphery; parietal callus granulose, nearly straight along outer edge. ***Surface:*** shiny, with somewhat irregular growth lines, base with fine and dense spiral striae. ***Color:*** yellowish brown, translucent; light yellow opposite callus.

REMARKS: The western dome is reported from "mountainsides and in ravines, under rocks and logs, and in leaf litter" (Hubricht 1985, p. 31). Howell County specimens were found under rocks and debris in dolomite glade habitat.



DISTRIBUTION: *Ventridens brittsi* was reported from Christian County (Hubricht 1985), and was found by the authors from Howell County in the Ozark Natural Division of Missouri. Elsewhere, it is found in eastern Oklahoma and northwestern Arkansas.

TYPE LOCALITY: Hot Springs, Ark.

Ventridens ligera (Say 1821)

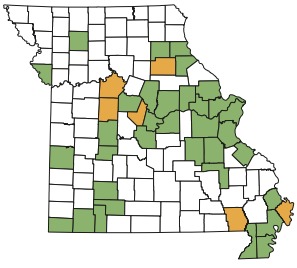
Globose Dome

Fig. 70. *Ventridens ligera*, diameter 13 mm, Washington County.

DESCRIPTION: ***Shell:*** medium, diameter 11 to 15 mm, height 8 to 12 mm, moderately solid with lip very fragile; shape globose; whorls 6½ to 7, moderately convex, body whorl large, broadly rounded and over ½ of shell height; suture moderately impressed, early whorls margined, umbilicus small, contained about 12 times in diameter of shell. ***Aperture:*** obliquely oval, lunate, flattened above, without lamellae; aperture with a thin white callus within, visible on outer surface as a light colored band; peristome very thin and fragile; parietal callus thin, outer edge ogee-shaped, convex near columella, concave externally; surface of parietal callus coarsely granular. ***Surface:*** of embryonic whorls smooth, finely granular; later whorls with closely spaced, coarse and irregular growth ridges; fine microscopic axial and spiral lines form a grid of minute granules on some surfaces of the shell, reminiscent of the fine microsculpture of *Mesomphix capnodes*. ***Color:*** yellowish brown, somewhat glossy, the callus visible on outer surface buff to yellowish. ***Animal:*** and tentacles slate black; eyes black, with a dark line behind the base of each eye stalk; collar pale gray, with fine white spots; sole light gray.

REMARKS: The globose dome is found predominately in mesic bottomlands along rivers, and occasionally on nearby hillsides, talus, and soil along bluffs.

Missouri fossils of *Ventridens ligera* were found in Pleistocene age talus in Boone, Callaway, Franklin, Jefferson, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Ventridens ligera* is found in all of the natural divisions in Missouri. Elsewhere, it occurs from Oklahoma to Michigan, east to New York, and south to North Carolina and northern Mississippi.

TYPE LOCALITY: Missouri

Zonitoides arboreus (Say 1816)

Quick Gloss

DESCRIPTION: ***Shell:*** small, diameter 4.5 to 6.0 mm, height 2.4 to 3.0 mm, moderately solid; shape depressed; whorls about 4½, convex, suture deeply impressed; umbilicus contained four and a half to five times within the shell diameter, evenly expanded throughout. ***Aperture:*** oval, lunate, without lamellae; peristome thin, not reflected; parietal callus is very thin and translucent, outer edge nearly straight, surface finely granular. ***Surface:*** of embryonic whorls smooth; later whorls with weak axial growth lines and minute spiral striae. ***Color:*** light yellowish brown with olive tint, translucent, glossy. ***Animal:*** bluish gray, lighter on the sides; tail unpigmented; eyes black; sole white or light gray.

REMARKS: Shells of the quick gloss are found under bark and around rotting logs and in leaf litter from hilltops to floodplains. It is also common in urban areas, and has been reported from Missouri caves (Hubricht 1941: 111).

Zonitoides arboreus is superficially similar to species of *Glyphyalinia* and *Nesovitrea*; however, it differs by the surface having irregular growth lines and without axial grooves. This species is an intermediate host for the brainworm *Parelaphostrongylus tenuis* (see *Haplotrema concavum* Remarks, Page 70)

Missouri fossils of *Zonitoides arboreus* were found in Pleistocene age loess, talus, and silt deposits in Boone, Callaway, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).

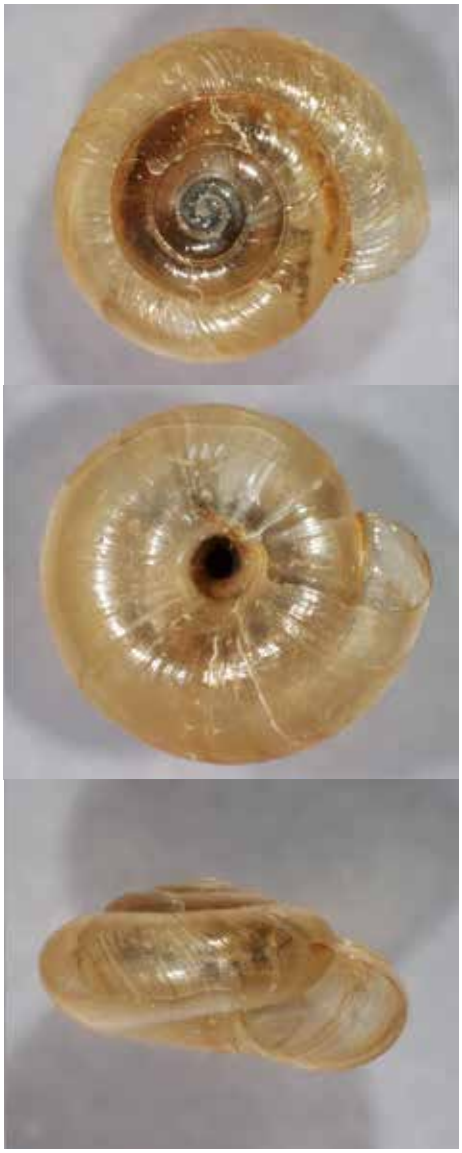
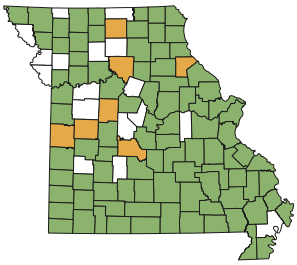


Fig. 71. *Zonitoides arboreus*, diameter 4.5 mm, St. Louis County.



DISTRIBUTION: In Missouri, it has been found in all the natural divisions, and it is probably present in every county. This species occurs in every state in the nation.

TYPE LOCALITY: unknown

Zonitoides limatulus (A. Binney 1840)

Dull Gloss

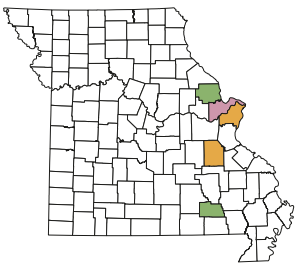
DESCRIPTION: ***Shell:*** minute, diameter 4.3 to 5.0 mm, height 2.0 to 2.7 mm, relatively solid; shape depressed; whorls about 4.5, slightly convex, suture well impressed; umbilicus contained three to four times in diameter. ***Aperture:*** obliquely oval, lunate, peristome thin, not reflected, without lamellae; parietal callus thin, leading edge nearly straight. ***Surface:*** of embryonic whorls smooth; later whorls with close spaced, prominent axial ridges, which are less distinct on the ventral surface; spiral striae weak to obsolete. ***Color:*** whitish corneous, some with a greenish tint; translucent to opaque.

REMARKS: *Zonitoides limatulus* live in bottomland habitat; the Lincoln County specimens were found in leaf litter and soil at the base of bluffs near the edge of the Mississippi River floodplain. This is one of the least common species in Missouri.

This species may be confused with *Discus whitneyi*, but is distinguished by the axial ridges, which in *D. whitneyi* are much coarser and more regularly spaced, with the ridges well defined on the base.

Missouri fossils of *Zonitoides limatulus* were found in Pleistocene age talus in St. Charles and St. Louis counties (Hubricht 1964a).

Fig. 72. *Zonitoides limatulus* (A. Binney 1840), diameter 4.9 mm, Lincoln County.



DISTRIBUTION: In Missouri, *Zonitoides limatulus* is found only in a few localities in eastern Missouri, including parts of the Glaciated Plains and Ozark natural divisions. Elsewhere, it occurs east to Kentucky, and north to Wisconsin and New York, with eastern Missouri at the western limit of its range.

TYPE LOCALITY: Ohio

Striatura meridonalis
(Pilsbry & Ferriss 1906)

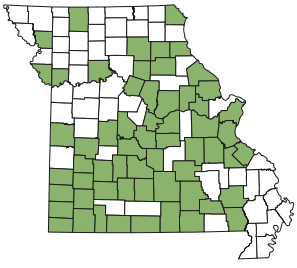
Median Striate

Fig. 73. *Striatura meridonalis*, diameter 1.6 mm, Barry County.

DESCRIPTION: ***Shell:*** micro, diameter about 1.7 mm, height about 0.9 mm, moderately solid; shape depressed; whorls about 3½, convex, embryonic whorl high and prominent; suture moderately deep; umbilicus large, contained about three times within diameter of shell. ***Aperture:*** rounded, without lamellae; peristome thin; parietal callus thin, transparent, outer edge straight, surface finely granulose. ***Surface:*** of embryonic whorls with strong spiral striae beginning at the tip of the whorl; later whorls with distinct and regularly spaced axial ridges; spiral striae cutting axial ridges to form a coarse, granular surface. ***Color:*** corneous with a greenish tint.

REMARKS: The median striate is found a variety of habitats. It has been collected from glades, leaf litter, logs, and soil in woodlands, and soil and talus along bluffs.

Among Missouri snails, the median striate most closely resembles the Minute Gem, *Hawaiia minuscula*. It can be separated from *H. minuscula* by the prominent spiral threads on the embryonic whorl, and the coarsely granular sculpture. It also has a relatively higher spire, as seen in lateral view. Missouri fossils of this species have been reported from Pleistocene age talus in St. Louis County (Hubricht, 1964a).



DISTRIBUTION: *Striatura meridonalis* is found in all the natural divisions of Missouri except the Mississippi Lowlands. Elsewhere, it ranges from Texas, north to Michigan, east to Pennsylvania, and south to Florida.

TYPE LOCALITY: The Guadalupe River above New Braunfels, Texas

Euconulus dentatus (Sterki 1893)

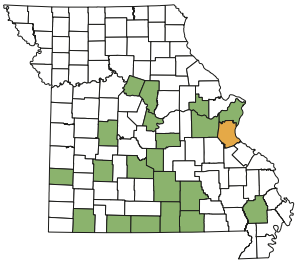
Toothed Hive

Fig. 74. *Euconulus dentatus*, diameter 2.2 mm, Barry County.

DESCRIPTION: ***Shell:*** minute, diameter about 2.4 mm, height about 2.3 mm, moderately fragile; shape globose; whorls about 6½, convex, suture moderately deep, body whorl of juveniles keeled, rounded in adults; umbilicus small. ***Aperture:*** of juveniles rectangular, adults rounded, lunate; peristome thin, fragile, not reflected; immature shells have two or three lamellae visible through the ventral wall of the body whorl, roughly 120 degrees apart, though sometimes closer; lamellae rounded or elongate, and sometimes visible through the aperture; parietal callus thin and transparent, outer edge convex, surface finely granulose. ***Surface:*** of embryonic whorls with very minute crossing axial and spiral striae; later whorls with spiral striae less apparent; minute striae gives the shell a silky luster. ***Color:*** pale reddish brown.

REMARKS: The toothed hive is found in moist to xeric leaf litter, usually in drier situations than *Euconulus trochulus*. "Because *E. dentatus* becomes mature in winter, and dies off in April, it is not collected as often as *E. chersinus* and *E. trochulus*" (Hubricht 1985:33).

In adult shells the lamellae are reduced to a single radial callus, or are absent. Shell size, shape, and number of whorls of this species are very similar to *E. trochulus*, and adults without lamellae are easily confused with the latter.



DISTRIBUTION: *Euconulus dentatus* is found in all the natural divisions of the state, except the Glaciated Plains. Elsewhere, it ranges from Louisiana to Illinois, east to Pennsylvania and South Carolina.

TYPE LOCALITY: Jackson County, Ala.

Euconulus fulvus (Müller 1774)

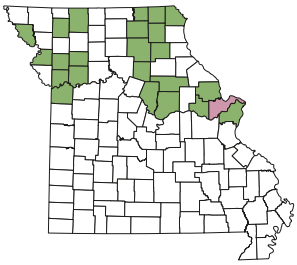
Brown Hive

DESCRIPTION: ***Shell:*** minute, diameter about 3.1 mm, height about 2.4 mm, moderately fragile; shape globose; whorls 5½, slightly convex, suture shallow, periphery rounded, whorls relatively wide in dorsal view; umbilicus small to closed, partially covered by peristome. ***Aperture:*** rounded, lunate to somewhat rectangular; peristome thin, fragile, not reflected, without lamellae; parietal callus thin and transparent, outer edge slightly convex, surface granular. ***Surface:*** similar to *Euconulus trochulus*, but somewhat more glossy. ***Color:*** light reddish to yellowish brown, with the apex lighter.

REMARKS: This species is typically found in moist leaf litter on wooded hillsides (Hubricht 1985: 33).

In Missouri, fossil shells of *Euconulus fulvus* were found in Pleistocene age loess and talus deposits in St. Charles and St. Louis counties (Hubricht 1964a).

Fig. 75. *Euconulus fulvus*, diameter 2.7 mm, Callaway County.



DISTRIBUTION: New State Record. *Euconulus fulvus* was found in the Glaciated Plains and Ozark Border natural divisions in Missouri. Nationally, it occurs from Minnesota to Maine, and south to Georgia.

TYPE LOCALITY: Denmark

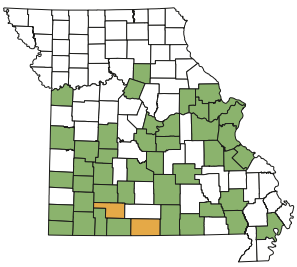
Euconulus trochulus (Reinhardt 1883)

Silk Hive

DESCRIPTION: ***Shell:*** minute, diameter about 2.5 mm, height about 2.6 mm; moderately fragile; shape globose; whorls about 7, convex; suture moderately impressed; umbilicus small to closed, partially covered by peristome. ***Aperture:*** rounded, lunate in adults, somewhat rectangular in juveniles; aperture without lamellae; peristome thin, fragile, not reflected; parietal callus thin and transparent, outer edge broadly convex, surface granular. ***Surface:*** of embryonic whorls with minute crossing axial and spiral striae; later whorls with spiral striae less apparent; minute striae gives the shell a silky luster; spiral striae distinct on base. ***Color:*** pale yellowish brown.

REMARKS: This species is found in mesic woodlands under moist leaves.

Fig. 76. *Euconulus trochulus*, diameter 2.6 mm, St. Louis County.



DISTRIBUTION: *Euconulus trochulus* is found in all of the natural divisions of Missouri, but occurs primarily in the southern half of the state. Elsewhere, it ranges from Texas to Illinois, east to Virginia, and south to northern Florida.

TYPE LOCALITY: Texas

Guppya sterkii (Dall 1888)

Sterki's Granule

DESCRIPTION: ***Shell:*** micro, diameter about 1.3 mm, height about .75 mm, fragile; shape depressed; whorls 3½ to 4, moderately convex; suture moderately impressed; shell imperforate. ***Aperture:*** rounded, semi-lunate, without lamellae; peristome thin; parietal callus thin and transparent, outer edge convex, columellar end extending over and covering umbilicus. ***Surface:*** with microscopic spiral and axial lines, spiral lines beginning on embryonic whorls. ***Color:*** yellowish pink, translucent; lip reddish.

REMARKS: Sterki's granule is similar in small size to *Punctum minutissimum*, but is easily distinguished by its closed umbilicus and by its smooth surface sculpture, which lacks the major and minor riblets of *Punctum* species. This minute snail is found under leaves in mesic woodlands, in soil along bluffs and rock outcrops, and occasionally in glades.

Missouri fossils of Sterki's granule have been found in Pleistocene age talus in St. Louis County, Missouri (Hubricht 1964a: 13).

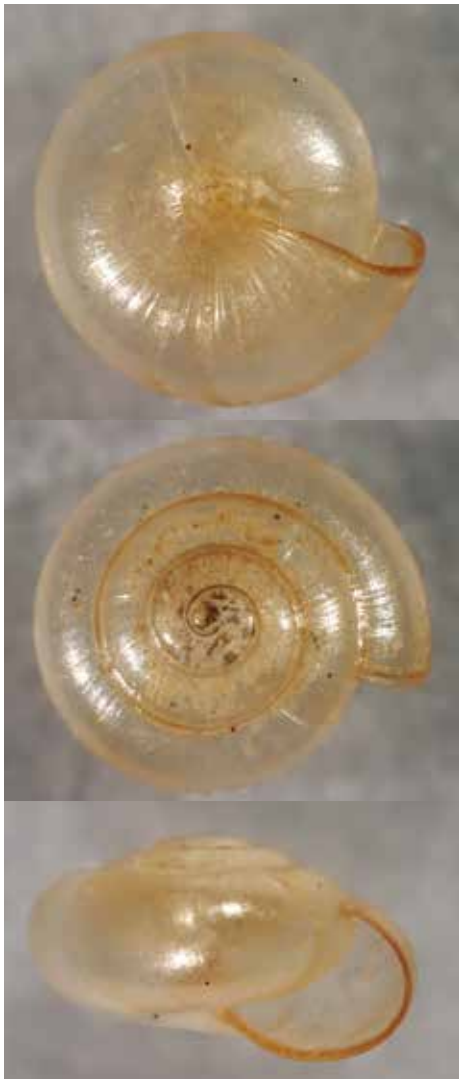
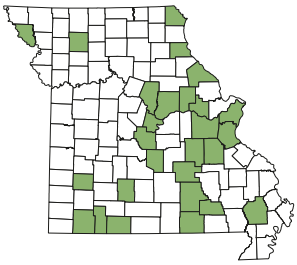


Fig. 77. *Guppya sterkii*, diameter 1.3 mm, Barry County.



DISTRIBUTION: *Guppya sterkii* is found in all of the natural divisions of Missouri, although it is not uniformly distributed. Elsewhere, it occurs in scattered localities from Oklahoma and Iowa east to New York, and south to Florida and Louisiana.

TYPE LOCALITY: New Philadelphia, Ohio

Glyphyalinia indentata (Say 1823)

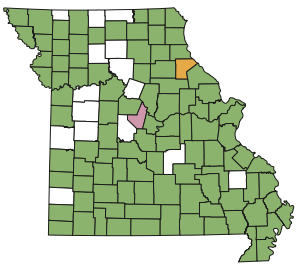
Carved Glyph

DESCRIPTION: ***Shell:*** minute to small, diameter 4.7 to 5.7 mm, height 2.1 to 3.0 mm, fragile; shape strongly depressed; whorls about 4½, flattened above, suture margined, shallowly indented; umbilicus minute, partially obscured by leading edge of lip. ***Aperture:*** oval, lunate, without lamellae; peristome thin; parietal callus very thin and difficult to see, microscopically granular, outer edge convex and extending well in front of aperture. ***Surface:*** glossy, embryonic whorl finely granulose; later whorls with regularly spaced axial grooves, about 28 on body whorl, extending across the base to the umbilicus; spiral striae faint, but may usually be seen on some parts of the body whorl. ***Color:*** light amber, translucent to nearly transparent. ***Animal:*** bluish black.

REMARKS: The carved glyph is found in a variety of habitats ranging from mesic to xeric, including riverside bluffs, moist leaf litter and soil, prairies, and glades. It is one of the most widespread snails in Missouri, it was collected by the authors at more than 400 sites in 97 counties and probably occurs in all the counties.

Fossil shells of *Glyphyalinia indentata* were found in Pleistocene age loess and talus deposits from Boone, Callaway, Franklin, Jefferson, Moniteau, Platte, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).

Fig. 78. *Glyphyalinia indentata*, diameter 4.8 mm, Warren County.



DISTRIBUTION: *Glyphyalinia indentata* is one of the most common snails in Missouri, and occurs in all natural divisions and in most counties. Elsewhere, it is known from Texas to Michigan, and east in nearly all of the other states.

TYPE LOCALITY: northern Philadelphia (Harrigate) and New Jersey

Glyphyalinia solida (H. B. Baker 1930)

Imperforate Glyph

Fig. 79. *Glyphyalinia solida*, diameter 3.0 mm (immature), Wayne County.

DESCRIPTION: ***Shell:*** small, diameter 6.4 to 7.5 mm, height about 4.0 mm, fragile; shape strongly depressed; whorls about 5¼, nearly flat; suture margined, not or very slightly impressed; shell imperforate. ***Aperture:*** rounded-lunate, without lamellae; peristome thin; parietal callus very thin, leading edge convex, wrapping around axis of shell and covering the umbilicus in immatures as well as adults. ***Surface:*** glossy, embryonic whorls smooth; later whorls with evenly spaced, axial grooves; grooves distinct on base; spiral striae fine and distinct on upper and lower surfaces. ***Color:*** light golden-brown. ***Animal:*** bluish black.

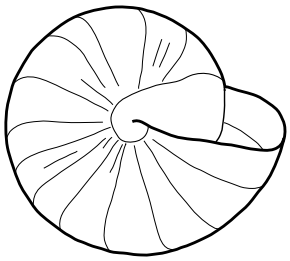
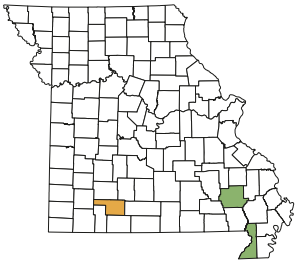


Fig. 80. *Glyphyalinia solida*, umbilicus covered by parietal callus.

REMARKS: The imperforate glyph is the only *Glyphyalinia* species in Missouri with a completely closed umbilicus. "It is usually found in moist leaf litter on wooded hillsides and ravines," (Hubricht 1985: 24).

Glyphyalinia solida was originally described as a subspecies of Glyphyalinia cryptomphala by H. B. Baker in 1931, and separated from *G. cryptomphala s. str.* based on larger size and stronger sculpture. Hubricht (1965a: 134) elevated the subspecies to species rank, indicating constant shell and anatomical differences, without intergradation. Hubricht's 1985 later publication on distributions of land snails in eastern North America also treated *G. solida* as a species.

The most recent catalog of North American mollusks (Turgeon et al. 1998) does not include *Glyphyalinia solida*. This was probably an oversight. We follow Hubricht's interpretation and treat *G. solida* as the species of *Glyphyalinia* with a covered umbilicus occurring in Missouri.



DISTRIBUTION: This snail is rare in Missouri. It has been found only in three counties in southern Missouri, in the Ozark and Mississippi Lowlands natural divisions. The range of *Glyphyalinia solida* extends from eastern Oklahoma to Michigan, east to Maryland, and south to Florida.

TYPE LOCALITY: Prior Cove, near Jasper, Marion County, Tenn.

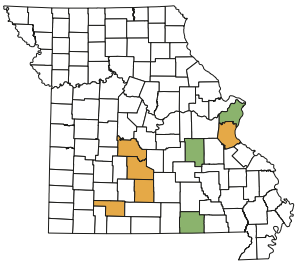
Glyphyalinia wheatleyi (Bland 1883)

Bright Glyph

DESCRIPTION: ***Shell:*** small, diameter 5 to 5.5 mm, height about 2.2 mm, fragile; shape strongly depressed; whorls 3¾ to 4¼, slightly convex, less flattened than in *Glyphyalinia indentata*; suture margined, moderately impressed; umbilicus widely open, contained four and a half to five times within shell diameter. ***Aperture:*** oval, lunate, without lamellae; peristome thin; parietal callus thin and transparent, outer edge convex and often irregular, surface granular. ***Surface:*** of first whorl smooth; later whorls with irregular axial grooves, which are closer together near the aperture; spiral striae fine. ***Color:*** light horn, translucent, shining.

REMARKS: *Glyphyalinia wheatleyi* is found in moist woodlands and in soil along bluffs. Fossil shells of the bright glyph were found in Pleistocene age talus in St. Louis County (Hubricht 1964a).

Fig. 81. *Glyphyalinia wheatleyi*, diameter 3.7 mm, Oregon County.



DISTRIBUTION: *Glyphyalinia wheatleyi* is found in the Ozark and Ozark Border natural divisions of Missouri, and elsewhere it occurs from Oklahoma to Wisconsin, east to Massachusetts, and south to Mississippi.

TYPE LOCALITY: Knoxville, Tenn.

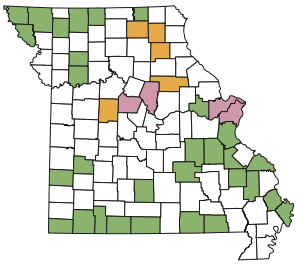
Nesovitrea electrina (Gould 1841)

Amber Glass

DESCRIPTION: ***Shell:*** minute to small, diameter 4.1 to 5.1 mm, height 2.5 to 2.8 mm, rather fragile; shape strongly depressed; whorls about 4¼, slightly convex, suture margined, shallow; umbilicus open and deep, contained about 4½ times in the diameter. ***Aperture:*** oval, lunate; peristome thin fragile, not reflected, without lamellae; parietal callus thin, transparent, with outer edge concave. ***Surface:*** glossy, first whorl smooth, later whorls with irregularly spaced axial grooves, base with grooves greatly diminished, spiral striae fine to absent. ***Color:*** light brown with a yellowish or greenish tint, translucent. ***Animal:*** almost black, lighter near the foot; sole tripartite, separated by impressed lines.

REMARKS: The amber glass is found in low moist areas, floodplains, and the margins of bodies of water (Hubricht 1985: 23). Missouri fossils of Nesovitrea electrina have been found in Pleistocene age loess, talus, and silt deposits from Boone, Cooper, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).

Fig. 82. *Nesovitrea electrina*, diameter 4.4 mm, Callaway County.



DISTRIBUTION: *Nesovitrea electrina* is widespread in Missouri and occurs in all of the natural divisions of the state. Elsewhere, it is known from Kansas to Minnesota east to Maine and Virginia (Hubricht 1985: 116).

TYPE LOCALITY: Maine

Mesomphix capnodes (W. G. Binney 1857)

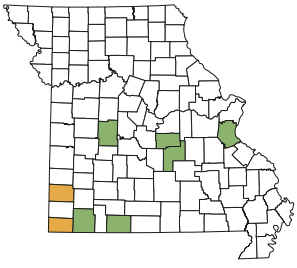
Dusky Button

DESCRIPTION: ***Shell:*** large, diameter 29.4 to 35.5 mm, height 17.7 to 26 mm (most Missouri specimens are smaller and apparently sub-adults, with less than 4½ whorls); shell thin and fragile; shape depressed-globose; whorls about 5, nearly flat above, body whorl large; suture only slightly impressed; umbilicus small, contained eight to 10 times within diameter of shell, umbilicus partially obscured by leading edge of lip. ***Aperture:*** very large, oval, lunate, flattened above, without lamellae; peristome thin and fragile, often broken; parietal callus thin, brownish. ***Surface:*** with abundant axial and spiral lines, forming a regular pattern of raised papillae, under high magnification visible as reflective highlights. ***Color:*** reddish brown, sometimes with olive tint; dark, growth/rest bands are sometimes visible.

Fig. 83. *Mesomphix capnodes*, sub-adult with about 4⅓ whorls, diameter 16 mm, Taney County.

REMARKS: The dusky button is usually found in xeric woodlands under leaf litter (Hubricht 1985).

Although very similar in general appearance to *Mesomphix friabilis*, the microsculpture of *M. capnodes* is very distinctive. At high magnification, it has clear-cut spiral and axial lines forming a regular pattern of microscopic highlights (Fig. 84, left). Similar surface also occurs in *M. globosus*, however, the prominent axial ridges on *M. globosus* easily separate it from *M. capnodes* or *M. friabilis*. Most specimens of *Mesomphix* found in Missouri are smaller and with fewer whorls than published descriptions. Many specimens of *M. capnodes* are in the size range of mature *M. globosus*; however, they have fewer whorls, which we interpret as sub-adults. We have not yet found small individuals, less than 19 mm, with the fully grown 5½ whorls of *M. globosus*.



DISTRIBUTION: *Mesomphix capnodes* is found in scattered counties within the Ozark and Ozark Border natural divisions of the state, and is uncommon. Elsewhere, it occurs from Oklahoma, east to Georgia and Virginia.

TYPE LOCALITY: Uniontown, Perry County, Ala.

Mesomphix friabilis (W. G. Binney 1857)

Brittle Button

DESCRIPTION: ***Shell:*** large, diameter 21 to 26 mm, height 17 to 20.5 mm, thin and fragile; shape depressed-globose; whorls about 5, flattened above; suture shallow; umbilicus small, contained 10 to 12 times within diameter of shell, may be partly obscured by leading edge of lip. ***Aperture:*** very large, oval, lunate, flattened above, without lamellae; peristome thin; parietal callus very thin, outer edge slightly convex. ***Surface:*** dull, with random, pebbly microsculpture; traces of spiral lines and weak growth lines visible, but not forming a regular pattern of raised papillae. ***Color:*** brownish to olive-yellow, one or more dark-brown growth/rest lines may be visible, parietal callus often stained darker.

REMARKS: The brittle button lives in mesic forests and river corridors under moist leaves at the leaf/soil interface.

Missouri fossil shells of *Mesomphix friabilis* were found in Pleistocene age talus in St Louis County (Hubricht 1964a).

Fig. 84. *Mesomphix capnodes* (left) and *M. friabilis* (right) surface microsculpture.

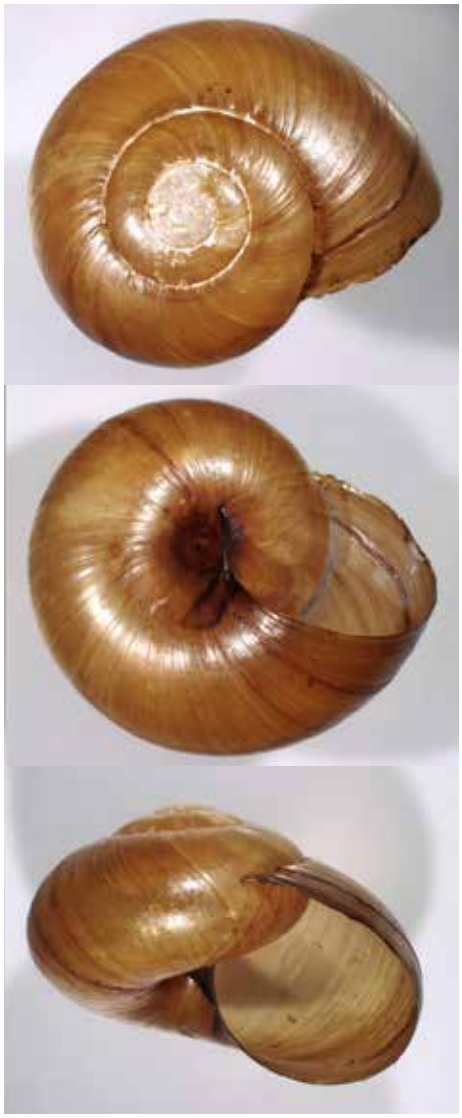
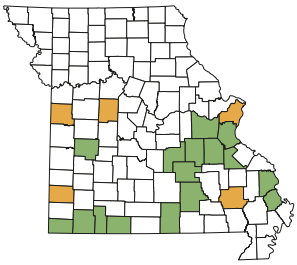


Fig. 85. *Mesomphix friabilis*, diameter 19 mm, Washington County.



DISTRIBUTION: *Mesomphix friabilis* occurs only in the southern half of Missouri, in the Ozark, Ozark Border, and Mississippi Lowlands natural divisions. Elsewhere, it occurs from Oklahoma and Texas, east to Alabama, and north to Indiana.

TYPE LOCALITY: Banks of the Wabash River

Paravitrea significans (Bland 1866)

Domed Supercoil

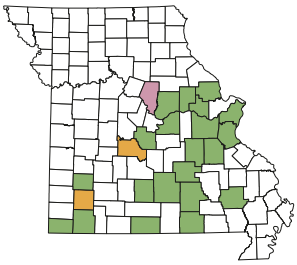
DESCRIPTION: ***Shell:*** minute to small, diameter 4.2 to 5.2 mm, height 2.0 to 3.0 mm, fragile; shape strongly depressed; whorls 6½ to 7, tightly coiled, slightly convex; periphery of body whorl located below the middle in fully adult shells, rounded in sub-adults; suture margined, slightly impressed; umbilicus widely open, contained five to six times in the diameter. ***Aperture:*** obliquely oval, lunate; peristome thin; mature shells without lamellae; immature shells with one or two pair of lamellae visible through the shell; parietal callus very thin, outer edge nearly straight, surface finely granular. ***Surface:*** of embryonic whorls smooth, later whorls with fine irregular axial striae, less pronounced on the base; spiral striae very faint. ***Color:*** pale horn.

REMARKS: The domed supercoil is found in a variety of habitats, including glades, soil along bluffs and mesic woodland leaf litter and soil.

Missouri fossils of *Paravitrea significans* were found in Pleistocene age talus in Boone and St. Louis counties (Hubricht 1964a).

Fig. 86. *Paravitrea significans*, diameter 4.6 mm, St. Louis County.

Fig. 87. Margined sutures in *Paravitrea significans*.



DISTRIBUTION: This species is found in the Ozark and Ozark Border natural divisions. It has a limited distribution centered in the Ozark Plateau, and also occurs in Kansas, Oklahoma, Arkansas, southern Illinois, and Tennessee.

TYPE LOCALITY: Fort Gibson, Muskogee, Okla.

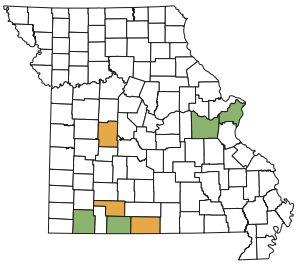
Paravitrea simpsoni (Pilsbry 1889)

Amber Supercoil

DESCRIPTION: ***Shell:*** minute, diameter 3.8 to 4.1 mm, height about 1.8 mm, moderately fragile; shape discoidal; whorls about 5½, tightly wound, body whorl at aperture more than twice the diameter of penultimate whorl; whorls nearly flat; suture shallowly impressed, margined; umbilicus widely open, contained about five times in diameter. ***Aperture:*** somewhat triangular, lunate, basal lip nearly straight, without lamellae; peristome thin; parietal callus very thin, outer edge nearly straight. ***Surface:*** of embryonic whorls smooth; later whorls with fine, irregular growth lines. ***Color:*** milky-white with amber tint.

REMARKS: *Paravitrea simpsoni* is found in moist leaf litter; dead shells are often found in soil at the base of limestone bluffs.

Fig. 88. *Paravitrea simpsoni*, diameter 3.8 mm, Barry County.



DISTRIBUTION: *Paravitrea simpsoni* is found in southern Missouri, within the Ozark and Ozark Border natural divisions. Outside of Missouri, it is known only from Arkansas, southeastern Kansas, and eastern Oklahoma.

TYPE LOCALITY: Limestone Gap, Atoka County, Okla.

Oxychilus cellarius (Müller 1774)

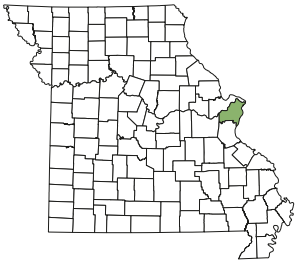
Cellar Glass-snail

DESCRIPTION: ***Shell:*** small, diameter about 9 to 12 mm, height about 4 mm, thin but moderately solid; shape strongly depressed; whorls about 5, shallowly convex; suture moderately impressed, margined; umbilicus open, contained about eight times within diameter of shell; body narrower at the aperture than *Oxychilus draparnaudi*. ***Aperture:*** obliquely oval, lunate, without lamellae; peristome thin; parietal callus thick, outer edge straight, surface coarsely granular, color with brownish tint. ***Surface:*** glossy, embryonic whorls smooth, later whorls with axial growth lines barely visible; spiral striae faint. ***Color:*** light yellowish brown, underside whitish. ***Animal:*** usually pale bluish gray.

REMARKS: The cellar glass-snail is known from cellars, in and around greenhouses, and under debris in urban and suburban gardens (Pilsbry 1946). In St. Louis, it was found on a steep, eastfacing, wooded hillside along the Mississippi River.

This species is very similar to *Oxychilus draparnaudi*, but differs primarily by finer surface sculpture and relatively narrower body whorl.

Fig. 89. *Oxychilus cellarius*, diameter 9 mm, St. Louis City.



DISTRIBUTION: In Missouri, *Oxychilus cellarius* has been found in only one locality, in St. Louis City, Ozark Border Natural Division. This is an introduced species, and has spread throughout much of the United States.

TYPE LOCALITY: Copenhagen, Denmark

Oxychilus draparnaudi (Beck 1837)

Dark-bodied Glass-snail

DESCRIPTION: ***Shell:*** medium, diameter 11 to 16 mm, height 5 to 7 mm, thin but moderately solid; strongly depressed; whorls about 5½, convex; suture shallowly impressed, margined; umbilicus open, contained about six times within diameter of shell, body whorl distinctly wider than Oxychilus cellarius at the aperture. ***Aperture:*** obliquely oval, lunate, without lamellae; peristome thin, not thickened but solid; parietal callus thin, outer edge uniformly convex, translucent, surface finely granulose. ***Surface:*** not usually very glossy, irregular axial growth lines well defined especially at the suture; spiral striae fine. ***Color:*** yellowish brown, underside whitish. ***Animal:*** blue-black.

REMARKS: *Oxychilus draparnaudi* was found in St. Louis along a sidewalk hedgerow outside the Missouri Botanical Garden. The date of its introduction into Missouri is not known. This snail is "carnivorous by preference" (Pilsbry 1946: 251).

This species is very similar to *Oxychilus cellarius*, but differs primarily by coarser surface sculpture and relatively wider body whorl.

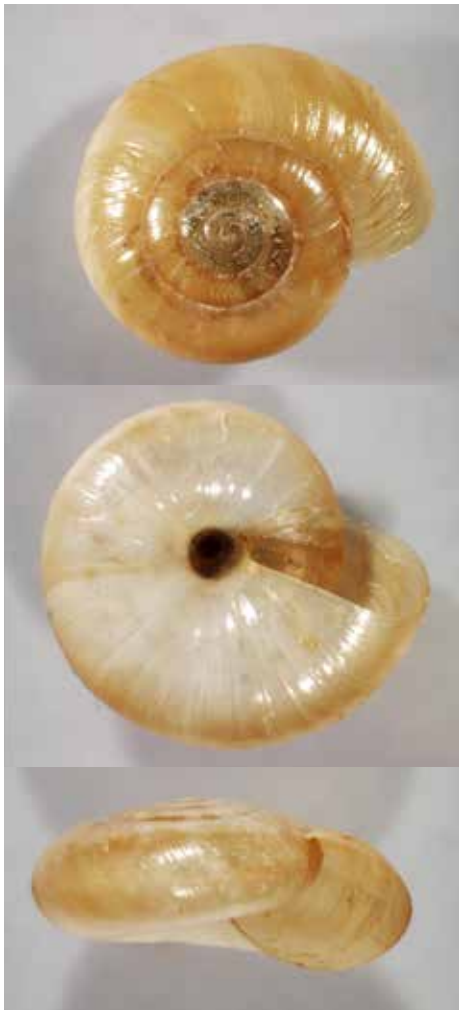
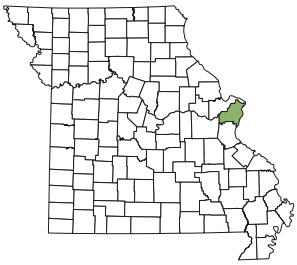


Fig. 90. *Oxychilus draparnaudi*, diameter 12 mm, St. Louis County.



DISTRIBUTION: New State Record. *Oxychilus draparnaudi* was found in Missouri at only one locality in St. Louis City. It is an introduced species, and now occurs from coast to coast, primarily in northern states (Pilsbry 1946: 251).

TYPE LOCALITY: France

Milax gagates (Draparnaud 1801)

Greenhouse Slug

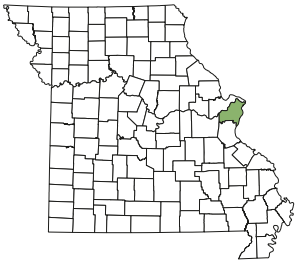
Fig. 91. *Milax gagates*, St. Louis County.

DESCRIPTION: Slug length to 50 mm extended; mantle with a horseshoe-shaped groove giving the mantle a two-tiered appearance; concentric ridges of mantle originating from its center; sole tripartite. ***Color:*** brownish tan, with tubercles outlined in gray-black; mantle brownish; pair of dark colored bands located on either side of the dorsal midline, spreading apart anteriorly, and continuing onto the mantle; breathing pore light colored; sole uniform light brown to cream.

REMARKS: The greenhouse slug is one of the more easily identified slug species. It is the only slug in Missouri with a "two-tiered" mantle.

Like other introduced slugs, the *Milax gagates* is a destructive pest on vegetables in gardens and greenhouses. It hides under boards, bricks, and rocks, often burrowing down 4 inches, where it feeds on the roots of plants.

"Greenhouse Slug" is one of several common names applied to this species; it is also called the "Jet Slug," "Smooth Jet Slug," "Jet Greenhouse Slug," or "Black Slug."



DISTRIBUTION: New State Record. *Milax gagates* is an introduced species in North America, originating in Europe. It is now widespread in most of the United States. It was found in Missouri only in St. Louis County in an urban setting.

TYPE LOCALITY: France

Limax maximus Linnaeus 1758

Giant Gardenslug

Fig. 92. *Limax maximus*, Jackson County.

DESCRIPTION: Slug length 80 to 200 mm extended, robust; mantle covering anterior ⅓ of body; dorsal keel on posterior ⅓ or less. ***Color:*** yellowish gray with black spots, some of which may be elongate; spots on the body may be arranged into three discontinuous bands; other black spots randomly scattered; neck, sole, and foot margin are pale; infrequently the body may be dark without spots or blotches; tentacles brown; slime is colorless.

REMARKS: The giant gardenslug is the largest slug in Missouri. It is usually found in gardens, parks, and around buildings, and seldom in forests. It is secretive, coming out at night to forage on many of the garden vegetables. It hides in burrows, drain tiles or under moist dark places during the day. This species is a host for the parasitic brainworm nematode, *Parelaphostrongylus tenuis* (see *Haplotrema concavum* Remarks, Page 70). *Limax maximus* has a unique mating behavior, which is seldom seen since it takes place at night. Prior to mating, the pair of slugs climbs to the underside of a structure or limb where they circle each other for a considerable length of time. They then eat the slime trail they have laid down during the circling, converting the slime into a very viscous form of slime. They attach this slime to the underside of the structure and launch themselves into the air. The pair of slugs hang together, head down, suspended from the string of secreted mucus that may be several inches in length. They entwine both their bodies and their extended copulatory organs, which are pendulous coils half as long as the body and distended with bright blue hemolymph (blood). There is no insertion. Rather, sperm packets are exchanged outside the body during mating and then later drawn in (Fig. 93). Needless to say, observers that encounter a mating pair of slugs are usually impressed.

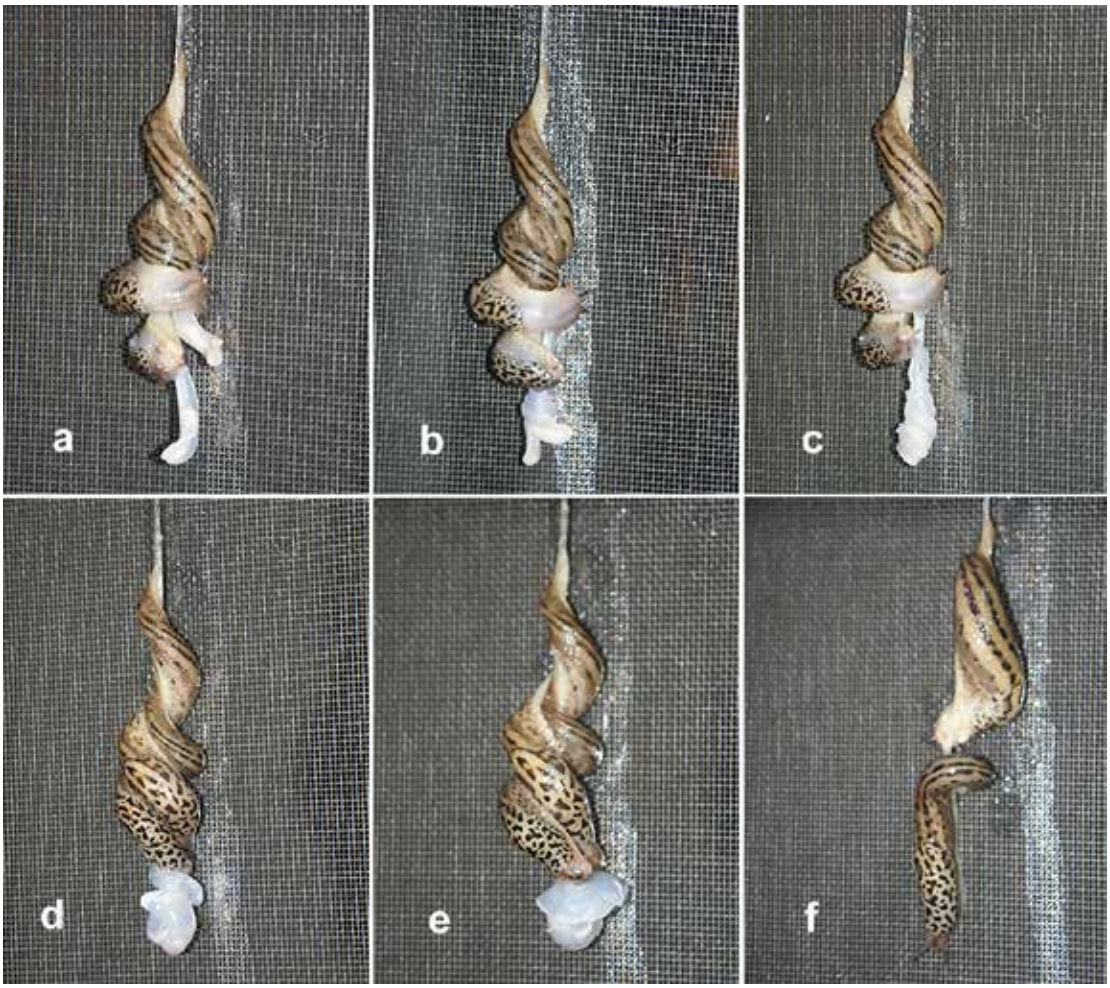
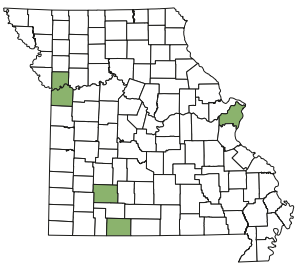


Fig. 93. *Limax maximus* mating in front of a screen door; sequenced from upper left, to lower right. Photo by Fred Oesch.



DISTRIBUTION: New State Record. *Limax maximus* was found in Missouri in only five counties: Greene, Clay, Jackson, Taney, and St. Louis. This is an introduced species, native to Europe, which now occurs throughout North America, mostly in the northern states and Canada. This species typically occurs around human habitations, mostly on private property, and therefore probably is much more widespread in Missouri than reported here.

TYPE LOCALITY: Sweden

This genus has variously been is treated as a subgenus of *Limax* or as a distinct genus. Most of the included species still appear in recent publications under either generic name.

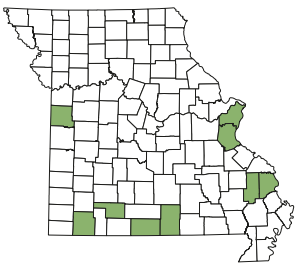
Lehmannia valentiana (Férussac 1823)

Threeband Gardenslug

DESCRIPTION: Slug length about 60 mm extended, slender; keel weak to absent; mantle covers the anterior ⅓ of the body; mantle with distinct concentric ridges. ***Color:*** light brown, becoming lighter laterally; mantle with lateral bands gray to black, and sometimes a less well defined median band; mantle often has pale yellow spots that sometimes disrupt the dark bands; body with a pair of thinner bands lateral to the dorsal mid-line; breathing pore surrounded by a whitish area; sole whitish; slime clear.

REMARKS: The threeband gardenslug in North America occurs in natural areas as well as greenhouses and other urban habitats. This slug can be a serious pest on garden vegetables.

Fig. 94. *Lehmannia valentiana*, upper, St. Louis County; lower, Jackson County.



DISTRIBUTION: New State Record. *Lehmannia valentiana* is found in widely scattered localities in the southern half of Missouri. It is native to Spain, and has been introduced widely into North America.

TYPE LOCALITY: Spain

Deroceras laeve (Müller 1774)

Meadow slug

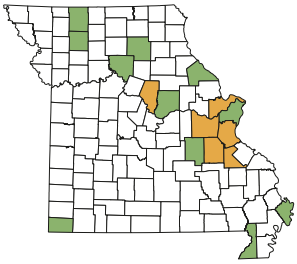
Fig. 95. *Deroceras laeve* (Müller 1774), length about 20 mm, Crawford County.

DESCRIPTION: Slug length 15 to 30 mm extended; mantle with fine concentric lines; breathing pore located on the posterior right side of the mantle. ***Color:*** usually dark gray to black, some individuals may be light gray to amber; body and mantle devoid of splotches or pigmented lines; border of breathing pore dark, slime clear and watery.

REMARKS: The meadow slug is found in prairies, lowlands and woodlands, as well as urban lawns, gardens and greenhouses. It has been reported, along with two other slug species (*Deroceras reticulatum* and *Arion subfuscus*) as a common pest of field crops in Ohio (see *D. reticulatum* Remarks, Page 104).

This species is a host for the brainworm nematode, *Parelaphostrongylus tenuis* (see *Haplotrema concavum* Remarks, Page 70).

In Missouri, fossil internal shells of *Deroceras* laeve have been found in loess deposits from St. Louis County (Hubricht 1964a).



DISTRIBUTION: *Deroceras laeve* is native to Missouri, and is found in all of the natural divisions except the Osage Plains. It is widespread from Texas to Iowa, east to New Hampshire and south to Florida.

TYPE LOCALITY: Denmark

Deroceras reticulatum (Müller 1774)

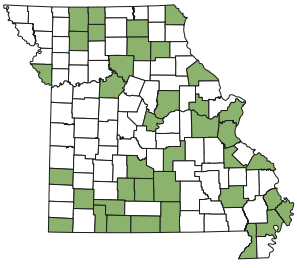
Gray Fieldslug

Fig. 96. *Deroceras reticulatum*, length about 45 mm, St. Louis County.

DESCRIPTION: Slug length 35 to 50 mm extended, slender; internal shell slightly convex, thin and showing faint growth lines; mantle with concentric rings, centered to the right of the middle; mantle more than ⅓ of total length; breathing pore in posterior ¼ of mantle; sole tripartite. ***Color:*** of most Missouri *Deroceras reticulatum* are light cream color, some have pigmented blotches or reticulations on the body outlined in dark colors; breathing pore has a white border; slime clear but becoming milky white when the slug is irritated; sole whitish or dirty yellow, median part gray.

REMARKS: The gray fieldslug is larger than the native *Deroceras laeve*. It also has a shorter life cycle; it hatches from eggs in the spring, grows to maturity and lays eggs in the fall for the next year's generation. It can be a serious pest on garden vegetables, although it also consumes dead slugs and other animal matter. In Ohio, the gray fieldslug is a common pest of field crops, and is most problematic with no-till practices where crop residues are left on the surface (Hammond, Michel & Eisley 2009).

Deroceras reticulatum is reported to be a host for the brainworm nematode (see *Haplotrema concavum* Remarks, Page 70).



DISTRIBUTION: New State Record. *Deroceras reticulatum* is an introduced species in North America, and is widespread, occurring in most states and provinces.

TYPE LOCALITY: Gardens of Rosenburg and Fredriksdal, Denmark

Hawaiia alachuana (Dall 1885)

Southeastern Gem

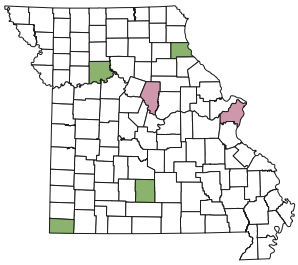
DESCRIPTION: Similar to *Hawaiia minuscula* in most aspects (see below); differs by a wider umbilicus, contained about 2.5 times in diameter of shell; in basal view the lip joins body whorl outside the midline of the whorl. In dorsal view, the body whorl is larger than in *H. minuscula*.

REMARKS: The southeastern gem is typically found under moist leaves and logs.

Missouri fossil shells of *Hawaiia alachuana* were found in Pleistocene age talus in Boone and St. Louis counties (Hubricht 1964a).

Fig. 97. *Hawaiia alachuana*, with remains of fly (diptera) pupae showing within the apertures. The identity of the fly is unknown.

Fig. 98. *Hawaiia alachuana*, Barry County, diameter 2.5 mm.



DISTRIBUTION: New State Record. *Hawaiia alachuana* is found in the Glaciated Plains and Ozark natural divisions of Missouri. Although widespread within the state, this is an uncommon species. Elsewhere, this species ranges from Texas, north to Michigan, east to New York and south to Florida.

TYPE LOCALITY: Alachua County, Fla.

Hawaiia minuscula (A. Binney 1840)

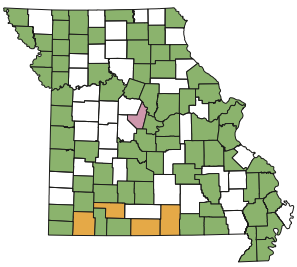
Minute Gem

DESCRIPTION: ***Shell:*** minute, diameter 2.0 to 2.8 mm, height 1.2 mm, moderately solid; shape depressed; whorls about 4, convex; suture deeply impressed; umbilicus widely open, contained about three times in diameter of shell, in basal view the lip joins body whorl about midway between the umbilicus and the midline of the whorl. ***Aperture:*** rounded, lunate, without lamellae; peristome thin; parietal callus thin, outer edge nearly straight. ***Surface:*** of embryonic whorl smooth; later whorls with fine uneven growth lines; spiral striae faint or not visible. ***Color:*** grayish white with faint brownish cast, translucent. ***Animal:*** bluish black.

REMARKS: The minute gem is found in almost all Missouri habitats, and it is one of the most common species found in soil samples. According to Hubricht (1985: 29), it is a species of bare ground.

Missouri fossils of *Hawaiia minuscula* were found in Pleistocene age loess and talus deposits from Callaway, Moniteau, and St. Charles counties (Hubricht 1964a, Greger 1933).

Fig. 99. *Hawaiia minuscula*, 2.5 mm, St. Louis County.



DISTRIBUTION: *Hawaiia minuscula* is widespread in Missouri, and is found in all of the natural divisions. It is also known from Texas to Minnesota, east to Maine, and south to Florida.

TYPE LOCALITY: Ohio

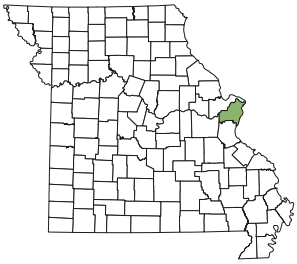
Arion hortensis Férussac 1819

Black Field Slug

DESCRIPTION: Slug length about 30 mm extended, slender; body without conical projections when contracted, mantle covers approximately one-third of body anteriorly. ***Color:*** slate-gray or bluish gray, with a broad, almost black band mid-dorsally and a black band on each side extending onto the mantle; head dark, the neck lighter; foot fringe and the sole of the foot yellow to orange due to the color of the imbedded slime, foot color disappears when the animal is preserved in alcohol.

Fig. 100. *Arion hortensis*, length about 30 mm, St. Louis County.

REMARKS: Ten to 50 transparent eggs are laid; they later become yellow and opaque. Eggs are about 2 by 2.5 mm. In New England there are two generations per year, one in the spring and a second that hatches in the fall. Each group mates in about six months and produces the next generation. They are believed to live less than a year. The black field slug is a serious pest on daffodils, strawberries and many garden plants.



DISTRIBUTION: New State Record. *Arion hortensis* has been found on private property at one site in St. Louis County. It is an introduced species, and occurs across North America, primarily in the northern states and Canada.

TYPE LOCALITY: unknown

Arion intermedius (Normand 1852)

Hedgehog Arion

Fig. 101. *Arion intermedius*, length extended about 20 mm, St. Louis City.

DESCRIPTION: Slug length less than 25 mm extended, somewhat robust; body when contracted with conical projections, giving a bristly appearance; projections not apparent in preserved specimens, mantle covers the anterior one-fourth of body. ***Color:*** of body gray with black dots anteriorly above the foot fringe; lateral bands very faint or absent; sole whitish gray, but may appear yellowish due to yellow slime.

REMARKS: The hedgehog arion is found under moist leaves, rocks, bricks and boards. In Missouri, it was first found on the grounds of the Missouri Botanical Garden in St. Louis, and later also found on the grounds of the St. Louis Zoo. Mr. Charlie Hoessel, director emeritus of the St. Louis Zoo, mentioned that the botanical garden often supplied the zoo with a variety of landscaping plants.

The ellipsoid eggs are white, and are laid in clusters of about one to 24 eggs. Their approximate size is 1.5 mm by 2.0 mm. The species multiplies rapidly, according to one author's (RO) experience. A few individuals apparently escaped from their growing boxes and established themselves in his backyard. Within three years they were common in suitable habitat.

DISTRIBUTION: New State Record. In Missouri, *Arion intermedius* has been found only in St. Louis County and the City of St. Louis. It is an introduced species, and occurs across North America, primarily in the northern states and Canada.

TYPE LOCALITY: Europe

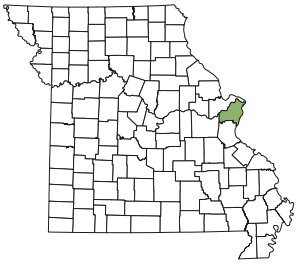
Arion subfuscus (Draparnaud 1805)

Dusky Arion

DESCRIPTION: Slug length about 60 mm extended, slender; without conical projections when contracted, mantle covering about the anterior one-third of body, sole is tripartite although it may be difficult to discern. ***Color:*** varies from brown, to light orange-brown, to bright orange, with pair of darker bands, one on each side, extending the full length of body, and with a dark, irregular cloud on top of mantle; dark markings are sometimes not clearly visible; foot fringe, in darker individuals, is marked with vertical, dark streaks; slime is yellow.

Fig. 102. *Arion subfuscus*, length 60 mm extended light orange-brown color form, with faint longitudinal bands, and without dark, vertical marks on foot fringe; St. Louis County.

REMARKS: In some areas *Arion subfuscus* it is considered a pest, feeding on a variety of garden plants. It has been reported along with two other slug species (*Deroceras reticulatum* and *D. laeve*) as a common pest of field crops in Ohio (see *D. reticulatum* Remarks, Page 104). It lays greenish yellow oval eggs, up to several dozen at one time, each about 2.7 mm in diameter.



DISTRIBUTION: New State Record. *Arion subfuscus* was found in Emmenegger Park in St. Louis County. It is an introduced species, originally from Europe, and reported in North America from northeastern states, Canada and California.

TYPE LOCALITY: France

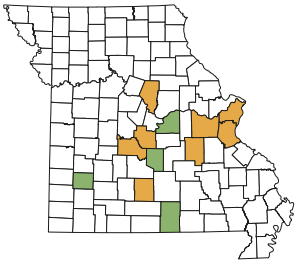
Megapallifera mutabilis (Hubricht 1951)

Changeable Mantleslug

Fig. 103. *Megapallifera mutabilis*, Howell County.

DESCRIPTION: Slug length about 25 mm while resting to about 50 mm when moving. The mantle covers most of the body. The pneumostome is located behind the right antennae in the front lower quarter of the mantle edge. Immature individuals have a series of oblique dark bands on their sides, which anteriorly merge with an indistinct dorsal band that often can be seen only in reflected light. With maturity, the oblique bands dissociate into gray brown spots on the sides. The lower portions of the bands fade into the pale tan background, while the upper portions remain more sharply defined. Small irregular spots occur randomly over most of the body.

REMARKS: The changeable mantleslug lives in moist woodlands wherever moist hiding places are available.



DISTRIBUTION: In Missouri, this is a slug primarily of the Ozark Division. Elsewhere, it occurs from eastern Texas to Iowa and in most states to the east.

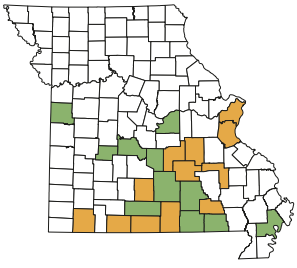
Megapallifera ragsdalei (Webb 1950)

Ozark Mantleslug

Fig. 104. *Megapallifera ragsdalei*, alcohol-preserved specimen, length 18 mm, Shannon County

DESCRIPTION: Slug medium-sized, mantle covering almost all of body. Colored with shades of black on a light background; sides with black oblique lines, sloping up and backward and originating from an intense, ragged, black band on the lateral sides of the body; dorsal midline with gray band and black spots or splotches.

REMARKS: The Ozark mantleslug is one of the easiest slugs to identify in Missouri. No other slug has the distinctive backward-sloping black lines emanating from a black band along the lower sides of the body. It is often found in and around cave entrances and other damp moist places. Webb (1950), who described the species, considered it to be lichenivorous. He found individuals on sandstone cliffs in association with *Neohelix alleni*.



DISTRIBUTION: *Megapallifera ragsdalei* is found only in the southern half of the state, in the Ozark, Ozark Border, Osage Plains and Mississippi Lowlands natural divisions. *Megapallifera ragsdalei* is endemic to the Ozark Plateau, and is found only in Missouri, Oklahoma, Arkansas and Illinois.

TYPE LOCALITY: six miles east of Calico Rock, State Route 56, Izard County, Ark.

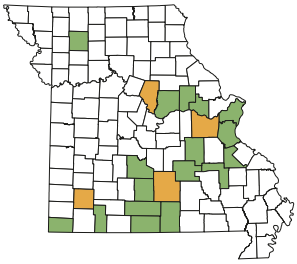
Pallifera marmorea Pilsbry 1948

Marbled Mantleslug

DESCRIPTION: Slug length about 42 mm contracted, to about 70 mm extended, robust; mantle is attached to the body near the anterior end and covers most of the body. ***Color:*** buff, marbled with dark gray; markings less dense near the ventral margin; gray blotches never organized into dorsal longitudinal bands as in *Philomycus carolinianus*, or into backward-sloping pigment bars as in *Megapallifera ragsdalei*.

Fig. 105. *Pallifera marmorea*, Taney County.

REMARKS: Within its range, the marbled mantleslug needs a moist environment. It is found in wooded areas, under leaves and rocks, on logs and under bark.



DISTRIBUTION: *Pallifera marmorea* is found in the Ozark, the Ozark Border and Glaciated Plains natural divisions. It occurs only in Oklahoma, Arkansas, Missouri, and Illinois.

TYPE LOCALITY: Oakwood, Champaign County, Ill.

Philomycus carolinianus (Bosc 1802)

Carolina Mantleslug

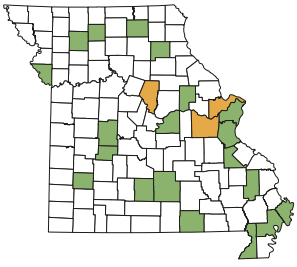
Fig. 106. *Philomycus carolinianus*, length about 75 mm, St. Louis County.

Fig. 107. *Philomycus carolinianus*, brownish "Ozarkian" form with reduced markings, Howell County.

DESCRIPTION: Slug length 75 to 100 mm extended, robust; mantle covering back and sides. ***Color:*** gray to brown background with three dark bands, one on the dorsal midline and one on each side; usually with two rows of elongated black spots on either side of the midline; in some highly pigmented individuals the black spots and the midline dark band may coalesce into a single black band; in pale individuals with reduced markings, the dorsal rows of spots may be absent; dark markings vary from black to dark brown; sole dull yellowish white.

REMARKS: The Carolina mantleslug lives in mesic woodlands and hillsides, and is found under bark, under leaves and crawling on logs. Individuals with reduced markings and brownish coloration were noted by Pilsbry (1948: 758) as an Ozarkian form of the species, which he named *Philomycus carolinianus flexuolaris*. Hubricht (1951b: 21) elevated *P. c. flexuolaris* to species, and restricted the species definition to exclude the Ozarkian form. As now understood, *P. flexuolaris* occurs only in the Appalachians. Although distinctive, the brownish Ozarkian form noted by Pilsbry is treated as variation within P. carolinianus.

Philomycus carolinianus is a host for the brainworm nematode, *Parelaphostrongylus tenuis* (see *Haplotrema concavum* Remarks, Page 70).



Distribution of *Philomycus carolinianus*; left: typical form; right: brownish, "Ozarkian" form.

DISTRIBUTION: *Philomycus carolinianus* is found in all of the natural divisions of Missouri except the Mississippi Lowlands. It is a native species, and occurs in eastern North America from Canada south to Florida and Texas.

TYPE LOCALITY: Charleston, S.C.

Species in this genus were formerly placed in the genera *Polygyra* and *Millerelix* (Pilsbry 1940; Turgeon et al. 1998; Emberton 1995a).

Daedalochila dorfeuilliana (I. Lea 1838)

Oakwood Liptooth

DESCRIPTION: ***Shell:*** small, diameter 7 to 9 mm, height 3 to 3.5 mm, solid; shape discoidal; whorls about 5½, moderately convex, tightly coiled in dorsal view; suture moderately impressed; umbilicus small in the center, greatly expanding in last ½ to 1 whorl. ***Aperture:*** rounded, semilunate, nearly occluded by large lamellae; parietal lamella arises from near the insertions of the lip, occludes more than ½ of aperture, and is wide and rectangular on the distal end; outer lip with two recessed lamellae, which are blunt, triangular, parallel to edge of lip, and separated by a deep, rectangular notch; upper palatal lamella usually larger and slightly more deeply recessed; columellar lamella blunt and recessed about ⅛ turn within aperture, sometimes visible through base of shell; peristome reflected and strongly thickened; parietal callus covered by large parietal lamella. ***Surface:*** shiny; embryonic whorl smooth; later whorls with coarse and regular axial ridges, nearly smooth ventrally; bottom of body whorl with fine spiral striae. ***Color:*** light brown; lip white with brownish tint, darker on outer lip.

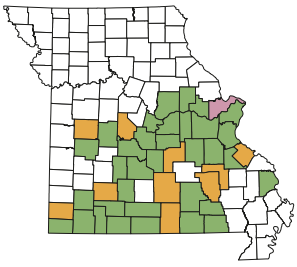
Fig. 108. *Daedalochila dorfeuilliana s. str.*, diameter 8.1 mm, St. Louis County; umbilicus (upper right) with about ½ turn of the suture visible.

REMARKS: A large-umbilicus form of *Daedalochila dorfeuilliana* was originally described as the species, *D. sampsoni* Weatherby (in the genus *Polygyra*), and later reduced to a subspecies of *D. dorfeuilliana* by Pilsbry (1940: 636). In the typical form of *D. dorfeuilliana*, the suture within the umbilicus is visible for about ½ turn, and the umbilicus of the body whorl appears to be offcenter. In *D. d. sampsoni*, the suture within the umbilicus is visible for a full turn or slightly more, and the umbilicus of the body whorl appears to be centered. Some southwestern Missouri populations are clearly the large-umbilicus form, *D. d. sampsoni*; however, the umbilicus is variable throughout most of its range.

Fig. 109. *Daedalochila dorfeuilliana sampsoni*, diameter 9 mm, Barry County; umbilicus with a full turn of the suture visible; columellar lamella showing through the shell wall about ⅛ turn from aperture.

The oakwood liptooth is a snail of xeric habitats, and is found in glades, xeric roadsides, stony hillsides and rocky pastures.

Fossils of *Daedalochila dorfeuilliana* were found in Pleistocene age talus from Franklin, St. Charles, and St. Louis counties (Hubricht 1964a).



DISTRIBUTION: In Missouri, *Daedalochila dorfeuilliana* is found in the Ozark and Ozark Border natural divisions. This species has a limited distribution, centered in the Ozark Plateau, but extending southwest to central Texas. It occurs only in Texas, Oklahoma, Kansas, Missouri, Arkansas, Louisiana, and southwestern Illinois.

TYPE LOCALITY: Uncertain. Reported as Cincinnati, Ohio, or Kentucky opposite Cincinnati; however, the species does not occur east of Illinois (Pilsbry 1940: 635).

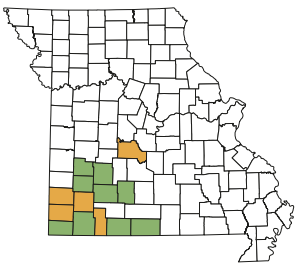
Daedalochila jacksoni (Bland 1866)

Ozark Liptooth

DESCRIPTION: ***Shell:*** small, diameter 6.3 to 8.2 mm, height 3.0 to 3.9 mm, solid; shape discoidal; whorls 5½ to 6, slightly convex, tightly coiled in dorsal view; body whorl constricted laterally and inflated dorsally behind the aperture (Fig. 110); suture moderately impressed; umbilicus very small in center, greatly expanded in last ¼ whorl. ***Aperture:*** rounded, semi-lunate, nearly occluded by three prominent lamellae; parietal lamella large and triangular, base continuous with lip, face concave; outer lip with two wide overlapping lamellae, not parallel with edge of lip; lower palatal lamella joined to lip edge at bottom end, directed inward toward upper end; upper palatal lamella deeply recessed, seen outside the shell as an elongate, whitish callus; columellar lamella absent; parietal callus covered by large parietal lamella; peristome reflected, thickened within. ***Surface:*** shiny; embryonic whorls smooth or with a few faint axial lines; later whorls with moderately coarse, somewhat irregular axial ridges; spiral striae scattered and indistinct. ***Color:*** light brown; lip white with brownish tint, darker on outer lip.

REMARKS: This species lives in xeric woodlands, glades, and well drained rocky pastures.

Fig. 110. *Daedalochila jacksoni*, diameter 3.4 mm, Barry County.



DISTRIBUTION: *Daedalochila jacksoni* is found only in the southwestern part of the Ozark Natural Division in Missouri. As the common name implies, this species is an Ozark Plateau endemic, and occurs only in eastern Oklahoma, southeastern Kansas, Arkansas, and Missouri.

TYPE LOCALITY: Fort Gibson, Muskogee County, Okla.

Daedalochila leporina (Gould 1848)

Gulfcoast Liptooth

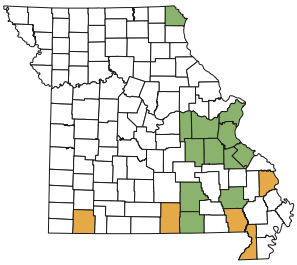
DESCRIPTION: ***Shell:*** small, diameter 5.7 to 6.5 mm, height 3.2 to 3.7 mm, solid; shape depressed; whorls about 5, moderately convex, suture slightly impressed; umbilicus partially covered by leading edge of reflected lip. ***Aperture:*** narrow, somewhat slit-like; parietal lamella relatively long, nearly straight; outer lip with two unequal-sized lamellae on a thickened ridge, lamellae separated by a deep notch; columellar wall with vertical buttress just inside the aperture, usually blocked from view by other lamellae, but sometimes visible through the base of the shell as a whitish spot; peristome reflected, outer edges relatively thin; parietal callus thin and transparent, outer edge "S"-shaped, surface finely granulose. ***Surface:*** dull; first embryonic whorl smooth, second whorl with short, closely spaced striae along the suture; later whorls with fine, irregular growth wrinkles and sparse hairs; hairs are easily rubbed off; adults are usually hairless, but hair scars or papillae remain. ***Color:*** brown.

REMARKS: The gulfcoast liptooth resembles species of *Stenotrema*, and is very different from the other *Daedalochila*. It differs from *Stenotrema* species by having a more widely open aperture and a partially open umbilicus.

Daedalochila leporina is found mostly in mesic woodlands.

Fossils of *Daedalochila leporina* were found in Pleistocene age talus in St. Louis County (Hubricht 1964a).

Fig. 111. *Daedalochila leporina*, diameter 6 mm, Crawford County.



DISTRIBUTION: *Daedalochila leporina* has been found in the Glaciated Plains, Ozark and Ozark Border natural divisions, primarily in the southeastern part of the state. This species is limited to the southern states, from Texas to Mississippi, north to Indiana.

TYPE LOCALITY: White Rock Springs, Ark.

Stenotrema barbatum (G. H. Clapp 1904)

Bristled Slitmouth

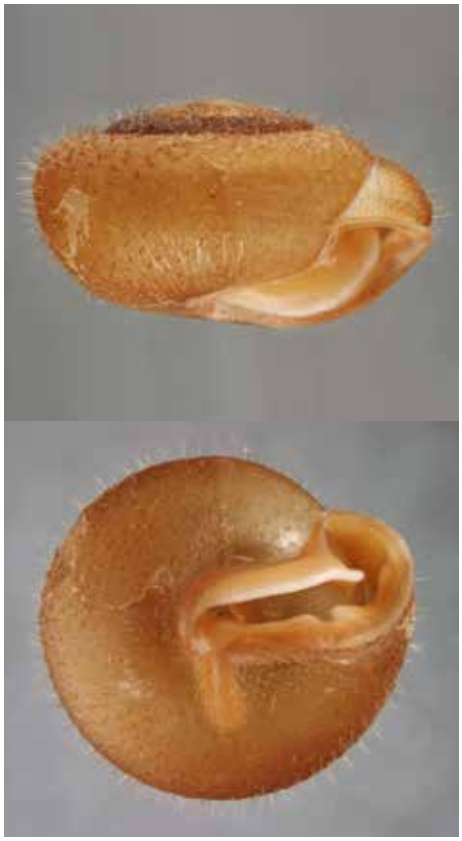
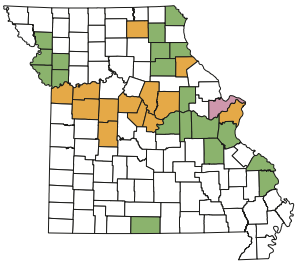


Fig. 112. *Stenotrema barbatum*, diameter 7.5 mm, Washington County.

DESCRIPTION: ***Shell:*** small, diameter 7.5 to about 9.0 mm, height about 5 mm, solid; shape depressed; whorls about 5½, slightly convex, body whorl strongly descending at aperture; suture moderately impressed; fulcrum very large, located about ¼ turn from aperture and extending from the axis to about half way across the whorl, sometimes visible through the base of shell as a whitish opaque area; shell imperforate. ***Aperture:*** slit-like, forming "J"-shaped opening with elongate parietal lamella; gap between parietal lamella and lip about 1 mm; parietal lamella nearly straight in basal view, with small to moderate buttress extending to lip; peristome reflected along outer edge, basal lip fused to body whorl from columella to notch or just beyond; parietal callus narrow beyond parietal lamella, thin, surface granulose. ***Surface:*** of embryonic whorl glossy, axial ridges thin and widely spaced, not granulate; later whorls dull, with fine growth wrinkles, and with long, fine hairs (hairs about 0.5 mm in length). ***Color:*** cinnamon.

REMARKS: The bristled slitmouth is found under logs and leaf litter in mesic woodlands and bottomland habitats. This species was also collected in moderate numbers by sweeping nettles (*Laportea canadensis*) and other bottomland vegetation with an insect sweep net.

Missouri fossil shells of *Stenotrema barbatum* were found in Pleistocene age loess, talus and silt deposits from Boone, Callaway Franklin, Jefferson, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Stenotrema barbatum* occurs primarily in northern and eastern Missouri, and is found in all natural divisions in the state except the Osage Plains and the Mississippi Lowlands. The record from Ozark County is an outlier and is based on a single specimen; however, the specimen meets all criteria used to recognize the species. Outside of Missouri, this species ranges from eastern Kansas to Minnesota, east to Connecticut, and south to Alabama.

TYPE LOCALITY: From the floodplain of the Tallapoosa River near the Montgomery road about five miles southwest of Wetumpka, Ala.

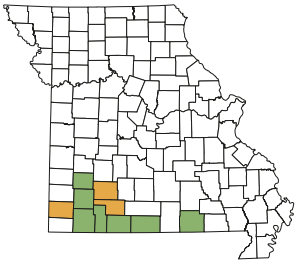
Stenotrema blandianum (Pilsbry 1903)

Missouri Slitmouth

Fig. 113. *Stenotrema blandianum*, diameter 8.1 mm, Dade County; lower lip protruding around notch.

DESCRIPTION: ***Shell:*** small, diameter 7.6 to 8.3 mm, height 4.3 to 4.5 mm, solid; shape depressed; whorls 5 to 5½, moderately convex; periphery slightly angular, above the midline of the body whorl; body whorl strongly descending at aperture; suture moderately impressed; fulcrum on interior of body whorl located about ¼ turn from aperture, extending from the axis to about ⅓ the width of the whorl, and sometimes visible through base of shell as a whitish opaque area; shell imperforate. ***Aperture:*** slit-like, forming a "J"-shaped opening with elongate parietal lamella, gap between parietal lamella and lip about 0.5 mm or less; parietal lamella long and high; inner end curved toward axis, outer end angled into aperture, thickened on the end; peristome reflected along outer edge, basal lip fused to body whorl from columella to well beyond notch, and near end of parietal lamella; notch of basal lip thickened and protruding, usually visible below the parietal lamella in lateral view (Fig. 113, upper); parietal callus relatively thick, outer edge nearly straight, curving around axis, surface coarsely granular. ***Surface:*** dull, embryonic whorls with fine axial ridges; some ridges interrupted and appearing granular; later whorls with irregular growth ridges and very fine wrinkles; surface without hairs or hair scars, or rarely with scattered hairs at suture and periphery. ***Color:*** pale cinnamon-brown.

REMARKS: This snail was found primarily in mesic floodplains, under rocks and leaves, and under and around rocks below river bluffs (Hubricht 1985: 40).



DISTRIBUTION: *Stenotrema blandianum* is concentrated in the southwestern part of the state, and is found only in the Ozark Natural Division. *Stenotrema blandianum* is nearly an endemic Missouri snail, and is recorded only from one area outside of Missouri, in Marion County, Ark.

TYPE LOCALITY: Springfield, Greene County, Mo.

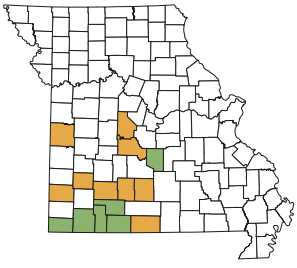
Stenotrema labrosum (Bland 1862)

Ozark Slitmouth

Fig. 114. *Stenotrema labrosum*, diameter 11 mm, Barry County.

DESCRIPTION: ***Shell:*** medium, diameter 10.5 to 12.7 mm, height 6.1 to 7.2 mm, solid; shape depressed, conic, whorls flattened above, body whorl strongly descending at aperture; suture very slightly impressed, periphery angular, above midline of body whorl; fulcrum on interior of body whorl located about ¼ turn from aperture, extending a very short distance from the axis, and sometimes visible through base of shell as a small whitish opaque area near columella; shell imperforate. ***Aperture:*** slit-like and forming "J"-shaped opening with elongate parietal lamella, gap between parietal lamella and lip about 0.5 mm; parietal lamella with inner end curved around axis, outer end angled inward and with small buttress extending toward lip; peristome reflected along outer edge, basal lip narrow, thickened, and fused to body whorl from columella to well beyond notch; parietal callus narrow beyond parietal lamella, thin, surface granulose. ***Surface:*** dull, embryonic whorls with minute axially lengthened granules; later whorls with short ridges of periostracal material on upper surface, and in well preserved, young shells with fringe of hairs at sutures and periphery, and rarely with scattered small hairs on under surface. ***Color:*** light cinnamon-brown; edges of lip whitish.

REMARKS: The Ozark slitmouth was found under leaves and debris on upland hillsides.



DISTRIBUTION: *Stenotrema labrosum* is restricted to the southwestern part of the Ozark and Osage Plains natural divisions in Missouri, and elsewhere occurs only in eastern Oklahoma and northwestern Arkansas. This is an Ozark Plateau endemic species.

TYPE LOCALITY: Hot Springs, Garland County, Ark.

Stenotrema stenotrema (Pfeiffer 1842)

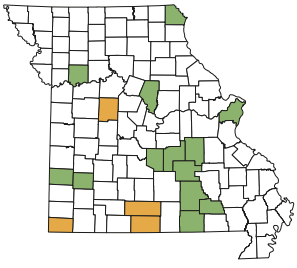
Inland Slitmouth

Fig. 115. *Stenotrema stenotrema*, diameter 10 mm, Oregon County.

DESCRIPTION: ***Shell:*** small to medium, diameter 8.0 to about 10.0 mm, height 5.5 to 7.0 mm, solid; shape depressed, conic; whorls about 5½, convex, body whorl strongly descending at aperture, suture moderately impressed; fulcrum on interior of body whorl located about ¼ turn from aperture, extending a short distance from the axis, and sometimes visible through base of shell as a whitish opaque spot; shell imperforate. ***Aperture:*** slit-like, forming a "J"-shaped opening with elongate parietal lamella, gap between parietal lamella and basal lip about 0.5 mm; parietal lamella nearly straight in basal view, inner end curved toward axis, outer end curved inward and with small buttress extending to lip; peristome reflected along outer edge, basal lip fused to body whorl from columella to well beyond notch; parietal callus narrow beyond parietal lamella, thin, surface granulose. ***Surface:*** of embryonic whorls dull and coarsely granulate, granules sometimes arranged in rows, but not forming distinct axial ridges; later whorls with fine uneven growth wrinkles, and rows of short hairs, about 0.2 mm long; hairs often worn off in mature shells and visible only as hair scars. ***Color:*** brownish tan to cinnamon-brown.

REMARKS: *Stenotrema stenotrema* was found primarily in mesic forests, base of bluffs along river corridors and nearby hillsides.

Missouri fossils of the inland slitmouth were found in Pleistocene age talus from Boone and St. Louis counties (Hubricht 1964a).



DISTRIBUTION: *Stenotrema stenotrema* was found primarily in the southern half of Missouri, with an isolated record in northeastern Clark County. It occurs in the Glaciated Plains, Osage Plains, Ozark and Ozark Border natural divisions. Elsewhere, it ranges from Texas, east to Ohio and Georgia.

TYPE LOCALITY: Indiana

The species in this genus were formerly placed in the genus *Stenotrema* under the group *Monodon* and section *Euchemotrema* (Pilsbry 1940). More recently, *Euchemotrema* has been treated as a genus (Emberton 1995a: 88).

Euchemotrema fraternum (Say 1824)

Upland Pillsnail

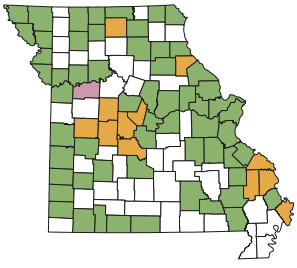
DESCRIPTION: ***Shell:*** small to medium, diameter 7.8 to 10.5 mm, height 5.9 to 6.9 mm, solid; shape globose-depressed; whorls 5 to 5⅔, convex, whorls more loosely coiled than *E. leai aliciae*, suture moderately impressed; shell imperforate to nearly covered perforate. ***Aperture:*** narrow oval, lunate; parietal lamella long, low, nearly straight; internal fulcrum located about ¼ turn in aperture, fulcrum short, sometimes visible through base of shell as whitish opaque area; peristome reflected, thickened within, the thickened portion may terminate near the columella creating a notch; parietal callus with outer edge "S"-shaped, surface granulose. ***Surface:*** dull, embryonic whorls closely covered with axially lengthened granules, often difficult to observe; later whorls densely covered with short hairs aligned with the growth lines; hairs often worn away with only their bases visible; spiral lines indistinct. ***Color:*** tan to tawny buff or cinnamon buff.

Fig. 116. *Euchemotrema fraternum*, diameter 7.8 mm, Green County.

REMARKS: The upland pillsnail lives in a variety of habitats; it's frequently found under leaf litter, logs and rocks in mesic and upland woodlands, but also occurs in grassland habitats.

Euchemotrema fraternum is an intermediate host for the brainworm nematode (see *Haplotrema concavum* Remarks, Page 70).

In Missouri, fossils of the upland pillsnail were reported in Pleistocene age talus from Boone, Callaway, Franklin, Jefferson, Lafayette, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a, Hubricht 1985).



DISTRIBUTION: *Euchemotrema fraternum* is widespread in Missouri, and was found in all of the natural divisions. This snail is reported from Missouri north to Minnesota, east to Maine, and south to northern Alabama.

TYPE LOCALITY: Philadelphia, Pa.

Euchemotrema leai aliciae (Pilsbry 1893)

Alice's Pillsnail

DESCRIPTION: ***Shell:*** small, diameter 7.3 to 7.8 mm, height 3.9 to 4.7 mm, solid; shape depressed globose; whorls 5½ to 6, convex, tightly coiled, suture moderately impressed; periphery high on body whorl; umbilicus partially covered by the lip. ***Aperture:*** narrow oval, lunate; parietal lamella thin and long, outer end straight, inner end curved to axis; internal fulcrum located about 1/10 turn in aperture, fulcrum long, sometimes visible through base of shell as whitish opaque area; peristome reflexed, thickened within, more so on basal lip; thickening may terminate before columella, creating a distinct notch; parietal callus thin and transparent, outer edge "S"-shaped, surface granulose. ***Surface:*** dull; embryonic whorls with closely spaced, axial ridges; outer whorls with very fine, irregular growth wrinkles and short hairs or hair scars. ***Color:*** cinnamon-brown.

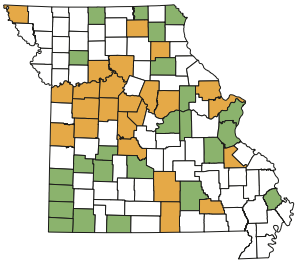
REMARKS: Alice's pillsnail is found mostly in mesic woodlands, but occasionally on prairies and more xeric hillsides.

This subspecies is distinguished from other members of the genus by the combination of relatively smaller size, more tightly coiled whorls and partially covered umbilicus.

The name *aliciae* was given to this subspecies by Dr. Pilsbry in honor of his sister Alice.

In Missouri, fossils of *Euchemotrema leai aliciae* were found in Pleistocene age talus in Boone and St. Louis counties (Pilsbry 1940, Hubricht 1964a).

Fig. 117. *Euchemotrema leai aliciae*, diameter 8.2 mm, Cedar County.



DISTRIBUTION: *Euchemotrema leai aliciae* is widespread in Missouri, and it was found in all of the natural divisions. Although this subspecies was recorded from many counties in the historical literature, we cannot determine if it is declining in numbers, or if the apparent decline results from inconsistent identification and collecting. It is known from Texas north to Kansas, east to Illinois and Kentucky, and south to Alabama.

TYPE LOCALITY: Near Lake Charles, Calcasieu Parish, La.

Euchemotrema leai leai (A. Binney, 1840)

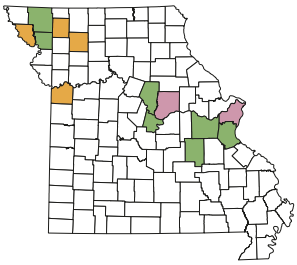
Lowland Pillsnail

DESCRIPTION: ***Shell:*** medium, diameter 6.1 to 9.4, height 3.9 to 5.7mm, solid; shape depressedglobose; whorls about 6, convex, suture moderately impressed; umbilicus moderately large, slightly covered by the reflected lip. ***Aperture:*** narrow-lunate; parietal tooth relatively short, straight, and not prolonged toward columella; internal fulcrum located about ¼ turn in aperture, fulcrum relatively short, sometimes visible through base of shell as whitish opaque area; peristome reflected, thickened within; parietal callus thin and transparent, outer edge "S"-shaped. ***Surface:*** dull; embryonic whorls smooth to granulate with fine axially lengthened granules; later whorls with faint growth wrinkles and fine hairs, the later usually worn away on adult shells. ***Color:*** light cinnamon-brown.

REMARKS: The Lowland Pillsnail was found predominately in moist grasslands and woodlands, under leaves and log.

Fossils are reported from Michigan, Illinois, and Indiana, and are probably from the Sangamon interglacial loess (Pilsbry, 1940: 679); from Pleistocene sediments in Indiana (Wayne, 1959); and from Wisconsin Stage glacial deposits in seven counties in Illinois (Leonard & Frye, 1960: 11).

Fig. 118. *Euchemotrema leai leai*, width 8mm, Crawford County.



DISTRIBUTION: *Euchemotrema leai leai* was found in the Glaciated Plains, Ozark, Ozark Border natural divisions of Missouri. This is a northern species, occurring from Kansas to Minnesota and Upper Michigan, and east to New York.

TYPE LOCALITY: Alpena County, Mich.

Mesodon clausus (Say 1821)

Yellow Globelet

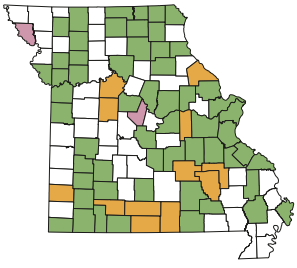
Fig. 119. *Mesodon clausus*, diameter 16.4 mm, Washington County.

DESCRIPTION: ***Shell:*** medium, diameter 12.5 to 19.5 mm, height 10.0 to 13.0 mm, solid; shape globose; whorls 5 to 5½, convex, suture moderately impressed; umbilicus mostly covered by the reflected lip and rarely completely closed. ***Aperture:*** rounded, lunate, without lamellae; peristome reflected, thickened within and a furrow behind; parietal callus relatively thin, translucent, leading edge "S"-shaped. ***Surface:*** shiny, embryonic whorls smooth; later whorls with axial ridges and distinct spiral striae. ***Color:*** light yellowish brown; growth/rest periods sometimes marked by darker bands. ***Animal:*** light colored.

REMARKS: The yellow globelet prefers mesic conditions, and is usually found in bottomlands, on nearby hillsides, and in grassy areas near wet habitat.

Pilsbry (1940: 712) states that the umbilicus of *M. clausus* always remains open; however, this does not appear to be true for all Missouri specimens. A population from Jefferson County agrees with *M. clausus* in other shell characters, but some individuals (about ⅓) have a large parietal callus, which surrounds and completely closes the umbilicus. Representatives of these were dissected, and the combination of penial characters (as described and illustrated by Emberton 1991) and shell characters indicate these are *M. clausus* with a closed umbilicus.

Missouri fossil shells of *Mesodon clausus* were found in Pleistocene age talus from Boone, Franklin, Holt, Moniteau, Platte, St. Charles, and St. Louis counties (Hambach 1890, Greger 1933, Hubricht 1964a, Hubricht 1985).



DISTRIBUTION: *Mesodon clausus* is widespread in Missouri, and is found in all the natural divisions of the state. It occurs from Oklahoma north to Minnesota, east to Maryland, and south to Alabama.

TYPE LOCALITY: Illinois

Mesodon elevatus (Say 1821)

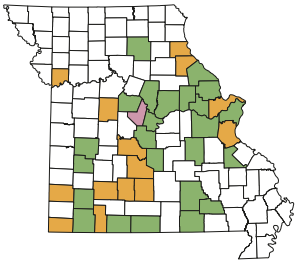
Proud Globe

DESCRIPTION: ***Shell:*** medium to large, diameter 18 to 26 mm, height 14.5 to 20.2 mm, Missouri shells tend be at the lower end of the size range, very solid; shape globose; whorls 6 to 7, convex, closely coiled; suture moderately impressed; shell imperforate. ***Aperture:*** somewhat triangular; parietal lamella short and high; basal lip with low ridge terminating where lip curves upward; peristome broadly reflected, furrowed behind, thickened within; basal lip straight, face slightly concave; parietal callus thin, translucent, leading edge slightly "S"-shaped, inner end wrapped around axial callus. ***Surface:*** somewhat dull, embryonic whorls smooth at tip, otherwise with fine, closely spaced axial lines; later whorls with somewhat regular growth ridges, crossed by distinct spiral striae. ***Color:*** pale olive-brown; one or two major rest periods stained dark brown. ***Animal:*** collar and tentacles slate gray with whitish capped reticulations; sides and tail similar; sole a little lighter.

REMARKS: The proud globe lives in mesic woodlands along river corridors, and is often associated with bluffs and talus; occasionally, it is found in more xeric, upland woodlands. Adults have been found overwintering in the soil, 3–4 inches below the surface.

Missouri fossils of *Mesodon elevatus* were found in Pleistocene age deposits of loess, talus and silt in Boone, Callaway, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht, 1964a).

Fig. 120. *Mesodon elevatus* (Say 1821), 22.6 mm, St. Louis County.



DISTRIBUTION: *Mesodon elevatus* is present in all the natural divisions except the Mississippi Lowlands. It occurs from Oklahoma to Michigan, east to Ohio, and south to northern Alabama.

TYPE LOCALITY: Cincinnati, Ohio

Mesodon thyroidus (Say 1816)

White-lip Globe

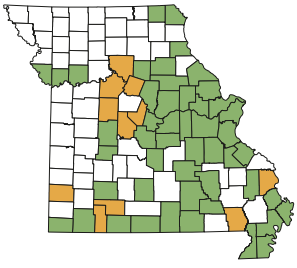
DESCRIPTION: ***Shell:*** medium to large, diameter 18 to 26 mm, height 11 to 18 mm; shape depressed globose; whorls 5 to 5½, convex, suture moderately impressed; umbilicus about ½ covered by the reflected lip. ***Aperture:*** oblique, round to oval, lunate; parietal lamella small, oblique, sometimes absent; peristome widely reflected, surface of reflected lip concave, furrowed behind lip; parietal callus thin and translucent, leading edge "S"-shaped, surface granulose. ***Surface:*** somewhat glossy; embryonic whorls smooth; later whorls with somewhat regular axial ridges and distinct spiral striae. ***Color:*** yellowish brown, brighter yellow behind the lip; lip white.

REMARKS: *Mesodon thyroidus* lives primarily in mesic woodlands along river corridors. During xeric conditions or when entering into hibernation it produces an epiphragm which is thin, transparent and made of mucus that later hardens to produce a moisture barrier. This species overwinters on the surface of the soil, under leaf cover, usually with the aperture facing up.

Mesodon thyroidus is an intermediate host for the brainworm nematode (see *Haplotrema concavum* Remarks, Page 70).

Missouri fossil shells of the white-lip globe were found in Pleistocene age talus in Boone, Callaway, Jefferson, Moniteau, and St. Louis counties (Greger 1933, Hubricht, 1964a).

Fig. 121. *Mesodon thyroidus*, diameter 23 mm, St. Louis County.



DISTRIBUTION: *Mesodon thyroidus* was found in all of the natural divisions of Missouri; although it is most common in the east-central part of the state. It is known from Texas to Upper Michigan, east to Connecticut, and south to Florida.

TYPE LOCALITY: Wissahickon Creek, Philadelphia, Pa.

Mesodon zaletus (A. Binney 1837)

Toothed Globe

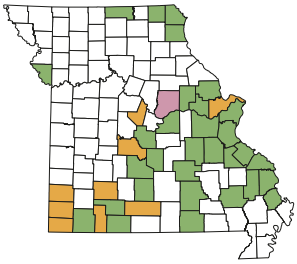
DESCRIPTION: ***Shell:*** large, diameter 20 to 31 mm, height 16 to 24.5 mm; very solid; shape globose; whorls 5½ to 6, moderately convex, suture slightly impressed; shell imperforate. ***Aperture:*** oval, lunate; parietal lamella white, oblique, rather small and low, sometimes absent; basal lip sometimes with a weak lamella near the columella; peristome broadly reflected, furrowed behind; parietal callus moderately thick, translucent to opaque, leading edge "S"-shaped, wrapping around axial callus. ***Surface:*** somewhat dull, embryonic whorl nearly smooth at tip, otherwise with fine axial lines; later whorls with closely spaced axial growth ridges and relatively coarse spiral striae. ***Color:*** pale yellowish brown; lip white. ***Animal:*** mantle strongly marked with irregular black spots, which are somewhat confluent.

REMARKS: *Mesodon zaletus* is found in mesic and xeric woodlands, and is often abundant in moist leaf litter and talus along river corridors.

Some large specimens of this species are similar in general appearance to *Neohelix alleni*; however, *Mesodon zaletus* usually have a parietal tooth, which is absent *N. alleni*, and *M. zaletus* is also less depressed.

In Missouri, fossils of the toothed globe were found in Pleistocene age talus in Callaway, Jefferson, and St. Louis counties (Greger 1933, Hubricht, 1964a).

Fig. 122. *Mesodon zaletus*, diameter 24 mm, St. Louis County.



DISTRIBUTION: *Mesodon zaletus* was found in all the natural divisions in Missouri, however, the authors did not find it in the Osage Plains. It occurs from Oklahoma to Iowa, east to New York, and south to Alabama.

TYPE LOCALITY: Cincinnati, Ohio

Patera pennsylvanica (Green 1827)

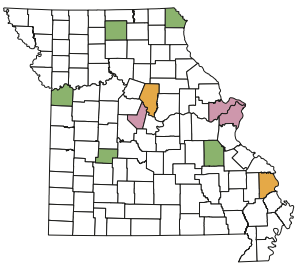
Proud Globelet

DESCRIPTION: ***Shell:*** large, diameter 15.5 to 20.0 mm, height 10.2 to 15.0 mm, solid; shape depressed-globose; whorls 5½ to 6, convex, suture moderately impressed; shell imperforate. ***Aperture:*** somewhat triangular, lower lip elongated; parietal lamella absent; basal lip with a low ridge or blunt lamella; peristome narrowly reflected, face convex, thickened within; parietal callus thin, leading edge shallow "S"-shaped, wrapping around axial callus. ***Surface:*** somewhat dull; embryonic whorl smooth at tip; later whorls with well-defined axial ridges, crossed with spiral striae. ***Color:*** light yellowish brown, brighter yellow behind lip; lip white.

REMARKS: This species is found in moist woodlands along river corridors.

In Missouri, fossil shells of *Patera pennsylvanica* were found in Pleistocene age talus in Boone, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht, 1964a).

Fig. 123. *Patera pennsylvanica*, diameter 18.5 mm, Washington County.



DISTRIBUTION: *Patera pennsylvanica* is a rare species in Missouri, in this study it was found in only five counties in the Glaciated Plains and the Ozark natural divisions. It occurs in a narrow band from Illinois east to Pennsylvania. Missouri is the western limit of its range.

TYPE LOCALITY: Chartiers Creek, Washington County, Pa.

Patera perigrapta (Pilsbry 1894)

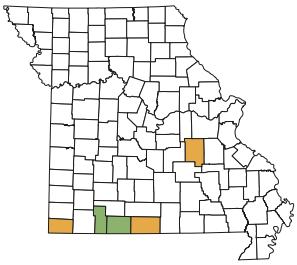
Engraved Bladetooth

DESCRIPTION: ***Shell:*** medium to large, diameter 15.8 to 23.4 mm, height 8.5 to 12.6 mm, solid; shape strongly depressed; whorls 5½ to 6, slightly convex, suture slightly impressed; shell imperforate. ***Aperture:*** somewhat triangular, elongate; parietal lamella short and high, widely separated from the umbilical callus; basal lip with a thickened ridge, terminating before the upward curve of the lip; peristome broadly reflected, thickened within, channeled behind; parietal callus thin and transparent, leading edge shallow "S"-shaped, wrapping around axial callus. ***Surface:*** somewhat dulled by fine sculpture; embryonic whorls with very fine axial lines; later whorls with axial growth ridges, crossed by engraved spiral striae; spiral striae more distinct on the base. ***Color:*** light yellowish brown, brighter yellow behind lip; lip white.

REMARKS: This species is rare in Missouri; recent collections by the authors of this species were only in areas along the White River and its tributaries.

Patera perigrapta lives in mesic forest, talus and glade-like habitats.

Fig. 124. *Patera perigrapta*, diameter 20 mm, Stone County.



DISTRIBUTION: *Patera perigrapta* is primarily a southwestern species in Missouri, is has been found only in the Ozark Natural Division. Elsewhere, it occurs from Arkansas east to North Carolina. Missouri is the northwestern limit of its range.

TYPE LOCALITY: Woodville, Jackson County, Ala.

Inflectarius inflectus (Say 1821)

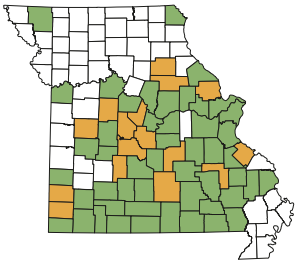
Shagreen

DESCRIPTION: ***Shell:*** small to medium, diameter 9.8 to 13.8 mm, height 5.4 to 8.1 mm, solid; shape depressed; whorls 4½ to 5½, moderately convex; body whorl thickened and strongly descending at the aperture; suture moderately impressed; shell imperforate. ***Aperture:*** squarish, trilobed; parietal lamella long and slightly curved; lip with two well developed lamellae; peristome broadly reflected, thickened within, channeled behind; parietal callus relatively thick, leading edge shallow "S"-shaped and wrapping around axial callus; surface of callus granulose. ***Surface:*** rather dull; embryonic whorls with fine axial ridges, some interrupted forming elongate granules; later whorls with irregular growth ridges, and a network of microscopic wrinkles paralleling the growth lines. ***Color:*** light brownish; lip white; thickening of body whorl on dorsal surface behind aperture white.

REMARKS: *Inflectarius inflectus* lives in mesic woodland habitats, and is common in moist leaf litter around bluffs and talus. It is also a troglophilic species found in all cave zones, and is one of the most frequently encountered gastropods in Missouri caves (Gardner 1986). The shagreen is also found in urban areas.

Missouri fossils of *Inflectarius inflectus* were found in Pleistocene age talus in Boone, Callaway, Franklin, Jefferson, St. Charles, and St. Louis counties (Greger 1933, Hubricht, 1964a).

Fig. 125. *Inflectarius inflectus*, diameter 11.0 mm, Oregon County.



DISTRIBUTION: *Inflectarius inflectus* is widely distributed in the southern half of the state, and is found in all the natural divisions, except the Mississippi Lowlands. It occurs from Texas and Kansas, north to Lower Michigan, east to North Carolina, and south to Florida.

TYPE LOCALITY: southern Missouri

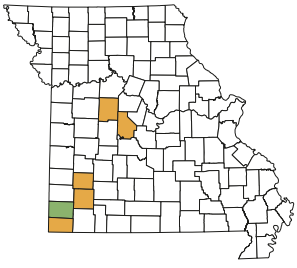
Triodopsis cragini Call 1886

Post Oak Threetooth

Fig. 126. *Triodopsis cragini*, diameter 8.3 mm, Newton County.

DESCRIPTION: ***Shell:*** medium, diameter 8.2 to 9.1 mm, height 4.3 to 4.7 mm, solid; shape depressed; whorls 5, convex, suture well defined; umbilicus deep and narrow. ***Aperture:*** rounded, tri-lobed; peristome reflected and thickened; parietal tooth straight to slightly curved, lip with two teeth, the outer tooth triangular and slightly recessed, basal tooth conical and slightly above the plane of the lip. ***Surface:*** shining, with prominent axial ridges; base smoother; embryonic whorl smooth. ***Color:*** light brown.

REMARKS: The post oak threetooth is found in dry upland woodlands and prairie habitats.



DISTRIBUTION: This species is rare in Missouri, and has been found in only six counties, along the border of the Ozark and Osage Plains natural divisions. In the other states it is found from Kansas to Texas, and east into Arkansas and Louisiana.

TYPE LOCALITY: Thayer, Neosho County, Kan.

Triodopsis discoidea (Pilsbry 1904)

Rivercliff Threetooth

DESCRIPTION: ***Shell:*** medium, diameter 14 to 17.2 mm, height 6.2 to 8 mm, solid; shape strongly depressed; whorls 4¾ to 5¾, slightly convex, suture slightly impressed; umbilicus open, contained about six times in the diameter of the shell. ***Aperture:*** trilobed; parietal lamella tall and short; palatal lamellae small, pointed or squarish; peristome reflected, thickened within, furrowed behind; parietal callus thin and transparent, leading edge shallow "S"-shaped to nearly straight. ***Surface:*** dull; embryonic whorls with fine axial lines, some areas smooth; later whorls with prominent regular axial ridges; spiral striae absent; surface on and between ridges sculptured with fine granules, usually most visible around umbilicus. ***Color:*** light yellowish brown; lip white.

REMARKS: The rivercliff threetooth as its common name implies is found along the limestone bluffs of major rivers. Among the species of *Triodopsis* occurring in Missouri, *T. discoidea* is most similar to *T. neglecta*. However, these species do not overlap in their ranges in Missouri. *T. discoidea* occurs only in areas adjacent to the Meramec, Missouri and Mississippi River valleys, while *T. neglecta* occurs only in the southwestern region of the state.

Missouri fossils of *Triodopsis discoidea* were found in Pleistocene age talus in Jefferson and St. Louis counties (Hubricht 1964a).

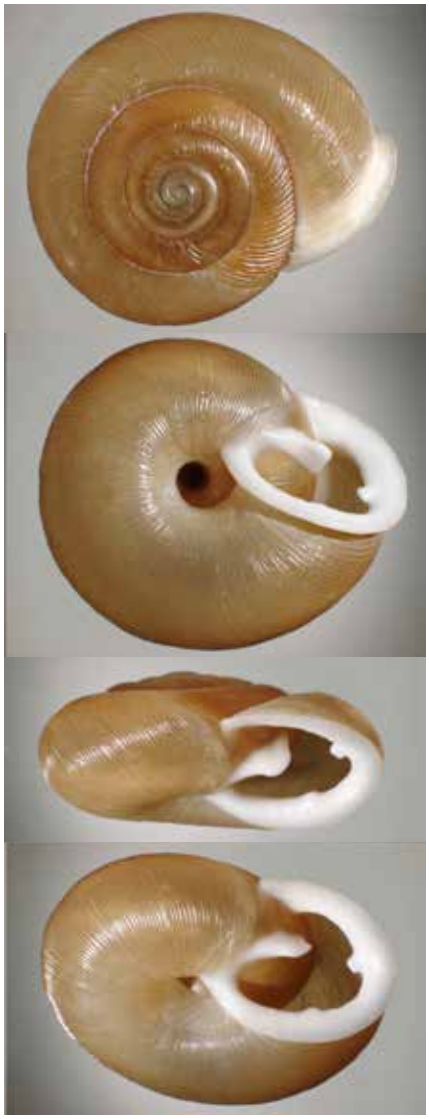
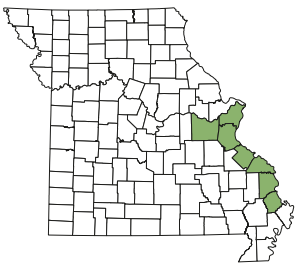


Fig. 127. *Triodopsis discoidea*, diameter 15.4 mm, St. Louis County.



DISTRIBUTION: *Triodopsis discoidea* has a very unusual distribution; it is found completely within the Ozark Border Natural Division, and is restricted to the bluff zones along the Mississippi, Missouri, and Meramec rivers. In other states, it occurs only along the Mississippi and Ohio rivers and a few miles up some of their tributaries.

TYPE LOCALITY: Charleston, Clark County, Ind.

Triodopsis hopetonensis (Shuttleworth 1852)

Magnolia Threetooth

DESCRIPTION: ***Shell:*** medium, diameter 8.5 to 10.5 mm, height 5.0 to 6.2 mm, solid; shape moderately depressed; whorls about 5½, convex; body whorl descending in front, with a periphery above the midline; suture moderately impressed; umbilicus moderately wide, contained about five times within the diameter of the shell. ***Aperture:*** rounded, slightly squarish, trilobed; parietal lamella high and thin, curved toward axis; palatal lamellae small, pointed; basal lamella usually with buttress on columellar side; peristome narrowly reflected, thickened within, furrowed behind; parietal callus heavy, translucent, leading edge slightly "S"-shaped; surface granular. ***Surface:*** dull; embryonic whorls smooth, with faint axial ridges; later whorls with prominent, evenly spaced axial ridges; ridges strong on the base; spiral striae absent. ***Color:*** light reddish brown; lip white.

REMARKS: Pilsbry (1940: 812) states that the magnolia threetooth is a species of the coastal plains often living at the margin of salt and brackish water, although it also is frequently found in urban areas. In Missouri it was found living along the stonewall bordering the Missouri Botanical Garden in St. Louis City.

Fig. 128. *Triodopsis hopetonensis*, diameter 10 mm, Jefferson County, Ill.

DISTRIBUTION: New State Record. *Triodopsis hopetonensis* was found only in St. Louis City in Missouri, on the grounds of the Missouri Botanical Garden. This represents a considerable range extension for this species, and is likely to be an introduction. Its reported range is Louisiana, east to Virginia, and south to northern Florida.

TYPE LOCALITY: Hopetown, Ga. Hopetown is the name of an old plantation south of the Altamaha River and five miles north of Darien, Ga.

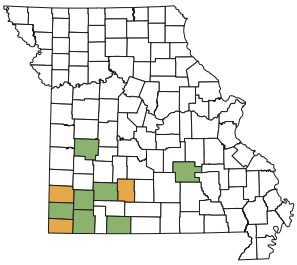
Triodopsis neglecta (Pilsbry 1899)

Ozark Threetooth

DESCRIPTION: ***Shell:*** medium, diameter 11.5 to 14 mm, height 4.5 to 6.7 mm, solid; shape moderately depressed; whorls about 5½, moderately convex; periphery slightly above midline on body whorl; body whorl descending steeply at aperture; suture moderately impressed; umbilicus moderately wide, contained about four times within diameter of shell. ***Aperture:*** squarish rounded, trilobed; parietal lamella prominent, curved and extending to the columella, basal lamella rather small tubercular; outer lamella squarish and more deeply recessed; peristome reflected, thickened within, furrowed behind; parietal callus is moderately thick and translucent; leading edge slightly concave, surface granulose. ***Surface:*** dull; embryonic whorls with faint axial lines, portions smooth; later whorls with prominent, regular axial ridges; ridges distinct on base; spiral striae absent. ***Color:*** pale olive-brown; lip white.

REMARKS: The Ozark threetooth is found in xeric woodlands, commonly under logs and rocks on rocky hillsides.

Fig. 129. *Triodopsis neglecta*, diameter 12 mm, Barry County.



DISTRIBUTION: *Triodopsis neglecta* is found in southwestern Missouri, in the Ozark and Osage Plains natural divisions. This species is an Ozark Plateau endemic, and is known only from Missouri, southeastern Kansas, northeastern Oklahoma, and northwestern Arkansas.

TYPE LOCALITY: Rogers, Benton County, Ark.

Xolotrema fosteri (F. C. Baker 1932)

Bladetooth Wedge

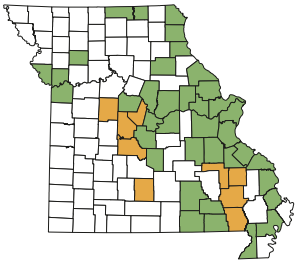
DESCRIPTION: ***Shell:*** medium, diameter 14.0 to 20.4 mm, height 8 to 11 mm, solid; shape strongly depressed; whorls about 5, slightly convex, body whorl sub-angular, periphery high; suture slightly impressed; shell imperforate. ***Aperture:*** oval, lunate; parietal lamella long, curved, narrowly separated or attached to axial callus, outer lip with a low lamella, often missing; basal lip with a thickened ridge forming a low lamella; peristome reflected, thickened within, channeled behind; parietal callus thin and translucent, leading edge "S"-shaped, wrapping around axial callus. ***Surface:*** rather dull; embryonic whorls with fine axial lines, portions smooth; later whorls with prominent axial ridges; spiral lines very fine, less distinct on base. ***Color:*** light yellowish brown, brighter yellow behind lip; lip white.

Fig. 130. *Xolotrema fosteri*, diameter 17 mm, Osage County.

REMARKS: This species is found in many habitats, including bluffs, under leaves, logs and rocks on hillsides and bottomlands, and in urban/suburban habitats.

Xolotrema fosteri is very similar in shape and size to *Patera perigrapta*; however, their ranges generally do not overlap in Missouri. *Patera perigrapta* is uncommon in Missouri, and occurs primarily in the southwestern counties bordering Arkansas. *Xolotrema fosteri* is very common in the eastern half of the state, and does not occur in the southwestern-most counties in Missouri. They also differ by the form of the parietal lamella, which is elongate and nearly reaching the axial callus in *X. fosteri*, and is very short and widely separated from the axial callus in *P. perigrapta*.

In Missouri, fossil shells of *Xolotrema fosteri* were found in Pleistocene age deposits of loess, talus and silt in Boone, Callaway, Franklin, Jefferson, Moniteau, St. Charles, and St. Louis counties (Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Xolotrema fosteri* is found primarily in the eastern half of Missouri, and occurs in all of the natural divisions except the Osage Plains. Elsewhere, it ranges from Texas to Iowa, and east to Ohio and Georgia, with outlier populations in New Jersey and Maryland. Missouri is the western limit of the species distribution.

TYPE LOCALITY: Hardin County, Ill.

Neohelix alleni (Sampson 1883)

Western Whitelip

Fig. 131. *Neohelix alleni*, diameter 27 mm, St. Louis County.

DESCRIPTION: ***Shell:*** large, diameter 20 to 31 mm, height 13.2 to 19 mm, solid; shape depressed globose; whorls about 5½, moderately convex, suture moderately impressed; shell imperforate.
Aperture: squarish rounded, basal lip straight and elongate, with a low ridge or lamella; peristome widely reflected, thickened within, not channeled behind; parietal lamella absent; parietal callus thin and translucent, lead edge "S"-shaped, surface granulose.
Surface: dull; embryonic whorls finely granular, with some faint axial lines; later whorls with regular axial ridges; spiral striae very fine.
Color: light yellowish brown; lip white.

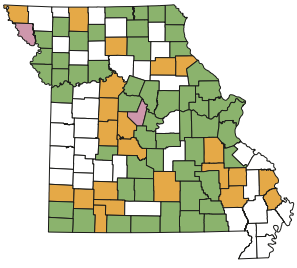
REMARKS: The western whitelip is found in mesic and xeric woods, and along bluffs associated with river corridors.

This is one of the largest land snails in Missouri, and is very similar to another large species, *Mesodon zaletus*. They differ by the parietal lamella, which is present in *M. zaletus* and absent in *N. alleni*. *Mesodon zaletus* is also usually taller and more globose for similarly sized shells.

Neohelix alleni was originally described as a variety of *N. albolabris*, and later elevated to species rank by Hubricht (1965a). These species are very similar, and are distinguished by the basal lip, which in N. alleni usually forms a distinct node (or thickening), and in *N. albolabris*, the basal node is absent or inconspicuous (Emberton 1988). *Neohelix albolabris* also occurs primarily east of the Mississippi River, with a western subspecies (*N. albolabris bogani* Emberton) found from Arkansas south to Mississippi, Louisiana and Texas (Emberton 1988).

Neohelix alleni is a host for the brainworm nematode, *Parelaphostrongylus tenuis* (see *Haplotrema concavum* Remarks, Page 70).

Missouri fossil shells of Neohelix alleni were found in Pleistocene age talus and silt deposits from Boone, Buchanan, Franklin, Holt, Moniteau, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht, 1964a).



DISTRIBUTION: *Neohelix alleni* is known from all the natural divisions in the state, but is uncommon in the Osage Plains and Mississippi Lowlands divisions. Elsewhere, it is known from a narrow region mostly west of the Mississippi River from Louisiana to Minnesota west to eastern Oklahoma and Kansas, with outlier populations in Alabama and Tennessee.

TYPE LOCALITY: Eureka Springs, Carroll County, Ark.

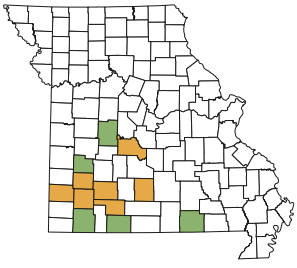
Neohelix divesta (Gould 1848)

Ozark Whitelip

DESCRIPTION: ***Shell:*** medium, diameter 13.7 to 17.0 mm; height 8.2 to 9 mm, solid; shape depressed; whorls about 5, slightly convex; suture slightly impressed; shell imperforate. ***Aperture:*** elongate-oval, lunate, without lamellae; peristome narrowly reflected, thickened within, channeled behind; parietal callus thin and transparent, leading edge shallow "S"-shaped to nearly straight, wrapping around columella at axis, surface granulose. ***Surface:*** dull; embryonic whorls with fine axial lines, some areas smooth and granular; later whorls with regular prominent axial ridges; spiral striae fine and distinct. ***Color:*** light yellowish brown, brownish or whitish growth/rest streaks usually present; lip white.

REMARKS: The ozark whitelip is found primarily on xeric wooded hillsides, under rocks, in leaf litter; and occasionally on glades.

Fig. 132. *Neohelix divesta*, diameter 17 mm, Barry County.



DISTRIBUTION: *Neohelix divesta* is found in Missouri only in the Ozark Natural Division. This is primarily an Ozark Plateau endemic, but extends south of Oklahoma and Arkansas into northern Louisiana and Texas.

TYPE LOCALITY: Washita Springs, Montgomery County, Ark.

Webbhelix multilineata (Say 1821)

Striped Whitelip

Fig. 133.
Webbhelix multilineata, diameter 23 mm, Jefferson County.

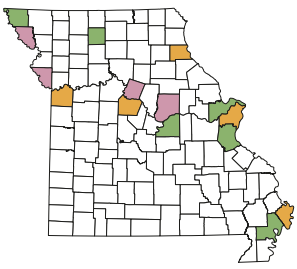
DESCRIPTION: ***Shell:*** large, diameter 20 to 25 mm, height 14 to 16 mm; moderately fragile, shells often injured; shape depressed globose; whorls about 5½, convex, suture well impressed; shell imperforate. ***Aperture:*** oval, lunate, usually without lamellae, rarely with a small parietal lamella; peristome narrowly reflected, thickened within, slight channel or none behind lip; parietal callus thin and translucent, leading edge slightly "S"-shaped, wrapping around axial callus, usually sharply concave near outer lip, surface granulose. ***Surface:*** dull; embryonic whorls smooth with few fine axial lines; later whorls with prominent regularly spaced axial ridges; ridges strong on base; spiral striae fine and weak. ***Color:*** olive-brown, with many reddish brown spiral bands; bands usually varying in width and number, sometimes absent; the band coloring is part of shell material, and usually shows inside the shell and on some areas of the lip; lip otherwise white to pinkish. ***Animal:*** "Body is generally blackish, with white granules separated by darker zones. Sole of foot black" (F. C. Baker 1939: 72).

REMARKS: This attractive snail lives in bottomland areas and adjacent hillsides along Missouri's largest rivers. It escapes floodwater, if the water rises slowly, by climbing up tree trunks or onto other vegetation. One of the authors (RO) observed dozens of them on tree trunks, in 3 or 4 feet of water during the 1993 flooding of the Mississippi River.

The striped whitelip may be predaceous on other snails, "Since no fatalities had been observed prior to the introduction of *[Webbhelix] multilineata* my curiosity was aroused when I found fresh, empty Succinea shells lying in full view on top of the soil. Finally, I happened to look into the terrarium just after a victim had been seized. The *[Webbhelix] multilineata* turned the Succinea onto its back then oriented it to the desired position, devouring the animal and "licked the shell clean" within a few minutes." (Crabb 1928: 35–36).

They aestivate in groups, each snail excavating a small area for the shell to lie within and oriented with the aperture facing upward. The aperture is closed by a thick white opaque epiphragm. The snails in these groups are sometimes agglutinated into one mass (Pilsbry 1940: 848).

Missouri fossils of *Webbhelix multilineata* were found in Pleistocene age deposits of loess and talus in Atchison, Callaway, Holt, Howard, Platte, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Hubricht 1964a).



DISTRIBUTION: *Webbhelix multilineata* was found in Missouri primarily along the Missouri, Grand, Thompson, and Mississippi rivers. Most of these are in the Big Rivers Natural Division. Elsewhere, it ranges from Kansas to Minnesota, east to New York, and south to West Virginia. The Missouri populations are near the southern limit for this species.

TYPE LOCALITY: Illinois and Missouri

Allogona profunda (Say 1821)

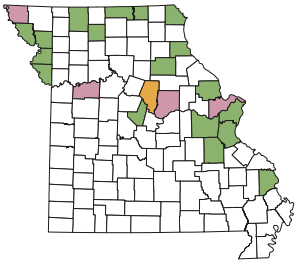
Broad-banded Forestsnail

Fig. 134. *Allogona profunda*, diameter 28 mm, Washington County.

DESCRIPTION: ***Shell:*** large, diameter 25 to 32 mm, height 15 to 17 mm, solid; shape strongly depressed; whorls 4½ to 5½, shallowly convex; suture slightly impressed; umbilicus large, contained about five times within the diameter of the shell. ***Aperture:*** rounded, lunate; basal lip with a low but distinct lamella; peristome broadly reflected, thickened within, not distinctly channeled behind; parietal callus moderately thick, translucent, leading edge slightly "S"-shaped, surface granulose. ***Surface:*** dull; embryonic whorl with faint axial lines, some areas smooth; later whorls with prominent, regularly spaced axial ridges; spiral striae distinct. ***Color:*** light yellowish brown, with a reddish brown band above the periphery; sometimes with multiple bands above and below the periphery; color bands occasionally absent. ***Animal:*** brownish on the dorsal surface; sides grayish; dorsal surface and sides with raised whitish areas; tentacles slate gray; sole creamy light gray.

REMARKS: This species is found under leaf litter on wooded hillsides and floodplains. It is one of the largest land snails in Missouri, and typical of many large snails, it spends the winter dormant period in a small depression on the soil surface, with the aperture facing upward. The aperture is covered with a whitish, opaque, partially calcareous epiphragm. Individual snails, after a summer of wandering around, return to near to where it hibernated the year before (Blinn 1963).

In Missouri, fossils of *Allogona profunda* have been reported in Pleistocene age loess, talus and silt deposits from Atchison, Boone, Callaway, Franklin, Jefferson, Lafayette, Moniteau, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Pilsbry 1940, Hubricht 1964a).



DISTRIBUTION: *Allogona profunda* occurs primarily in the northern and eastern parts of Missouri, and was found in the Glaciated Plains, Ozark Border and Big Rivers natural divisions. In other states, it ranges from Kansas to northern Michigan, east to New York, and south to northern Alabama.

TYPE LOCALITY: Cincinnati, Ohio, and "Engineer Cantonement," about five miles south of Omaha, Neb.

SPECIES NOT FOUND BY AUTHORS

The combined total for recent collecting and historic records is 149 species of land snails and slugs for the state of Missouri. Of these, the following 13 species were reported by Hubricht (1985), but were not found during recent field work by the authors:

Anguispira strongylodes (Pfeiffer 1854)

Southeastern Tigersnail

Clade Stylommatophora > Informal Group Sigmurethra > Family Discidae

DESCRIPTION: ***Shell:*** medium, diameter about 18 mm, height about 10 mm, moderately solid; shape depressed; whorls about 5, convex, last whorl rounded, suture moderately impressed; umbilicus large, contained four to five times within shell diameter. ***Aperture:*** oval, lunate; peristome thin, not reflected; aperture without teeth; parietal callus straight along outer edge, or with minor irregularities, thin, transparent, flames from whorl below show through clearly. ***Surface:*** dull, with regularly spaced axial growth ridges on all whorls except the embryonic whorls, axial ridges coarser and more widely spaced than *Anguispira alternata*; spiral striae faint to indistinct. ***Color:*** light yellowish brown or greenish brown with rows of reddish brown blotches or flames, base with fewer and smaller markings; body whorl with three to four bands of flames; markings may be less distinct on base than *A. alternata*.

DISTRIBUTION: This species was reported from four counties in Missouri (Hubricht 1985, Map 159), but it has not been found in recent collections. Throughout its entire range it occurs from central Texas north to Missouri and Kentucky, and in all states to the south.

TYPE LOCALITY: Texas

REMARKS: *Anguispira strongylodes* is similar in most aspects to *A. alternata*, but with coarser axial ridges, at least in the northern part of its range (which includes Missouri). It is found in the same habitat as *A. alternata* and sometimes with it (Hubricht 1985: 18).

Carychium exiguum (Say 1822)

Obese Thorn

Clade Eupulmonata > Family Carychiidae

DESCRIPTION: ***Shell:*** micro, length about 1.6 to 2.0 mm, diameter 0.7 to 0.8 mm. ***Surface:*** of last two whorls smooth or weakly striate; otherwise, similar to *Carychium exile*.

DISTRIBUTION: *Carychium exiguum* is known in Missouri only from Knox County, Glaciated Plains Natural Division (Hubricht 1985), and was not found in recent collecting by the authors. Elsewhere, it ranges from Kansas to South Dakota, east to Maine, and South Carolina.

TYPE LOCALITY: Harrigate, Philadelphia, Pa.

REMARKS: *Carychium exiguum* is "usually found in wetter situations than *C. exile*, although they are sometimes found together" (Hubricht 1985: 6). Harry (1997–1998) provides detailed observations on microhabitat, life history, morphology, behavior, and anatomy for this species.

Catinella oklahomarum (Webb 1953)

Detritus Ambersnail

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** small, height about 8 mm, diameter about 6.6 mm; apex less obtuse than *Catinella wandae*; umbilicus covered for upper ⅓ of columella. ***Color:*** intense greenish yellow.

DISTRIBUTION: In Missouri, the detritus ambersnail has been reported from Barry County (Hubricht 1985, Map 135). In other states it occurs from Oklahoma to Pennsylvania, and all the states to the south.

TYPE LOCALITY: Six miles west of Sardis, Pushmataha County, Okla.

REMARKS: *Catinella oklahomarum* is primarily a southern and eastern species associated with acid soils, "usually found in the leaf litter of wooded hillsides or in pine woods on the coastal plain" (Hubricht 1985: 16, 98).

Cochlicopa lubricella (Porro 1838)

Thin Pillar

Clade Stylommatophora > Subclade Orthurethra > Family Cochlicopidae

DESCRIPTION: ***Shell:*** similar to *Cochlicopa lubrica*, but somewhat smaller and more slender; whorls less convex and suture shallower; apex appearing less acute. ***Color:*** usually pale.

DISTRIBUTION: The thin pillar has been reported from Atchison County in northwestern Missouri (Hubricht, 1985: 61), but was not collected by the authors. Nationally it occurs from South Dakota and Kansas east to Maine.

TYPE LOCALITY: France

REMARKS: This species is found in the same habitats as *Cochlicopa lubrica* (Hubricht 1985: 6). See *Cochlicopa lubrica* Remarks, Page 37.

Daedalochila deltoidea (Simpson 1889)

Oklahoma Liptooth

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: *Daedalochila deltoidea* is similar to *D. jacksoni*, but with "the edge of the parietal callus elevated in a triangle with highest point at junction of the upper ramus of the entering fold" (Pilsbry 1940: 632).

DISTRIBUTION: The Oklahoma liptooth has been reported from Newton County, but it was not found in more recent collecting by the authors. It also occurs in east central Oklahoma and western Arkansas.

TYPE LOCALITY: Oklahoma

REMARKS: This species lives in the same habitat as *Daedalochila jacksoni*, but not found with it (Hubricht 1985). This species was originally recognized as a variety of *D. jacksoni* (Simpson), and later treated as a subspecies of *D. jacksoni* by Pilsbry (1940). It was elevated to species rank by Branson (1962) and followed as such by subsequent authors. Coles and Walsh (2006) reviewed the *Daedalchila plicata* group, which includes D. jacksoni. They did not discuss *D. deltoidea*, however, since dissections were presented for "all the species in the group," by implication they did not view *D. deltoidea* as a valid species. However, since it was not explicitly synonymized or treated as a subspecies, we continue to list the name at the species level, and, because of its close taxonomic association with *D. jacksoni*, we include it in the genus *Daedalochila*.

Glyphyalinia lewisiana (G. H. Clapp 1908)

Pale Glyph

Clade Stylommatophora > "Limacoid Clade" > Family Oxychilidae

DESCRIPTION: ***Shell:*** minute, diameter about 3.5 mm, height 1.5 mm, fragile; shape strongly depressed, whorls about 3½ to 4, shallowly convex, suture margined, slightly impressed; umbilicus widely open, contained about five times within shell diameter. ***Aperture:*** oval, lunate, without lamellae; peristome thin. ***Surface:*** glossy, axial striae delicate, very regular and close together, smoother below. ***Color:*** yellowish white, translucent.

DISTRIBUTION: The pale glyph is rare in Missouri and is known only from Crawford and Taney counties (Gardner 1986), within the Ozark Natural Division. Elsewhere in eastern United States, it ranges from Arkansas east to Virginia (Hubricht 1985).

TYPE LOCALITY: Huntsville, Ala.

REMARKS: "A burrowing species, usually found on the undersides of stones" (Hubricht 1985: 24). The Missouri specimens were collected from leaves near cave entrances (Gardner 1986: 11).

Inflectarius edentatus (Sampson 1889)

Smooth-lip Shagreen

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: Similar to *I. inflectus*, but with greatly reduced lip lamellae.

DISTRIBUTION: In Missouri, the smooth-lip shagreen has been reported from Taney County (Hubricht 1985: 159), but it was not found or identified in the authors' collections. This species also occurs in northern Arkansas.

TYPE LOCALITY: Boston Mountains, Winslow, Washington County, Ark.

REMARKS: This species is "found under rocks and logs on wooded hillsides" (Hubricht 1985: 41).

Linisa texasiana (Moricand 1833)

Texas Liptooth

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** medium, diameter 10 to 11 mm, height 5 to 5.2 mm, solid; shape strongly depressed; whorls 5½, slightly convex, suture moderately impressed, last whorl descending and abruptly crossing the periphery; umbilicus small in the center, greatly expanded in last whorl, with suture visible for about ½ turn. ***Aperture:*** rounded, semi-lunate; parietal lamella triangular, pointed; lip with two lamellae on the basal part of the lip, with parietal lamella directed dorsad of upper lamella; peristome reflected, strongly thickened. ***Surface:*** with regular, prominent axial ridges, base smoothish except near aperture, embryonic whorls smooth. ***Color:*** light brown, usually with a dark color band above the periphery, base lighter.

DISTRIBUTION: The Texas liptooth has been reported from Barry County, but was not found in recent collections by the authors. In the other states it is known from Texas north to southern Kansas, and southeast to Alabama.

TYPE LOCALITY: Texas

REMARKS: This species is similar in form to some species of *Daedalochila*, but is easily recognized by the reduced apertural lamellae, and often by the dark color band above the periphery. This snail is found on low ground, under litter, in prairie and woodland habitats (Hubricht 1985: 37).

Oxyloma salleana (Pfeiffer 1849)

Louisiana Ambersnail

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** medium, length about 14.4 to 19.8 mm, width about 7.4 to 10.7 mm, very thin and fragile; shape elongate-oval, spire somewhat shorter than O. retusa, body whorl very large and long; whorls 2½; shell imperforate. ***Aperture:*** oval, large and long, about 0.7 times total length of shell, and about 0.6 times as wide as long, base less dilated and more parallel-sided than O. retusa, receding in lateral view; peristome thin; lip not reflected or thickened; aperture without lamellae. ***Surface:*** with irregularly spaced and shallow growth ridges; spiral lines irregular. ***Color:*** straw yellow to whitish horn, translucent.

DISTRIBUTION: The Louisiana ambersnail has been reported from St. Charles, St. Louis, and Franklin counties, but it was not found in recent collections by the authors. Elsewhere, its range is limited to the lower Mississippi valley and eastern Texas.

TYPE LOCALITY: New Orleans, La.

REMARKS: This snail lives in wet areas similar to *Oxyloma retusa*.

Pallifera fosteri F. C. Baker 1939

Foster Mantleslug

Clade Stylommatophora > "Limacoid Clade" > Family Philomycidae

DESCRIPTION: Slug small, length about 20 mm; mantle nearly covering entire animal, with prominent hump at anterior end. ***Color:*** white to off-white, with blackish spots or blotches that may form irregular longitudinal lines near the base of the mantle, and with smaller dot-like spots scattered over the dorsal surface, occasionally coalescing to form irregular blotches.

DISTRIBUTION: This slug was reported from Camden, Franklin, Washington, and St. Louis counties (Hubricht 1985: 103). Elsewhere, it occurs from Lower Michigan, south to Louisiana and around the coastal states to Maryland.

TYPE LOCALITY: Oakwood, Champaign County, Ill.

REMARKS: The Foster mantleslug is found in a variety of habitats from floodplains to upland woods in leaf litter and around old fallen trees (Hubricht 1985: 18).

Succinea indiana Pilsbry 1905

Xeric Ambersnail

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** medium, length 10 to 11 mm, diameter 6 to 7 mm, moderately fragile; shape elongate-oval; whorls 2½ to 3, suture well defined, whorls convex; imperforate. ***Aperture:*** large, about 60 percent of shell height, about 0.6 times as wide as long and about 0.6 times as long as shell; peristome very thin, not reflected, without teeth. ***Surface:*** glossy, with sculpture of fine growth wrinkles. ***Color:*** bright golden, with apex reddish, or entirely pale yellow.

DISTRIBUTION: The xeric ambersnail has been reported from Barry County in Missouri (Hubricht, 1985, Map 117). Elsewhere, it is found Texas to North Dakota, and in the southeastern states from Missouri to Maryland.

REMARKS: *Succinea indiana* is usually found in xeric conditions often on bare ground in sunny locations (Hubricht, 1985, p. 15).

Xolotrema denotatum (Férussac 1821)

Velvet Wedge

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** medium to large, diameter 18.3 to 25.6 mm, height 10 to 13 mm, solid; shape depressed, whorls 5½, convex, sutures well impressed; body whorl only slightly descending to the aperture, slightly contracted behind lip, umbilicus closed (given as mostly closed for some localities). ***Aperture:*** oval, lunate, peristome reflected, more broadly so in the basal and upper margins; parietal tooth long, curved, extending to umbilical callus; basal lip with a thickened ridge forming a low tooth truncate at outer end, outer lip with a conic tooth at inner margin. ***Surface:*** with close-set papillae bearing stiff hairs; embryonic whorl covered with fine axial striae, later whorls coarsely striate and covered with fine wrinkles. ***Color:*** dark brown to light olive-brown.

DISTRIBUTION: This species is reported from Crawford and Mississippi counties in the Ozark and Mississippi Lowlands natural divisions of Missouri (Hubricht 1985: 166). It was not found by the authors during their field work in the state. In other states it occurs from eastern Arkansas to Michigan east to Vermont and south to Alabama.

TYPE LOCALITY: unknown

REMARKS: The velvet wedge is found on mesic hillsides and occasionally on associated floodplains.

Zonitoides kirbyi R. W. Fullington 1974

Shadow Gloss

Clade Stylommatophora > "Limacoid Clade" > Family Gastrodontidae

DESCRIPTION: ***Shell:*** small, diameter about 6.3 mm, height, about 3.4 mm, moderately solid; shape depressed, whorls convex, expanding rapidly, sutures moderately impressed; umbilicus contained about 3.2 times in the diameter, expanding rapidly in the last whorl. ***Aperture:*** oval, lunate, peristome thin. ***Surface:*** glossy, translucent; embryonic whorl smooth, later whorls with fine evenly spaced growth lines, which are more pronounced on the body whorl and less so on the base, spiral striae fine and visible on the dorsal surface of the whorls.

DISTRIBUTION: *Zonitoides kirbyi* has been reported from Camden, Christian, Pulaski, and Texas counties in the Ozarks Natural Division of Missouri (Hubricht 1985: 140). Nationally it is known from Oklahoma and Texas.

TYPE LOCALITY: Palmetto Park, Ottine, Gonzales County, Texas

REMARKS: The shadow gloss was originally described from a cave however it has also been found in surface environments (Hubricht, 1985: 32). In Missouri most records are from caves.

SPECIES ONLY KNOWN FROM FOSSIL RECORDS

The combined total for recent collecting and historic records is 149 species of land snails and slugs for the state of Missouri. Of these, the following 14 species are known only from fossil records.

Catinella gelida (F. C. Baker 1927)

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae Beck, 1837

DESCRIPTION: ***Shell:*** small, length 6.6 to 8.0 mm, diameter 3.3 to 4.5 mm, thin and fragile, shape oval; whorls about 3½, convex, suture deeply impressed, shell imperforate. ***Aperture:*** oval, relatively slender, about 0.6 times length of shell, and about 0.7 times as wide as long, peristome thin, aperture without lamella. ***Surface:*** with irregular, shallow growth wrinkles.

DISTRIBUTION: This species is known only from fossil shells in Missouri. Elsewhere, fossils have been found from Mississippi north to Iowa, and east to Ohio. Possible relict populations of this species have been reported in eastern Wisconsin (Nekola 2004).

TYPE LOCALITY: Irene, Boone County, Ill.

REMARKS: In Missouri, fossils of *Catinella gelida* were reported from Pleistocene age loess, talus, and silt in St. Louis County (Hubricht, 1964a).

Columella columella alticola (Ingersoll 1875)

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: ***Shell:*** minute, length 2.5 to 2.8 mm, diameter about 1.3 mm, moderately solid, shape elongate. with middle 3 whorls nearly equal in diameter, apex broadly rounded; whorls 6½ to 7, convex, suture strongly impressed, umbilicus open, small. ***Aperture:*** rounded, truncated at body whorl; peristome thin, not reflected; aperture without lamellae; parietal callus thin.***Surface:*** with fine irregular growth lines or wrinkles. ***Color:*** light brown with some whitish streaks.

DISTRIBUTION: This species is known only from fossils in Missouri, with the nearest records of live snails from southwestern Texas. It is widespread in western states from New Mexico to Idaho.

TYPE LOCALITY: Cunningham Gulch, Colo.

REMARKS: In Missouri, fossils of *Columella columella alticola* have been found in Pleistocene age loess deposits in St. Charles and St. Louis counties (Hubricht 1964a).

Discus macclintocki (F. C. Baker 1928)

Pleistocene Disc

Clade Stylommatophora > Informal Group Sigmurethra > Family Discidae

DESCRIPTION: ***Shell:*** small, diameter 6.0 to 6.5 mm, height 3.2 to 3.6 mm, solid; shape moderately to strongly depressed, whorls 5–6, periphery rounded, convex above, sutures deeply impressed; umbilicus widely open, contained about three times in the diameter of the shell; ***Aperture:*** rounded to oval, lunate, peristome thin, without lamellae; ***Surface:*** with closely spaced axial ridges, base almost smooth in lower part of body whorl. ***Color:*** light brown, without reddish coloration.

DISTRIBUTION: The Pleistocene disc is known only from fossils in Missouri. It was found alive in 1928, in a state park in Iowa. Other states with fossil records are Iowa and Illinois.

TYPE LOCALITY: Bixby State Park, Clayton County, Iowa

REMARKS: Living populations of *Discus macclintocki* occur in a small number of sites in northern Iowa and Illinois, where they live in north facing, algific talus slopes. In Missouri, fossils of *Discus macclintocki* were found in Pleistocene age deposits of loess and talus in Franklin, Jefferson, St. Charles, and St. Louis counties (Pilsbry 1948, Hubricht 1964a, Hubricht 1985).

Discus shimeki (Pilsbry 1890)

Striate Disc

Clade Stylommatophora > Informal Group Sigmurethra > Family Discidae

DESCRIPTION: ***Shell:*** small, diameter 6 to 6.5 mm, height 3.7 to 4 mm, solid, shape depressed; whorls 4½, convex, periphery rounded, suture deep, umbilicus contained about four times in diameter of shell. ***Aperture:*** oval, lunate; peristome thin, not reflected; without lamellae. ***Surface:*** with first 1½ whorls smooth, later whorls with prominent regularly spaced axial ridges, the intervals about as wide as the ridges, ridges becoming somewhat lower and irregular on the body whorl, disappearing in the peripheral region, and marked only by weak growth wrinkles on the base. ***Color***: brownish, fossil shells usually whitish.

DISTRIBUTION: This species is known in Missouri only from fossil shells, with the nearest living populations in South Dakota. *Discus shimeki* is rather widespread in western states, at elevations above 5000 feet, from Arizona north into Canada.

TYPE LOCALITY: Iowa City, Iowa

REMARKS: Fossils of the striate disc have been reported in Missouri from Pleistocene age loess and talus deposits in Franklin, St. Charles, and St. Louis counties (Hubricht, 1964a, Pilsbry 1948).

Discus whitneyi (Newcomb 1864)

Forest Disc

Clade Stylommatophora > Informal Group Sigmurethra > Family Discidae

DESCRIPTION: ***Shell:*** small, diameter 5.0 to 6.3 mm, height 2.7 to 3.6 mm, solid; shape strongly depressed; whorls 3⅔ to 4½, convex, suture deeply impressed, periphery rounded; umbilicus widely open, contained about three times in the diameter. ***Aperture:*** rounded, lunate, peristome thin, not reflected, without lamellae. ***Surface:*** with prominent and regularly spaced axial ridges, which continue over the base, upper surface between ridges glossy or with faint granulations; embryonic whorls smooth; parietal callus thin. ***Color:*** light brown; fossil shells usually whitish.

DISTRIBUTION: This species is known only from fossils in Missouri; however, living populations in southern Iowa suggests that it may also occur in northern Missouri. In the other states, living populations are reported from the Dakotas east to North Carolina and Maine.

TYPE LOCALITY: Kalamath Valley, Ore.

REMARKS: The forest disc prefers low moist habitats (Hubricht 1985: 19). *Discus whitneyi* is also implicated as a host for the brainworm nematode *Parelaphostrongylus tenuis*, a parasite of deer and other ungulates (see *Haplotrema concavum* Remarks, Page 70). Fossils are reported from North Dakota south to Texas, and northeast to Ohio.

In Missouri, fossils were found in Pleistocene age deposits of loess, talus, and silt in Boone, Cooper, Franklin, Holt, Platte, St. Charles, and St. Louis counties (Swallow 1855, Hambach 1890, Greger 1933, Pilsbry 1948, Hubricht 1964a).

Euconulus chersinus (Say 1821)

Wild Hive

Clade Stylommatophora > "Limacoid Clade" > Family Euconulidae

DESCRIPTION: ***Shell:*** minute, diameter 2.4 to 2.9 mm, height 2.2 to 3.4 mm; whorls 6 to 8. Otherwise, shell very much like *Euconulus trochulus*.

DISTRIBUTION: *Euconulus chersinus* is known in Missouri only from fossil specimens. Living populations occur from Kentucky south to Louisiana, and east to North Carolina.

TYPE LOCALITY: Sea Islands of Georgia

REMARKS: The wild hive is "found in moist leaf litter on wooded hillsides and in ravines" (Hubricht 1985: 33).

In Missouri, fossils of *Euconulus chersinus* have been reported from Pleistocene age talus deposits from St. Louis County (Hubricht 1964a); however, this species is not listed from Missouri in Hubricht's later publication (Hubricht 1985). It's uncertain if the specimens were reidentified as a different species, or if the 1985 publication omitted the record.

Lucilla scintilla (Lowe 1852)

Oldfield Coil

Clade Stylommatophora > Informal Group Sigmurethra > Family Helicodiscidae

DESCRIPTION: ***Shell:*** minute, width about 2.2 mm, height about 1.2 mm, moderately solid; whorls about 4½, convex, gradually increasing in size, suture deeply impressed, umbilicus open, contained 2.8 times in the diameter. ***Aperture:*** nearly round, peristome thin not reflected, parietal callus thin. ***Surface:*** with growth wrinkles weak, without any trace of spiral striae. ***Color:*** yellowish corneous.

DISTRIBUTION: *Lucilla scintilla* is known in Missouri only from fossils. Living populations are found from Texas north to Wisconsin, and east to Maryland and Florida.

TYPE LOCALITY: Dove, Marion County, Tenn.

REMARKS: This species lives in open grassy situations and also in caves (Hubricht 1985: 22). Missouri fossil shells of *Lucilla scintilla* were found in Pleistocene age deposits of loess and talus in St. Louis County (Hubricht 1964a).

Novisuccinea chittenangoensis (Pilsbry 1908)

Chittenango Ambersnail

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** medium to large, length 19 to 23.3 mm, diameter 10.5 to 11.3 mm, fragile, shape oval; whorls 3½, convex, suture moderately impressed; shell imperforate. ***Aperture:*** oval, about 0.5 times total length of shell, and about 0.8 times as wide as long; peristome thin, aperture without lamellae. ***Surface:*** as in *Novisuccinea ovalis*.

DISTRIBUTION: The Chittenango ambersnail is known only from fossil shells in Missouri. Living populations range in a narrow band along the Appalachian Mountains, from Kentucky to New York.

TYPE LOCALITY: Chittenango Falls, Madison County, N.Y.

REMARKS: In Missouri, fossils of this snail are known from Pleistocene age loess deposits in Atchison, St. Charles, and St. Louis counties (Pilsbry 1948, Hubricht, 1964a, Hubricht 1985). This is the largest shell of all the Succineidae known from Missouri.

Pupilla blandi Morse 1865

Rocky Mountain Column

Clade Stylommatophora > Subclade Orthurethra > Family Pupillidae

DESCRIPTION: ***Shell:*** minute, length 3.2 to 3.6 mm, diameter about 1.5 mm, solid, shape ovalcylindric; whorls about 6, moderately convex, suture moderately impressed; umbilicus rimate. ***Aperture:*** rounded, truncated at body whorl; peristome reflected, with a prominent callus behind lip; aperture only slightly thickened within; lamellae consisting of a small parietal, a deeply set columellar, not usually visible in frontal view, and a deeply set lower palatal. ***Surface:*** of embryonic whorl with fine granulations, later whorls with fine irregular growth wrinkles. ***Color:*** light reddish brown, lighter behind lip.

DISTRIBUTION: The Rocky Mountain column is known in Missouri only from fossil shells. Living populations are widespread in Rocky Mountain States.

TYPE LOCALITY: Fort Berthold, N.D.

REMARKS: Fossils of *Pupilla blandi* in Missouri are reported from Atchison and Carroll counties (Pilsbry 1948, Hubricht 1985).

Pupilla muscorum (Linnaeus 1758)

Widespread Column

Clade Stylommatophora > Subclade Orthurethra > Family Pupillidae

DESCRIPTION: ***Shell:*** minute, length 3 to 4 mm, diameter 1.5 to 1.7 mm, solid, shape ovalcylindric; whorls 5⅓ to 6½, moderately convex, suture moderately impressed; umbilicus rimate. ***Aperture:*** rounded, truncated at body whorl; peristome with a prominent callus behind lip; reflected and with a strong callus within; usually without lamellae, however, occasionally with one to three lamellae. ***Surface:*** of embryonic whorls nearly smooth, later whorls with fine irregular growth wrinkles. ***Color:*** light brown, lighter behind lip.

DISTRIBUTION: *Pupilla muscorum* is known in Missouri only from fossil shells. Living populations in the eastern United States occur from North Dakota and Iowa, east to Maine.

TYPE LOCALITY: Sweden

REMARKS: In Missouri, the widespread column has been found in Pleistocene loess and talus deposits in St. Charles and St. Louis counties (Hubricht 1964a).

Succinea bakeri Hubricht 1963

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** medium, length 13.1 to 15.3 mm, diameter 6.7 to 7.4 mm. "Shell with a little over 3 whorls, thin, but firm, elongate ovate, sculpture of unevenly spaced growth lines and wrinkles. Spire acute, moderately long, sutures well marked, periphery well rounded. ***Aperture:*** ovate, occupying sixty percent of the length of shell; outer, basal and columellar margins well rounded" (Hubricht 1963).

DISTRIBUTION: This species is known only as a Pleistocene age fossil. In Missouri it was found in loess and talus deposits in St. Louis County (Hubricht 1964a).

TYPE LOCALITY: St. Clair County, Ill.

Vertigo hubrichti Pilsbry 1934

Hubricht's Vertigo

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: ***Shell:*** minute, length 2 mm, diameter 0.9 mm, solid; shape oval; whorls 5 to 5½, strongly convex, suture deep. ***Aperture:*** sub-triangular, with five prominent lamellae (parietal, columellar, basal, lower palatal, upper palatal), parietal lamella oriented toward the space between the two palatals; lower palatal deeply immersed; peristome indented at the upper palatal lamella; body whorl with deep impressions over the palatal lamellae.

DISTRIBUTION: This species is known only from fossil specimens in Missouri. Living populations occur in algific talus of the Paleozoic Plateau of the upper Midwest (Nekola 1999).

TYPE LOCALITY: loess deposits near Mona, St. Louis County, Mo.

REMARKS: Missouri fossils of *Vertigo hubrichti* are reported from Pleistocene age loess, silt, and talus deposits in St. Charles and St. Louis counties (Pilsbry 1948, Hubricht 1964a).

Vertigo modesta (Say 1824)

Cross Vertigo

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: ***Shell:*** minute, length about 2.6 mm, diameter about 1.3 mm, moderately solid, shape oval; whorls about 5½, convex, suture moderately impressed, imperforate. ***Aperture:*** subtriangular, peristome slightly reflected, with a weak crest behind the lip, aperture with four lamellae, parietal and lower palatal point toward each other, the columellar and upper palatal also generally point to each other, hence the common name of cross vertigo. ***Surface:*** glossy, with weak axial striae, more distinct on the middle whorls. ***Color:*** light cinnamon brown, outer lip brown, lamellae white.

DISTRIBUTION: *Vertigo modesta* is reported living in New England and far northern areas; in the Midwest it is known only from fossils found in Pleistocene age deposits.

TYPE LOCALITY: west of the western end of Lake Superior, Minn.

REMARKS: In Missouri, the cross vertigo has been found in Pleistocene age loess, talus, and silt deposits from St. Louis and St. Charles counties (Pilsbry 1948, Hubricht 1964a).

Vertigo ventricosa (Morse 1865)

Five Tooth Vertigo

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: ***Shell:*** micro, length 1.7 to 1.9 mm, diameter about 0.1 mm, solid; shape oval; whorls 4 to 4½, convex, suture moderately impressed; umbilicus small. ***Aperture:*** subtriangular; peristome reflected, thickened within, with shallow indentation along outer margin; aperture with five prominent lamellae (parietal, columellar, basal, lower, and upper palatals). ***Surface:*** nearly smooth, glossy, with only faint trace of axial lines, and fine granulations. ***Color:*** brown.

DISTRIBUTION: This species is known only from fossil shells in Missouri. Living populations range from northern Illinois to Michigan, east to Virginia and Maine.

REMARKS: In Missouri, fossils of Vertigo ventricosa were found in Pleistocene age talus in St. Louis County (Pilsbry 1948, Hubricht 1964a).

SPECIES OF POSSIBLE OCCURRENCE

The following 13 species of snails and slugs are not known from Missouri, but do occur in adjacent counties of neighboring states, and may be found in Missouri in the future.

Catinella wandae (Webb 1953)

Slope Ambersnail

Clade Stylommatophora > Subclade Elasmognatha (=Heterurethra) > Family Succineidae

DESCRIPTION: ***Shell:*** somewhat smaller than *Catinella oklahomarum*; apex more obtuse than *C. oklahomarum*; umbilicus covered, rarely partly unsealed. ***Color:*** greenish yellow.

DISTRIBUTION: The slope ambersnail has not been recorded for Missouri. However, it is known from adjacent areas of Kansas.

TYPE LOCALITY: banks of a small stream, 8½ miles south and ½ mile east of Alma, Wabaunsee County, Kan.

REMARKS: *Catinella wandae* lives in leaf litter on well-drained wooded slopes (Hubricht 1985: 16).

Daedalochila lithica (Hubricht 1961)

Stone Liptooth

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: *Daedalochila lithica* is similar to *D. dorfeuilliana* Lea, and differs only in the structure of the aperture. The parietal lamella is lower and rounded rather than squarish. The lamellae of the outer lip are smaller and are not deeply immersed.

DISTRIBUTION: The stone liptooth has not been found in Missouri, but does occur in adjacent counties of Arkansas. This species has a very narrow range, limited to Oklahoma and Arkansas.

TYPE LOCALITY: Stone County, Ark.

REMARKS: This species has been "found under logs, rocks and leaf litter in dry upland woods" (Hubricht 1985).

Daedalochila simpsoni (Pilsbry & Ferriss 1907)

Wyandotte Liptooth

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** small, diameter about 9.3 mm, height about 4.7 mm, umbilicus tightly closed at center; similar to *Daedalochila jacksoni* in all other characters.

DISTRIBUTION: The Wyandotte liptooth has not been reported from Missouri, however it has been found in a bordering county of Oklahoma. It also occurs in Arkansas.

TYPE LOCALITY: Wyandotte, Ottawa County, Okla.

REMARKS: This species lives in the same habitat as *Daedalochila jacksoni* and *D. deltoidea*, but never with them (Hubricht 1985).

Euchemotrema hubrichti (Pilsbry 1940)

Carinate Pillsnail

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** small, diameter 8.9 to 9.7 mm, height 3.8 to 4.7 mm, solid, shape depressed, acutely keeled at the periphery; whorls 4½ to 5, first two convex others nearly flat, body whorl descending at aperture, suture very shallow, shell imperforate. ***Aperture:*** narrow oval, parietal lamella nearly straight, basal lip thickened, but narrowed and forming a rounded sinus at the columella. ***Surface:*** granulose, fresh shells covered with minute hairs, later whorls with irregular growth wrinkles on upper surface. ***Color:*** light reddish brown.

DISTRIBUTION: *Euchemotrema hubrichti* has not been found in Missouri, but is known from adjacent counties in western Illinois.

TYPE LOCALITY: Union County, Ill.

REMARKS: The carinate pillsnail was first identified in Pleistocene age talus exposed during road construction. Living snails were found later in crevices along the bluffs facing the Mississippi River (Hubricht 1943), and under limestone slabs at the tops of bluffs (Anderson and Smith 2005).

Gastrocopta sterkiana Pilsbry 1917

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: *Gastrocopta sterkiana* is similar to *G. procera*, but differs by the form of the parietal lamella. In *G. sterkiana* the parietal lamella is visible as a low callus extending outward toward the columellar insertion; in basal view, the joined angular and parietal lamellae appear 'Y' shaped. In *G. procera* the outer end of the parietal lamella is very short or indistinct.

DISTRIBUTION: *Gastrocopta sterkiana* has not been found in Missouri, however its proximity to Missouri's southern border suggests it may be found there. It occurs in northern Arkansas, Oklahoma, and Texas.

REMARKS: *Gastrocopta sterkiana* inhabits drier areas than *G. procera*.

Glyphyalinia luticola Hubricht 1966

Furrowed Glyph

Clade Stylommatophora > "Limacoid Clade" > Family Oxychilidae

DESCRIPTION: ***Shell:*** small, diameter about 5.7 mm, height about 2.6 mm, fragile, shape strongly depressed; whorls about 4 to 4½, moderately convex, suture moderately impressed; umbilicus small. ***Aperture:*** lunate, peristome thin, without lamellae. ***Surface:*** glossy, with more widely spaced axial grooves, about 20 on body whorl, as compared to Glyphyalinia indentata, which has about 28; spiral striae fine. ***Color:*** coppery in fresh shells, transparent. ***Animal:*** slate colored.

DISTRIBUTION: This species has not been reported from Missouri, however it has been found in adjacent counties of Arkansas and Oklahoma. Its reported range is from Oklahoma east to New Jersey, and south to Florida.

TYPE LOCALITY: Lillian, Ala.

REMARKS: "*Glyphyalinia luticola* may be readily be distinguished from *G. indentata* by its coppery color. The umbilicus is usually smaller than is usually found in *G. indentata* within its range, and is usually found in wetter habitats. It is a species of swamps, where it is frequently found with *Vertigo* and *Catinella*" (Hubricht 1966).

Mesomphix globosus (MacMillan 1940)

Globose Button

Clade Stylommatophora > "Limacoid Clade" > Family Oxychilidae

DESCRIPTION: ***Shell:*** medium, diameter 15.2 to 18.5 mm, height about 13 mm, thin and fragile, shape very globose; whorls about 5½, flattened above, slightly convex, suture shallow; umbilicus small, partly obscured by leading edge of lip. ***Aperture:*** large, oval, lunate, without lamellae; peristome thin, parietal callus thin. ***Surface:*** with axial growth ridges prominent and regularly spaced; spiral lines very fine, and with minute granulations; base smooth and polished. ***Color:*** reddish brown.

DISTRIBUTION: The globose button has not been found in Missouri, but is known to occur in counties of Arkansas and Tennessee bordering the Bootheel. Elsewhere, it ranges from Texas north to Indiana and south to Florida.

TYPE LOCALITY: Santee Canal, Berkeley County, S.C.

REMARKS: "Usually found in leaf litter on low ground, floodplains and swamps." (Hubricht 1985: 26). This species is most likely to be confused with juveniles of *Mesomphix capnodes* (see *M. capnodes* Remarks, Page 93).

Paravitrea capsella (Gould 1851)

Dimple Supercoil

Clade Stylommatophora > "Limacoid Clade" > Family Oxychilidae

DESCRIPTION: ***Shell:*** small, diameter about 5.5 mm, height about 3 mm, fragile; shape strongly depressed, whorls 6½ to 7, tightly coiled, slightly convex; periphery of body whorl located at the midline; suture slightly impressed, margined; umbilicus open. ***Aperture:*** lunate, peristome thin, young shells only rarely have lamellae, mature shells without lamellae. ***Surface:*** glossy, with relatively widely spaced axial grooves. ***Color:*** amber.

DISTRIBUTION: *Paravitrea capsella* has not been found in Missouri, however it has been reported from bordering counties of Illinois. Nationally, its range extends from Alabama north to Illinois, and east to Ohio and Virginia.

TYPE LOCALITY: Adams County, Ohio.

REMARKS: "What has been called *P. capsella* by Pilsbry and others is not that species, but a complex of anatomically distinct species with little or no shell differences. It will be necessary to re-collect all of the lots that have been labeled *P. capsella* and dissect them to make a positive identification," (Hubricht 1985: 28).

Paravitrea multidentata (A. Binney 1840)

Dentate Supercoil

Clade Stylommatophora > "Limacoid Clade" > Family Oxychilidae

DESCRIPTION: ***Shell:*** minute, diameter 2.5 to 3 mm, fragile; shape depressed; whorls 6, tightly coiled, slightly convex, suture shallow, periphery of body whorl located above midline, umbilicus small, open. ***Aperture:*** lunate, narrow; peristome thin, two or more rows of "radial barriers" or very small white "teeth" are visible through base of shell. ***Surface:*** smooth, shining, growth lines barely visible. ***Color:*** grayish white, translucent.

DISTRIBUTION: *Paravitrea multidentata* has not been found in Missouri, but does occur in Arkansas adjacent to McDonald and Barry counties. Elsewhere, it ranges from Alabama north to Michigan, and east to Maine.

TYPE LOCALITY: Middlebury, Addison County, Vt.

REMARKS: The dentate supercoil is "found in pockets of deep moist leaf litter" (Hubricht 1985).

Strobilops texasianus Pilsbry & Ferriss 1906

Southern Pinecone

Clade Stylommatophora > Subclade Orthurethra > Family Strobilopsidae

DESCRIPTION: ***Shell:*** minute diameter, 2.3 to 2.4 mm, height about 2.0 mm, solid; shape conic globose; whorls 5½, convex, suture deeply impressed; umbilicus small contained about eight times in the diameter. ***Aperture:*** oval, semi-lunate, peristome slightly reflected, thickened within; parietal lamella emerging to leading edge of parietal callus; infraparietal lamella barely visible, located deep within the body whorl; interparietal lamella short and located deep inside the whorl, near the inside ends of the other lamellae; columellar lamella short, very close to the axis; five basal lamellae, the inner is short and very broad situated near the axis, the second is longer, higher and sinuous, the third is short, very thin and sometimes missing, fourth and fifth are low and thin; a palatal lamella may be seen at the periphery (Fig. 53, Page 64); the lamellae are reduced in number as the shell matures with the full number being present only in the late juvenile stage; parietal callus strong and thick. ***Surface:*** of embryonic whorls smooth, the remainder with prominent radial ridges, which continue over the base undiminished. ***Color:*** reddish brown, lighter at the apex.

DISTRIBUTION: This species has not been found in Missouri; however, it has been reported from bordering counties in Arkansas and Oklahoma. In the other states it is known from Texas to Florida, and north to Pennsylvania.

TYPE LOCALITY: Alexandria, La.

REMARKS: The southern pinecone is found in areas somewhat wetter than *Strobilops labyrinthicus* (Hubricht 1985: 13).

Triodopsis vulgata (Pilsbry 1940)

Dished Threetooth

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** medium, diameter 13.5 to 19.5 mm, height 7.3 to 10.4 mm, solid; shape moderately to strongly depressed, whorls 5½ to 6, convex, suture moderately impressed; umbilicus open, contained four and a half to five times in diameter of shell. ***Aperture:*** trilobed, parietal lamella tall, nearly straight, outer lip lamella wide, peristome reflected, somewhat dished or concave in profile view, thickened within, lip wider than T. discoidea and T. neglecta, especially on the outer and basal portions; channel behind lip with an arc-shaped depression at the position of the outer lip tooth; parietal callus thin, nearly straight at leading edge. ***Surface:*** with fine closely spaced axial ridges, spiral striae weak or missing. ***Color:*** yellowish brown.

DISTRIBUTION: This species has been reported from Cape Girardeau, Jefferson, and St. Louis counties (Pilsbry, 1940, p. 806); however, it was not collected in Missouri by the authors. Elsewhere, it is reported from Louisiana north to Michigan and east to New York (Hubricht, 1985: 165).

TYPE LOCALITY: Columbus, Ohio

REMARKS: The dished threetooth is found in leaf litter on wooded hillsides.

In Missouri, fossils of this species have been reported from Pleistocene age talus from St. Louis County (Hubricht, 1964a).

Vertigo teskeyae Hubricht 1961

Swamp Vertigo

Clade Stylommatophora > Subclade Orthurethra > Family Vertiginidae

DESCRIPTION: *Vertigo teskeyae* is very similar to *V. ovata*, but differs by its darker color (when fresh), larger size (length 2.1 to 2.9 mm, diameter 1.5 to 1.8 mm), and by the apertural lamellae. In *V. teskeyae*, the infraparietal and suprapalatal lamellae are never present, the columellar lamella is horizontal and located in about the center of the columella, the basal lamella is usually small to obsolete, and when present is located at the end of a callus extending along the base and outer walls of the aperture. In *V. ovata*, the infraparietal and suprapalatal lamellae are often present, the columellar lamella is located above the center of the columella, and the basal lamella is located in a subcolumellar position, and not on a callus.

DISTRIBUTION: This species has not yet been found in Missouri, but has been collected in adjacent counties of Arkansas and Illinois, and almost certainly occurs in the Bootheel area (J. Nekola, pers. com., on pupillids of eastern U.S.) In the other states is known from east Texas and in all the coastal states to Maryland.

REMARKS: The swamp vertigo, as its common name implies, is found crawling on wet mud and debris of swamps (Hubricht 1961: 62). This is the largest vertigo species in the region.

Xolotrema obstrictum (Say 1821)

Sharp Wedge

Clade Stylommatophora > "Limacoid Clade" > Family Polygyridae

DESCRIPTION: ***Shell:*** large, diameter 21.3 to 26.6 mm, height, 10.5 to 14.3 mm, solid, depressed to strongly depressed; whorls about 5½, flat dorsally, convex below with an acute keel above the suture after the second whorl, suture very shallow; imperforate. ***Aperture:*** oval, lunate; parietal lamella and outer lip similar to *Xolotrema fosteri*. ***Surface:*** of embryonic whorls finely striate, later whorls with rather widely spaced axial striae and minute growth wrinkles more or less broken into granules, upper surface of body whorl with faint spiral striae; body whorl of some shells with periostracal laminae or erect scales. ***Color:*** cinnamon.

DISTRIBUTION: *Xolotrema obstrictum* has not been found in Missouri, but does occur in adjacent counties of Tennessee. It ranges from Alabama north to Illinois.

REMARKS: The sharp wedge is "found on rocky river bluffs near logs" (Hubricht 1985).

APPENDIX A:
LAND SNAILS CITED

The following are the Missouri localities sampled by the authors (RO, LW).

Adair County

Big Creek State Forest, (40.1764°N, 92.6188°W)

Henry Truitt Public Access, (40.2352°N, 92.6852°W)

Sugar Creek State Forest, (40.1240°N, 92.6582°W)

Thousand Hills State Park, (40.1832°N, 92.6503°W); from three small prairie remnants, (40.1835°N, 92.6477°W)

Andrew County

E. N. Davis Memorial Forest, (40.0688°N, 94.7990°W)

Elrod Mill Access, (39.9991°N, 94.6933°W)

Honey Creek Wildlife Area, (39.9416°N, 94.9878°W)

Atchison County

Brickyard Loess Mound Prairie, (40.4634°N, 95.5692°W)

Tarkio Prairie, (40.5071°N, 95.2175°W)

Audrain County

C. L. Northcutt Conservation Area, (39.2195°N, 92.0172°W)

Robert White II Wildlife Area, (39.3309°N, 91.8487°W)

Sears Memorial Wildlife Area, (39.2597°N, 91.7172°W)

Barry County

Roaring River State Park, 5 miles south of Cassville, (36.5876°N, 93.8415°W)

Eagle Rock, 1 mile southwest of (36.5396°N, 93.7613°W)

Eagle Rock, 2 miles north of (36.5764°N, 93.7556°W)

Eagle Rock, 2.5 miles southwest of (36.5345°N, 93.7857°W)

Eagle Rock, 4.25 miles southwest of (36.5217°N, 93.8214°W)

Flag Spring State Forest, (36.6155°N, 94.0320°W)

Barry County (cont.)
Mark Twain National Forest, (36.5237°N, 93.8219°W); (36.5118°N, 93.8380°W); (36.7265°N, 93.6033°W); (36.5118°N, 93.8380°W); (36.6382°N, 93.7156°W)
Piney Creek Wilderness, (36.6890°N, 93.6122°W); (36.7002°N, 93.6085°W)
Roadside along County Hwy E, (36.5652°N, 93.7168°W)
Roadside, 8.5 miles east Cassville, (36.6402°N, 93.7183°W)
Roaring River State Park, (36.5888°N, 93.8342°W); (36.5727°N, 93.8005°W); (36.5858°N, 93.8408°W)
Seligman, (36.5208°N, 93.9459°W)

Barton County
Catlin Prairie, (37.6337°N, 94.2758°W)
Pawhuska Prairie, (37.5393°N, 94.1628°W)
Prairie State Park, (37.5337°N, 94.5858°W); (37.5334°N, 94.5742°W); (37.5197°N, 94.5500°W); Gay Feather Trail, (37.5156°N, 94.5744°W)
Shelton L. Cook Memorial Meadow, (37.4192°N, 94.1519°W), (37.4221°N, 94.1516°W)

Bates County
Harmony Mission and Peabody Wildlife Management Areas, (38.0723°N, 94.4272°W)
Outfall Pool below a small lake, (38.4392°N, 94.5827°W)
Roadside Pool beside Willow Creek, (38.3981°N, 94.5374°W)
Small Pool southwest corner of airport at Co Hwy TT and U.S. Bus. 71, (38.2925°N, 94.3430°W)

Benton County
Brickley Hollow Access, (38.2837°N, 93.2265°W)
Hi Lonesome Prairie, (38.4772°N, 93.2222°W)
Lincoln Towersite, (38.3608°N, 93.2843°W)
Mt. Hulda Towersite, (38.3693°N, 93.1070°W)

Bollinger County
Castor River State Forest, (37.2503°N, 90.1680°W)
Clubb Creek State Forest, (37.1895°N, 90.0098°W); (37.1583°N, 90.0062°W)
Dark Cypress Swamp, (37.1022°N, 90.0387°W)
Little Whitewater State Forest, (37.5537°N, 90.0845°W)
Mark Twain National Forest, (37.4446°N, 90.1419°W)

Boone County
Mount Horeb Cemetery, (39.2165°N, 92.2823°W)
Pinnacles Natural Area, (39.1322°N, 92.3213°W)
Rock Bridge State Park, (38.8819°N, 92.2973°W)
Rocky Fork Lakes Wildlife Area, (39.0733°N, 92.3074°W)
Three Creeks Conservation Area, (38.8410°N, 92.2790°W); (38.8517°N, 92.2820°W); (38.8519°N, 92.2858°W); (38.8489°N, 92.2830°W), (38.8404°N, 92.2792°W)

Buchanan County
Bluffwoods Conservation Area, (39.6340°N, 94.9498°W)
Sunbridge Hills Conservation Area, (39.8130°N, 94.8708°W)

Butler County
Corkwood Natural History Area, (36.5593°N, 90.5362°W)
Oak Fire Tower, (36.8723°N, 90.4043°W)
Mark Twain National Forest, (36.8553°N, 90.4192°W)
9 miles northwest of Poplar Bluff, (36.8483°N, 90.5147°W)
University Forest, (36.9038°N, 90.3316°W)

Callaway County
Hwy 94, 3 miles east of Jefferson City along (38.5871°N, 92.1218°W)
Little Dixie Lake Wildlife Area, (38.9106°N, 92.1213°W)
Reform Wildlife Area, (38.7427°N, 91.7778°W)
Tucker Prairie, (38.9508°N, 91.9912°W); (38.9480°N, 91.9917°W)
Whetstone Creek Wildlife Area, (38.9499°N, 91.6890°W); (38.9473°N, 91.6933°W); (38.9460°N, 91.7178°W); (38.9600°N, 91.6907°W); (38.9519°N, 91.6942°W)

Camden County
Ha Ha Tonka State Park Prairie, (37.9815°N, 92.7592°W); (37.9784°N, 92.7670°W); (37.9787°N, 92.7712°W)

Cape Girardeau County
Apple Creek State Forest, (37.5423°N, 89.5910°W)
Bollinger Mill Historic Site, (37.3675°N, 89.8027°W)
Hillside, 2 miles north of Bainbridge, (37.4368°N, 89.4448°W)
Hillside west of Mississippi River, (37.4592°N, 89.4857°W)
Maintz Wildlife Preserve, (37.4871°N, 89.7970°W); (37.4865°N, 89.7997°W)
Roadside Pool at junction of U.S. Hwy 61 and MO Hwy 74,

(37.2800°N, 89.5553°W)
Trail-of-Tears State Park, 7 miles north of Cape Girardeau, (37.4575°N, 89.4661°W)
Trail of Tears State Park, (37.4282°N, 89.4403°W); (37.4580°N, 89.4863°W)

Carroll County
Bunch Hollow Conservation Area, (39.5850°N, 93.6048°W)
Little Compton Lake Conservation Area, (39.5472°N, 93.2958°W)
W. L. Schifferdecker Memorial Conservation Area, (39.3779°N, 93.6802°W)

Carter County
Chilton Creek Preserve, (37.0627°N, 91.0791°W); (37.0773°N, 91.0765°W); (37.0789°N, 91.1048°W); (37.0692°N, 91.0548°W); (37.0602°N, 91.0557°W); (37.0582°N, 91.0607°W); (37.0793°N, 91.0548°W); (37.0663°N, 91.0864°W)
Current River bluffs, 4 miles northwest of Van Buren, (37.0533°N, 91.0592°W)
Peck Ranch Conservation Area, (37.0355°N, 91.2095°W); (37.0394°N, 91.1550°W)

Cass County
Amarugia Wildlife Area, (38.5433°N, 94.4430°W)
Clearfork Cemetery, (38.6140°N, 94.2155°W)
Garden City Lake, (38.5658°N, 94.1737°W)
Harrisonville, Lake Luna, (38.6657°N, 94.3387°W)
Garden City, (38.5578°N, 94.1947°W)
Railroad right-of-way at U.S. Hwy 71, (38.6565°N, 94.3652°W)

Cedar County
Bluff Springs Conservation Area, (37.7862°N, 93.7613°W)
Sky Prairie, 6 miles west of Stockton, (37.6958°N, 93.9463°W)
Stockton Lake State Park, (37.6198°N, 93.7687°W); (37.6200°N, 93.7658°W)
Stockton Lake, Rutledge Bluff, (37.6292°N, 93.7833°W)
Turkey Creek State Wildlife Area, (37.7800°N, 93.6812°W)
Wah-Kon-Tah Prairie, 2 miles east of Eldorado Springs, (37.8767°N, 93.9900°W)

Chariton County
Nannie B. Floyd Conservation Area, (39.6620°N, 93.0463°W)
RR right-of way, (39.4171°N, 93.0973°W)
Santa Fe RR right-of-way at MO Hwy 111, (39.6284°N, 93.0811°W)
Yellow Creek Conservation Area, (39.5847°N, 93.2330°W)

Christian County
Busiek State Forest, (36.8652°N, 93.2344°W); (36.8633°N, 93.2240°W)
Glade along MO Hwy 125, (36.9055°N, 93.0436°W)
Mark Twain National Forest, (36.8229°N, 93.1144°W); (36.8179°N, 93.0835°W)

Clark County
Athens State Historic Site, (40.5928°N, 91.7106°W); north-facing slopes along Des Moines River, (40.5931°N, 91.7111°W)
Charlie Heath Memorial Conservation Area, (40.5857°N, 91.8762°W); (40.5780°N, 91.9021°W)
Clark Conservation Area, (40.5621°N, 91.8012°W)
Fox Valley Lake Conservation Area, (40.5041°N, 91.7681°W)
Illiniwek Village State Historic Site, (40.4270°N, 91.5532°W)

Clay County
Cooley Lake Wildlife Area, hillside to Missouri River floodplain, (39.2414°N, 94.2374°W)
Maple Woods Nature Preserve in Gladstone, (39.2297°N, 94.5461°W)
Smithville Lake Hunting Area, (39.4380°N, 94.5168°W)
Watkins Mill State Park, (39.4098°N, 94.2532°W)

Clinton County
Roadside cut along I-35, (39.4818°N, 94.3052°W)
Trice-Dedman Memorial Woods, (39.5652°N, 94.3960°W)
Wallace State Park, (39.6590°N, 94.2117°W); (39.6509°N, 94.2157°W); (39.6521°N, 94.2142°W); (39.6669°N, 94.2128°W)

Cole County
Hillside by cave, one other collection at this site, (38.3889°N, 92.1788°W)
Honey Creek Access, (38.4932°N, 92.2433°W); (38.4915°N, 92.2290°W)
Moreau River Access, (38.5428°N, 92.1058°W)
Moreau River, mesic hillside, (38.5384°N, 92.1687°W)
Pikes Camp Access hillside to floodplain, (38.4662°N, 92.1720°W)
St. Thomas, 2.5 miles northeast of (38.3888°N, 92.1772°W)

Cole County (cont.)
Scrivner Road Wildlife Area, (38.4862°N, 92.3922°W)
Stringtown Bridge Access, (38.5352°N, 92.1003°W)

Cooper County
Hillside to Missouri River floodplain, (38.9518°N, 92.5833°W)
Lamine River Wildlife Area, (38.7047°N, 92.9625°W)
Prairie Home Wildlife Area, (38.7777°N, 92.5930°W)

Crawford County
Meramec River bluffs, 5.75 miles east southeast of Bourbon, (38.1204°N, 91.1615°W)
Courtois Creek bluffs, (38.0133°N, 91.1898°W); (38.0222°N, 91.1953°W); (38.0243°N, 91.2061°W)
Courtois Creek, near mouth at Huzzah Creek, (38.0239°N, 91.2056°W)
Huzzah Creek bluffs, (38.0012°N, 91.2202°W); (37.9987°N, 91.2035°W); (37.9610°N, 91.1818°W); (38.0012°N, 91.2200°W); (37.9846°N, 91.2082°W); (38.0083°N, 91.2013°W)
Huzzah Creek bluffs along a spring branch, (37.9620°N, 91.1841°W)
Hwy E at Huzzah Creek crossing, 2 miles south Onondaga Cave State Park, (38.0306°N, 91.2151°W)
Huzzah State Forest, (38.0065°N, 91.2011°W)
Huzzah Wildlife Area, (38.0257°N, 91.2017°W); (38.0142°N, 91.2435°W); (38.0267°N, 91.2120°W); (38.0305°N, 91.2110°W)
Meramec River spring along, 2.2 miles northwest of Steelville, (37.9882°N, 91.3877°W)
Meramec River bluff, (38.1161°N, 91.1548°W); (38.1841°N, 91.0927°W); (38.1493°N, 91.1231°W)
Meramec State Park glade, (38.1963°N, 91.1125°W)
Onondaga Cave State Park, (38.0571°N, 91.2374°W); (38.0598°N, 91.2306°W); (38.0534°N, 91.2452°W); (38.0587°N, 91.2290°W)

Dade County
Greenfield Glade, (37.3738°N, 93.8546°W)
Hillside, 3.5 miles southeast of Greenfield, (37.3858°N, 93.7591°W)
Horse Creek Prairie Conservation Area, (37.4072°N, 93.9933°W)
Indigo Prairie, (37.3625°N, 93.9023°W)
Niawathe Prairie, (37.5142°N, 93.9717°W)
Penn-Sylvania Prairie, (37.2947°N, 90.5916°W)
Stockton Lake Forest, (37.4832°N, 93.8587°W)
Stony Point Prairie, (37.5433°N, 94.0313°W)

Dallas County
Bennett Spring State Park glade, (37.7188°N, 92.8493°W)
Lead Mine State Forest, (37.8454°N, 92.9410°W)
Niangua River hillside glade, (37.7880°N, 92.8602°W)

Daviess County
Gallatin Wildlife Area, (39.8430°N, 93.9250°W)
Holmes Bend Access, (39.8923°N, 93.9250°W)
Jamesport, 8.5 miles north of (40.0957°N, 93.7739°W)
Savage Access at Co Hwy Z, (40.0492°N, 94.2132°W)

De Kalb County
Cameron City Lake #3, (39.7743°N, 94.2687°W)
King Lake Conservation Area, (40.0378°N, 94.4513°W)
Pony Express Conservation Area, (39.7925°N, 94.3825°W)

Dent County
Current River, floodplain, (37.4267°N, 91.6430°W), (37.4257°N, 91.6493°W); bluffs (37.4348°N, 91.6544°W), (37.4317°N, 91.6148°W)
Indian Trail State Forest, (37.7520°N, 91.3905°W); (37.7523°N, 91.3905°W)
Montauk State Park, (37.4563°N, 91.6730°W); Natural Area, (37.4498°N, 91.6903°W)

Douglas County
Cemetery and roadside along Hwy.14, (36.8494°N, 92.3336°W)
Glade north of MO Hwy 181, (36.9494°N, 92.1200°W)
Bryant Creek, hillside, (36.7098°N, 92.2763°W); at river access point, (36.9142°N, 92.4953°W)

Dunklin County
Drainage Ditch berms at MO Hwy 84, (36.2373°N, 89.9809°W)
Ben Cash Wildlife Area, (36.1925°N, 90.1932°W)
Hornersville Swamp Wildlife Area, (36.0160°N, 90.2102°W)
Wilhemia State Forest, (36.5107°N, 90.1896°W)

Franklin County
Engleman Woods Conservation Area, 1 mile southwest of Saint Albans, (38.5694°N, 90.7789°W)
Gray Summit, 3 miles south of (38.4363°N, 90.8254°W)
Meramec Conservation Area, Arthur G. Heyne Memorial Annex, (38.2288°N, 91.0791°W)
Meramec State Park, (38.2300°N, 91.1105°W); (38.2301°N, 91.0676°W); bluff, (38.2308°N, 91.0830°W); bluff to floodplain, (38.2186°N, 91.0762°W)
Hillside along railroad tracks, 1 mile east of New Haven, (38.6073°N, 91.1907°W)
Robertsville State Park, (38.4365°N, 90.8043°W); (38.4345°N, 90.8228°W); (38.4305°N, 90.8165°W)
Miller/Oesch Glade, 8.5 miles south of Saint Clair, (38.2237°N, 90.9773°W)
Hillside along private drive, 9 miles south of Saint Clair, (38.2181°N, 90.9793°W)
Hillside along private drive, 8.5 miles south of Saint Clair, (38.2237°N, 90.9773°W)
Shaw Nature Reserve, at Long Glade, (38.4645°N, 90.8206°W)
Shaw Nature Reserve (38.4606°N, 90.8190°W); (38.4609°N, 90.8145°W); (38.4615°N, 90.8267°W); (38.4671°N, 90.8179°W)
Meramec State Park, 2 miles east of Sullivan, (38.1944°N, 91.1162°W); (38.2018°N, 91.1204°W); (38.2306°N, 91.0825°W); (38.2358°N, 91.0804°W)
Washington, at end of Hancock St., talus along railroad, (38.5557°N, 91.0008°W)

Gasconade County
Canaan State Forest, (38.3268°N, 91.6069°W)
Gasconade River, riverbanks, (38.4683°N, 91.6287°W)
Mint Spring Natural Area, (38.2067°N, 91.5393°W)
Tea Access, (38.2977°N, 91.3993°W)

Gentry County
Andy Denton Access, (40.0957°N, 94.3487°W)
Elam Bend Conservation Area, (40.0770°N, 94.2578°W)

Greene County
Bois D'arc Wildlife Area, (37.2952°N, 93.5060°W); (37.3058°N, 93.5193°W); (37.2928°N, 93.5173°W)
Green Lawn Cemetery, (37.4012°N, 93.5500°W)
Little Sac Woods Urban Forest, (37.3832°N, 93.3952°W); (37.3818°N, 93.4003°W)
Phenix Access, (37.3648°N, 93.5780°W)
Pasture near house, 3 miles northeast of Ash Grove, (37.3503°N, 93.5555°W); (37.3521°N, 93.5534°W)
Rocky Barrens Conservation Area, (37.3127°N, 93.3977°W)

Grundy County
Chicago Rock Island and Pacific RR right-of-way, (40.1910°N, 93.6037°W)
Crowder State Park, (40.1005°N, 93.6488°W); (40.0861°N, 93.6739°W)
Spickard, abandoned RR right-of-way, (40.2483°N, 93.5958°W)

Harrison County
Grand Trace State Forest, (40.3350°N, 93.9918°W)
Lotts Creek Wildlife Area, (40.5402°N, 94.1980°W)
Wayne Helton Memorial Wildlife Area, (40.2460°N, 93.8157°W)

Henry County
Urich Wildlife Area, (38.4845°N, 93.9542°W)

Hickory County
J. F. Murphy Memorial Forest, (37.9472°N, 93.3888°W)
Muleshoe Conservation Area, (37.9879°N, 93.0992°W)
Pomme de Terre State Park, (37.9890°N, 93.0962°W)

Holt County
J. C. McCormack Conservation Area, (40.0590°N, 95.2325°W)
Monkey Mountain Wildlife Area, (39.9367°N, 95.0102°W); (39.9110°N, 95.0108°W)
Riverbreaks State Forest, (39.9183°N, 95.1221°W)

Howard County
Davisdale Wildlife Area, (39.0035°N, 92.6175°W)
Hungry Mother Wildlife Area, (39.2435°N, 92.5483°W)

Howell County
Carmen Springs Wildlife Area, (36.9317°N, 92.0599°W); (36.9090°N, 92.0783°W); (36.9363°N, 92.0413°W)
Dean Davis Memorial Wildlife Area, (36.8978°N, 91.9107°W)
White Ranch State Forest, (36.5211°N, 91.8436°W); (36.5270°N, 91.8504°W)

Iron County
Barton Fen, (37.6450°N, 91.0670°W)
Fen, 2 miles east southeast of Bixby, (37.6498°N, 91.0782°W)
Ketcherside Mountain State Forest, (37.5508°N, 90.6801°W)
Russell Mountain, (37.5725°N, 90.6917°W)
Taum Sauk Mountain, (37.5683°N, 90.7215°W)

Jackson County
Blue River Glade, (38.9788°N, 94.5376°W)
Blue Valley Park, in Kansas City, (39.0741°N, 94.5118°W)
Burr Oak Woods Urban Forest, (39.0433°N, 94.2951°W); (39.0424°N, 94.2840°W)
James Reed Memorial Wildlife Area, (38.8742°N, 94.3165°W)
Longview Lake, (38.9202°N, 94.4715°W)
Lee's Summit, (38.9137°N, 94.3340°W)
Swope Park, beside Wildcat Hollow Dr., (38.9856°N, 94.5203°W); at Hillcrest and Oldham Dr., (38.9894°N, 94.5178°W)
Union Cemetery, in Kansas City just east of the Liberty Memorial, (39.0758°N, 94.5815°W)
Watts Mill, 103rd St. and State Line Road, Kansas City, (38.9415°N, 94.6090°W)

Jasper County
Center Creek, at Loop I-44, (37.0729°N, 94.1065°W)
Center Creek, at Alt. U.S. 71, (37.1055°N, 94.3114°W)
Stones Corner Access, (37.1677°N, 94.5132°W)

Jefferson County
Big River bluff and floodplain, (38.1073°N, 90.6848°W); floodplain, (38.1112°N, 90.6819°W)
De Soto, 2.5 miles east of, (38.1349°N, 90.5092°W)
Hillside to floodplain, 6.5 miles southeast of Crystal City, (38.1645°N, 90.3069°W)
Rush Island, 9 miles southeast of Crystal City, (38.1383°N, 90.2684°W)
Hilda J. Young Memorial State Forest, (38.4355°N, 90.6633°W); (38.4427°N, 90.6630°W)
Mastodon State Park, (38.3817°N, 90.3920°W)
Nancy B. Altvater La Barque Hills, (38.4133°N, 90.7265°W); (38.4106°N, 90.7265°W)
Pacific Palisades Conservation Area, 1 mile southeast of Pacific, (38.4791°N, 90.7167°W); (38.4721°N, 90.7257°W); (38.4710°N, 90.7207°W)
Valley View Glade, (38.2630°N, 90.6285°W); (38.2555°N, 90.6227°W)
Victoria Glade, (38.2035°N, 90.5352°W)
Young Conservation Area, (38.4416°N, 90.6644°W)

Johnson County
College Street, in Warrensburg, (38.7625°N, 93.7383°W)
R. and M. Perry Memorial Wildlife Area, (38.9010°N, 93.5082°W)

Knox County
Abandoned RR right-of-way, 0.5 miles southeast of Knox City, (40.1383°N, 91.9965°W)
Henry Sever Lake Conservation Area, (40.0147°N, 91.9900°W)
White Oak Bend Access, (39.9963°N, 92.0210°W)

Laclede County
Bear Creek State Forest, (37.8285°N, 92.6818°W); Ford Tract, (37.7283°N, 92.4788°W)
Bennett Spring State Park, Bennett Spring Branch bluff, (37.7232°N, 92.8558°W); hanging fen, (37.7234°N, 92.8570°W)
Coffin Cave Natural History Area, (37.7812°N, 92.8533°W)
Osage Fork State Forest C Road Tract, (37.5755°N, 92.6826°W)

Lafayette County
Spring-fed marsh, (39.1923°N, 93.7832°W)
Waverly, 4 miles west northwest of (39.2221°N, 93.5885°W)
RR right-of-way, (39.0316°N, 93.8804°W)

Lawrence County
Paris Springs Access, (37.1923°N, 93.6865°W)
Providence Prairie, (37.2712°N, 93.9838°W)
Robert E. Talbot Wildlife Area, (37.1484°N, 94.0293°W); (37.1408°N, 93.9244°W)

Lewis County
Deer Ridge Conservation Area, (40.1693°N, 91.7900°W)
Hwy 61 at Wyaconda River, (40.0585°N, 91.5002°W)
Wyaconda Crossing State Forest, (40.1858°N, 91.6083°W)

Lincoln County
Bluff along railroad track, (39.1402°N, 90.7678°W)

Cuivre River State Park, (39.0338°N, 90.9593°W); savanna, (38.9999°N, 90.9128°W), glade, (39.0254°N, 90.9222°W)
Troy, 3 miles northeast of (39.0154°N, 90.9439°W); (39.0179°N, 90.9160°W)
Silex, 0.5 miles northeast of (39.1288°N, 91.0472°W)
Prairie Slough Wildlife Area, (39.2056°N, 90.7385°W)
Roadcut northeast of Junction of Co Hwys E and RA, (39.1302°N, 90.9843°W)
Roadside along U.S. Hwy 61, (39.0098°N, 90.9770°W)
White Memorial Wildlife Area, (39.1783°N, 91.0092°W)
William R. Logan Wildlife Area, (39.1542°N, 91.0337°W)

Linn County
Burlington RR right-of-way, (39.7895°N, 93.0049°W)
Pershing State Park, (39.7559°N, 93.2162°W)

Livingston County
Grand River, drift, (39.7557°N, 93.5563°W); floodplain, (39.6651°N, 93.2865°W)
Punkin Access, hillside to floodplain, (39.9410°N, 93.6163°W)

McDonald County
Big Sugar Creek, (36.6108°N, 94.3511°W); edge of floodplain, (36.6137°N, 94.3530°W)
Buffalo Hills Natural Area, (36.7386°N, 94.5610°W)
Hillside along U. S. Hwy 71, (36.5497°N, 94.3296°W)
Huckleberry Ridge State Forest, (36.5927°N, 94.3255°W); (36.6083°N, 94.3103°W)
Lanagan Fire Tower, (36.6100°N, 94.4693°W)
Little Sugar Creek at MO Hwy 90, (36.5513°N, 94.2842°W); floodplain, 36.5395°N, 94.2881°W)
Mt. Shira Access, (36.5810°N, 94.4638°W)
1 mile northwest Noel, (36.5593°N, 94.4963°W)
Powell Fire Tower, (36.5505°N, 94.1868°W)
Roadcut on U.S. Hwy 71, (36.5963°N, 94.3942°W)

Macon County
Atlanta-Long Branch Wildlife Area, (39.8770°N, 92.4849°W)
Hidden Hollow State Forest, (39.9963°N, 92.6360°W)
Long Branch State Park, (39.7650°N, 92.5023°W); (39.8180°N, 92.5067°W)
Mussel Fork Wildlife Area, (39.7310°N, 92.8543°W)
Thomas Hill Wildlife Area, (39.6704°N, 92.6092°W)

Madison County
Little St. Francis River, hillside, (37.5552°N, 90.3577°W); at Thompson Ford, (37.5545°N, 90.3577°W)
Marble Creek Campground, (37.4511°N, 90.5406°W)
Silver Mines Recreational Area, (37.5603°N, 90.4402°W)

Maries County
Clifty Creek Natural Area, (38.0394°N, 91.9681°W)
Rinquelin Trail Community Lake, (38.0870°N, 92.1517°W)
Spring Creek Gap State Forest, (38.1443°N, 91.8065°W); (38.1507°N, 91.8065°W); (38.1528°N, 91.8100°W)

Marion County
Elmslie Memorial State Forest, (38.1567°N, 91.8128°W)
Helton, hillside to Mississippi River floodplain, (39.7720°N, 91.4147°W)
Hillside southwest of Lovers Leap Scenic View, at U.S. Hwy 36 and MO 79, (39.7127°N, 91.3595°W)
Horseshoe Bend Access, (39.8338°N, 91.7858°W)
J. Thad Ray Wildlife Area, (39.7297°N, 91.4132°W)

Mercer County
Chloe Lowry Marsh, (40.4372°N, 93.6105°W)
Lake Paho Wildlife Area, (40.4195°N, 93.6650°W)

Miller County
Bat Cave Conservation Area, talus slope, (38.3189°N, 92.2898°W)
Boeckman Bridge State Wildlife Area, hillside bluff, (38.2281°N, 92.2478°W)
Madden Ford Access, (38.0544°N, 92.3097°W)
Saline Valley Wildlife Area at Kings Bluff Access, (38.2772°N, 92.3908°W); (38.2752°N, 92.4222°W)
Wilson Camp Access, (38.1773°N, 92.3218°W)

Mississippi County
Big Oak Tree State Park, (36.6435°N, 89.2897°W)
Seven Island Wildlife Area, (36.6218°N, 89.2988°W)
Ten Mile Pond Wildlife Area, (36.7050°N, 89.3275°W)

Moniteau County
R. and V. Smith Conservation Area, (38.6649°N, 92.4379°W)

Monroe County
Mark Twain State Park, (39.4640°N, 91.7985°W)
Mark Twain Lake, hillside, (39.5197°N, 91.7833°W); quarry, (39.4534°N, 91.8171°W)
Woodland Access, (39.5393°N, 92.2120°W)

Montgomery County
Bluffton, near intersection of Hwy 94 and Katy Trail, (38.7058°N, 91.6239°W)
Danville Wildlife Area, hillside, (38.8707°N, 91.5023°W); (38.8703°N, 91.5002°W)
Graham Cave State Park, (38.9034°N, 91.5713°W); (38.9055°N, 91.5700°W); (38.9055°N, 91.5726°W)
Grand Bluffs Conservation Area, (38.7110°N, 91.6195°W)
Hillside to Missouri River floodplain, 4.5 miles west of Rhineland, (38.7060°N, 91.6194°W)
Loutre Lick Access, (38.8802°N, 91.5887°W)
Marshall I. Diggs Wildlife Area, (39.0700°N, 91.6328°W)

Morgan County
Hite Prairie, (38.4210°N, 92.8640°W)

New Madrid County
Donaldson Point State Forest, (36.5760°N, 89.4778°W); (36.5527°N, 89.4402°W); (36.5440°N, 89.4480°W); (36.5639°N, 89.4611°W)

Newton County
Diamond Grove Prairie, (37.0238°N, 94.3827°W)
Fort Crowder Conservation Area, (36.8267°N, 94.3157°W)
Goodman Towersite, (36.7730°N, 94.4175°W)
Tipton Ford Access, (36.9801°N, 94.4413°W)

Nodaway County
Bilby Ranch Wildlife Area, (40.3415°N, 95.1734°W)
Keever Bridge Access, (40.4287°N, 94.6330°W)
Nodaway County Community Lake, (40.4300°N, 94.8558°W)

Oregon County
Brawley Hollow Cave #3, (36.7553°N, 91.2219°W)
Eleven Point River, bluff, (36.7693°N, 91.2721°W); (36.7080°N, 91.2058°W)
Eleven Point River at Hwy 19, (36.7870°N, 91.3495°W)
Falling Spring, (36.8679°N, 91.2954°W)
Grand Gulf State Park, (36.5443°N, 91.6370°W)
Gravel Cave, (36.7235°N, 91.1743°W)
4 miles east of Greer, (36.7674°N, 91.2674°W)
McCormack Lake shoreline, (36.8222°N, 91.3503°W)
McCormack Lake, along McCormack-Greer Trail, (36.8121°N, 91.3484°W)
McCormack Lake, (38.8120°N, 91.3485°W)
Many Springs Cave, T25NR04W Sec 30, (36.8070°N, 91.4373°W)
Mark Twain National Forest, (36.8292°N, 91.3472°W); at Braswell Fire Tower, (36.7123°N, 91.3117°W); at Greer Spring Trail, (36.7859°N, 91.3471°W)
Myrtle Access, (36.5115°N, 91.1680°W)
Seven Piles of Rock Cave, (36.7667°N, 91.2225°W)
Whites Creek Cave, adjacent hillside, (36.7238°N, 91.2047°W)

Osage County
Ben Branch Recreational Area, (38.5735°N, 91.7882°W)
Bonnots Mill Access, (38.5703°N, 91.9744°W)
Bonnots Mill, 0.5 miles southwest of, (38.5728°N, 91.9711°W)
Chamois Fishing Access, (38.6764°N, 91.7633°W)
Hillside along railroad tracks, 2 miles west of Morrison, (38.6767°N, 91.6718°W)
Hillside talus, 3.75 miles west southwest of Chamois, (38.6588°N, 91.8347°W)
Missouri River floodplain, 4 miles northwest of St. Aubert, (38.6479°N, 91.8638°W)
Painted Rock State Forest, (38.4026°N, 92.1078°W)
Bluffs facing Osage River, 6 miles southwest of Westphalia, (38.4024°N, 92.1135°W)

Ozark County
Althea Spring, (36.6423°N, 92.2270°W)
Bryant Creek at river access point at Hodgson Mill, (36.7079°N, 92.2650°W)
Caney Mountain Wildlife Area, at Landers Bald, (36.6861°N, 92.3923°W); at Headquarters Glade, (36.6850°N, 92.3913°W)
Caney Mountain Wildlife Area, (36.6821°N, 92.4463°W)
Glade along Co Hwy W, (36.5237°N, 92.5832°W)
Hammond Camp, (36.7561°N, 92.1520°W)
Hillside along Bryant Creek, 1.2 miles northwest of

Hodgson Mill, (36.7165°N, 92.2850°W)
Hillside along Bryant Creek, 1 mile northwest of Hodgson Mill, (36.7132°N, 92.2816°W)
Mark Twain National Forest, (36.7500°N, 92.7507°W)
McGarr Ridge, (36.7450°N, 92.1492°W)
Patrick Bridge Access, (36.6428°N, 92.2222°W)
Timber Knob Fire Tower, (36.5648°N, 92.4715°W)

Pemiscot County
Twin Borrow Pit, (36.3727°N, 89.5979°W)
Roadside pool along I-55, 2 miles south of Caruthersville, (36.1483°N, 89.6544°W)
Wolf Bayou, (36.3199°N, 89.6376°W)

Perry County
76 State Forest, (37.7198°N, 89.6143°W)
Knob School Spring Cave (37.8240°N, 89.8992°W)
Mark Twain National Forest, (37.6405°N, 90.0505°W)
Mystery Cave in the sinkhole entrance, (37.6689°N, 89.8208°W)
Perry County Community Lake, (37.7262°N, 89.9112°W)
Starland, hillside, (37.7096°N, 89.5860°W)
Starland Quarry, (37.7070°N, 89.5903°W)
Tom Moore Cave, (37.7632°N, 89.9025°W)

Pettis County
Bothwell State Park, (38.7862°N, 93.2178°W)
Drover's Prairie, (38.5278°N, 93.3013°W)
Goodnight Henry Prairie, (38.5738°N, 93.2165°W)
Heath Creek at Hwy. 65, (38.9107°N, 93.2082°W)
Paint Brush Prairie, (38.5368°N, 93.2690°W)
Otterville, 1 mile east of (38.7076°N, 92.9686°W)

Phelps County
Mark Twain National Forest, at Mill Creek Trail, (37.8753°N, 91.9283°W)

Pike County
Clinton Spring, (39.4424°N, 91.0386°W)
Du Pont Wildlife Area, (39.5526°N, 91.1721°W)
Du Pont Reservation, swamp near north side of entrance road, (39.5605°N, 91.1774°W); at scenic overlook to floodplain, (39.5694°N, 91.1874°W)
Frankford, (39.4857°N, 91.3067°W)
Frankford, 1 mile southeast of, (39.4823°N, 91.3071°W)
Ranacker Wildlife area, across road from entrance, (39.4623°N, 91.2865°W)
Ted Shanks Wildlife Area, hillside to floodplain, (39.5380°N, 91.1645°W); closed canopy swamp, (39.5350°N, 91.1405°W)

Platte County
Platte Falls Wildlife Area, (39.3710°N, 94.7603°W)
Roadside ditch along Hwy 45, (39.4635°N, 94.9755°W)
Weston Bend State Forest, (39.3797°N, 94.8753°W)

Polk County
Brush Creek Conservation Area, (37.8121°N, 93.6218°W)
Pleasant Hope Conservation Area, (37.4415°N, 93.3070°W)
Roadside cut along MO Hwy 245, (37.5337°N, 93.6135°W)
Sentinel Conservation Area, (37.7893°N, 93.3382°W)

Pulaski County
Fort Leonard Wood, hillside along Big Piney River, (37.7233°N, 92.0588°W); hillside by Davids Cave, (37.7292°N, 92.0537°W); hillside by Kneebuster Cave, (37.7373°N, 92.0815°W); hillside by Miller Cave, (37.7097°N, 92.0650°W); hilltop, (37.7233°N, 92.0555°W); (37.7239°N, 92.0572°W); river bluffs, (37.7232°N, 92.0562°W), (37.7233°N, 92.0589°W)
Gasconade River bluffs at Rte. 17 Bridge, (37.8519°N, 92.2118°W)

Putnam County
Mineral Hills State Forest, (40.4270°N, 92.9665°W)
Rebel Cove Wildlife Area (40.5563°N, 92.7133°W); marsh, (40.5692°N, 92.7079°W)

Ralls County
Indian Camp Access, (39.6151°N, 91.3954°W)
Limestone Quarry, (39.6174°N, 91.4118°W)
Mark Twain Lake, boat access area, (39.4863°N, 91.7103°W)
Salt River at CO Hwy A, (39.5727°N, 91.5680°W)

Randolph County
Rudolf Bennitt Wildlife Area, (39.2622°N, 92.4405°W)

Randolph County (cont.)
Water Works Lake, (39.3323°N, 92.5065°W)

Ray County
Crooked River Conservation Area, (39.4047°N, 94.0640°W)
F. E. Wagner Conservation Area, (39.3893°N, 93.8980°W)
Foxglove Conservation Area, (39.3920°N, 94.1168°W)
Lawson City Lake, (39.4543°N, 94.2043°W)

Reynolds County
Deer Run State Park, (37.2917°N, 90.9894°W)
Grasshopper Creek, (37.4353°N, 91.0937°W)
Johnson Shut-ins State Park, (37.5276°N, 90.8571°W)
Nancy B. Altvater Grasshopper Hollow, (37.4218°N, 91.0931°W)
Webb Creek State Forest, (37.1005°N, 90.8375°W)

Ripley County
Current River bluff, (36.6205°N, 90.8458°W)
Fourche Creek State Forest, (36.5107°N, 91.0412°W)
Mark Twain National Forest at Fourche Lake Recreational Area, (36.6472°N, 91.0573°W)
Sand Pond Wildlife Area, (36.5043°N, 90.6032°W)
Wells Branch Fen, (36.6660°N, 90.9010°W)
White Oak Trail, (36.6703°N, 90.8668°W)

St. Charles County
Hwy 79 at bridge over Cuivre River, (38.9212°N, 90.7488°W)
Missouri River floodplain, 1 mile upstream of Hwys. 40/64 bridge, (38.6778°N, 90.7120°W)
Weldon Spring Wildlife Area, hillside to floodplain, (38.6155°N, 90.7652°W); hillside, (38.6620°N, 90.7416°W)
Katy Trail, 1 mile northeast of Defiance, (38.6510°N, 90.7650°W)
Katy Trail at Weldon Spring Conservation Area, (38.6771°N, 90.7130°W)

St. Clair County
Brush Creek Natural Area, (37.8650°N, 93.7032°W)
Dave Rock Natural Area, (38.1167°N, 93.7323°W)
Hillside along Truman Lake, (38.0929°N, 93.6046°W)
Kings Prairie, (37.9898°N, 93.6058°W)
Lichen Glade, (38.0572°N, 93.7849°W)
Schell-Osage Wildlife Area, (38.0101°N, 94.0483°W); (38.0070°N, 94.0465°W)
Taberville Prairie, (38.0463°N, 93.9998°W)
Wah-Kon-Tah Prairie, (37.9028°N, 93.9830°W)

St. Francois County
Saint Francois State Park, 3 miles northeast of Bonne Terre, (37.9725°N, 90.5335°W)
Knob Lick, (37.6635°N, 90.3853°W)
St. Francois State Park, Coonville Fen, (37.9869°N, 90.5155°W); (37.9677°N, 90.5319°W); (37.9560°N, 90.5219°W)
St. Joe State Park, (37.8161°N, 90.5246°W); (37.8121°N, 90.5194°W); (37.8083°N, 90.5239°W)

Ste. Genevieve County
Magnolia Hollow Conservation Area, 5 miles east northeast of Bloomsdale, (38.0449°N, 90.1429°W)
Grassy hilltop at Co Hwy DD and I-55, (38.0568°N, 90.2777°W)
Hawn State Park, sandstone glade, (37.8442°N, 90.2193°W); (37.8405°N, 90.2146°W); at Red Trail, (37.8285°N, 90.2262°W)
Pickle Spring, (37.8018°N, 90.2883°W)
Roadside cut at I-55, 4.5 miles northwest of Bloomsdale, (38.0882°N, 90.3005°W)
Saltpeter Cave, (37.8137°N, 90.0940°W)

St. Louis County and City of St. Louis
Fox Creek at Rte 66, 1 mile west of Allenton, (38.4995°N, 90.6905°W)
Fox Creek just north of Hwy 44, 1.5 miles west of Allenton, (38.5033°N, 90.7039°W)
Babler State Park, (38.6193°N, 90.7117°W); (38.6209°N, 90.7132°W); (38.6231°N, 90.6902°W); (38.6284°N, 90.6963°W); (38.6336°N, 90.7024°W)
Bee Tree Park, (38.4163°N, 90.3192°W); (38.4058°N, 90.3297°W)
Bellerive Park 5600 Broadway in St. Louis City, (38.5618°N, 90.2425°W)
Castlewood State Park, (38.5502°N, 90.5346°W); (38.5508°N, 90.5456°W)
Cliff Cave Park, (38.4590°N, 90.2895°W); hillside to Mississippi River floodplain, (38.4102°N, 90.3230°W); (38.4617°N,

90.2876°W)
Creve Coeur Lake, hillside, (38.7108°N, 90.4797°W); (38.7145°N, 90.4783°W)
Hillside and bluffs above Missouri River floodplain 1 mile southwest of Creve Coeur Lake, (38.6891°N, 90.5062°W)
Emmenegger Park, near Hwy 44 and Hwy 270 interchange, (38.5295°N, 90.5180°W)
Eureka, 2 miles north of (38.5189°N, 90.6248°W)
Forest 44 Conservation Area, (38.5301°N, 90.5193°W); (38.5223°N, 90.5149°W); (38.5355°N, 90.5008°W)
Forest Park, in St. Louis, (38.6353°N, 90.2816°W)
Webster Groves, (38.5670°N, 90.3675°W)
Litzsinger Road Ecological Center, (38.6262°N, 90.3796°W)
Manchester, 1 mile north of, (38.6068°N, 90.5081°W)
1 mile east of Glencoe, Meramec River hillside, (38.5457°N, 90.6076°W)
Missouri Botanical Garden, outside along stone wall, (38.6048°N, 90.2605°W); (38.6092°N, 90.2582°W); (38.6048°N, 90.2605°W)
Bluffs facing Pelican Island, 0.75 miles northeast of Musicks Ferry, (38.8706°N, 90.3291°W)
Glendale, (38.5893°N, 90.3877°W)
Green Tree Park, (38.5618°N, 90.4464°W)
Possum Woods Conservation Area, (38.5532°N, 90.4323°W)
Powder Valley Nature Center, (38.5548°N, 90.4233°W); (38.5573°N, 90.4313°W)
Queeny Park, (38.6153°N, 90.4903°W)
Rockwoods Reservation, (38.5680°N, 90.6605°W); (38.5632°N, 90.6474°W); (38.5712°N, 90.6620°W); at Rockwoods Spring, (38.5607°N, 90.6570°W); (38.5621°N, 90.6619°W); (38.5634°N, 90.6462°W); (38.5648°N, 90.6467°W)
St. Louis Zoological Garden, (38.6366°N, 90.2966°W)
Sioux Passage County Park, 3 miles east of Musicks Ferry, (38.8598°N, 90.2788°W)
Sioux Passage Park, (38.8588°N, 90.2780°W)
Mehlville, (38.5143°N, 90.3167°W)
Suson Park, (38.4728°N, 90.3914°W)
Tilles Park, (38.6242°N, 90.3633°W)
Unger County Park, (38.5579°N, 90.4436°W)
Washington University Tyson Research Center, (38.5208°N, 90.5558°W)

Saline County
Blind Pony Wildlife Area, (39.0438°N, 93.3667°W)
Dennis Spring, (39.0457°N, 93.0488°W)
Van Meter State Park, (39.2700°N, 93.2715°W)

Scotland County
Ella Ewing Lake, (40.3437°N, 92.0125°W)
Indian Hills Conservation Area, (40.3388°N, 92.2420°W); (40.3265°N, 92.2677°W)
Lake Showme, (40.4358°N, 92.2185°W)

Scott County
Drainage ditch and roadside, 4.5 miles southwest Chaffee, (37.1397°N, 89.7200°W)
Hillside talus at Rockview, (37.2020°N, 89.6282°W)
General Watkins State Forest, (37.0556°N, 89.6200°W); (37.0720°N, 89.6202°W); (37.0633°N, 89.6084°W)
Tywappity Lake Forest, (37.1872°N, 89.6358°W)

Shannon County
Chilton Creek Preserve, (37.0982°N, 91.1003°W); (37.0923°N, 91.0970°W); (37.0965°N, 91.0683°W); (37.1002°N, 91.0790°W)
Clow State Forest, (37.2080°N, 91.3915°W)
Current River bluffs, 1 mile southeast Akers, (37.3585°N, 91.5368°W)
Current River bluffs, 2 miles southeast Akers, (37.3571°N, 91.5232°W)
Current River bluffs, 2.5 miles southeast Akers, (37.3556°N, 91.5053°W)
Current River at Medlock Cave, (37.3960°N, 91.5893°W)
Dusty Solution Cave #2, (37.1656°N, 91.4946°W)
Dusty Solution Cave #3, (37.1557°N, 91.4811°W)
Little Cave, (37.1010°N, 91.4683°W)
Meander Cave, (37.1028°N, 91.5562°W)
Roadside along MO Hwy 19, 3 miles north of Round Spring, (37.3281°N, 91.4160°W)
White Oak Crawl Cave, (36.8887°N, 91.3104°W)

Shelby County
Arrow Wood Conservation Area, (39.7403°N, 92.0450°W)
Hunnewell Wildlife Area, (39.7150°N, 91.8622°W)
Pin Oak Conservation Area, (39.7722°N, 92.1476°W)
Shelbina, (39.6906°N, 92.0373°W)

Stoddard County
Holly Ridge Natural Area, (36.8452°N, 89.9097°W)
Holly Ridge State Forest, (36.8467°N, 89.9107°W)

Stone County
Ashe Juniper Natural Area, (36.5913°N, 93.3397°W)
Big Bay Campground, (36.6181°N, 93.5674°W)
Jessie Hollow State Forest, (36.7680°N, 93.3733°W)
Roadside Glade along Co Hwy JJ, (36.5520°N, 93.3610°W)
Wire Road Conservation Area, (36.9256°N, 93.5893°W)

Sullivan County
Rocky Ford Access, (40.0643°N, 93.1655°W)
Union Ridge State Forest, (40.2235°N, 92.9102°W)

Taney County
Bear Cave, hillside around cave entrance, (36.5547°N, 92.8030°W)
Bear Cave Hollow, (36.5548°N, 92.8127°W)
Boston Ferry Conservation Area, (36.6950°N, 93.1957°W)
Cane Bluff Double Cave, (36.6533°N, 92.9597°W)
Cave Road at MO Hwy 160, (36.5917°N, 92.8263°W)
Drury State Wildlife Management Area, 1.8 miles northeast of Mincy, (36.5736°N, 93.0839°W)
Mincy Wildlife Management Area (36.5212°N, 93.0868°W); (36.5217°N, 93.0839°W)
Glade along Cave Road, 3 miles northeast Protem, (36.5623°N, 92.8310°W)
Glade Top Trail, (36.6625°N, 92.8496°W)
Hilltop Lookout Tower, (36.7732°N, 93.1337°W)
Mark Twain National Forest, (36.5923°N, 92.8304°W); (36.7353°N, 92.8498°W)
Mincy Public Use Area, (36.5437°N, 93.1129°W)
Rattlesnake Glade, 3 miles northeast Protem, (36.5615°N, 92.8258°W)
Roadside 3.5 miles northeast of Protem, (36.5758°N, 92.8355°W)
Ruth and Paul Henning Conservation Area, (36.6603°N, 93.2948°W); (36.6562°N, 93.3048°W)
Shepard of the Hills Wildlife Area, (36.5985°N, 93.3000°W)
Table Rock State Park, (36.5767°N, 93.2992°W)

Texas County
Big Piney River bluff, (37.2595°N, 92.0208°W)
Mark Twain National Forest, (37.4838°N, 92.0418°W)
Quercus Flatwoods Natural Area, (37.5480°N, 91.7852°W)
Shafer Cemetery, (37.5596°N, 91.8814°W)
Slabtown Bluff Trail, (37.5622°N, 92.0170°W)

Vernon County
Four Rivers Wildlife Area, at headquarters, (38.0192°N, 94.3287°W)
Gamma Grass Prairie, (38.0253°N, 94.3923°W)
Prairie Woods State Forest, (37.9714°N, 94.3462°W)

Warren County
Daniel Boone State Forest, (38.7757°N, 91.3930°W)
Katy Trail hillside, 2 miles west of Treloar, (38.6506°N, 91.2252°W)
Little Lost Creek State Forest, (38.7956°N, 91.2811°W); (38.7849°N, 91.2854°W)
Massie Creek at Abe Hollow, (38.7814°N, 91.3167°W)
Reifsneider State Forest, (38.7830°N, 91.1055°W); (38.7694°N, 91.0979°W)

Washington County
Mineral Fork bluff, (38.0965°N, 90.7470°W)
Hwy 47 at Mineral Fork Crossing, 11 miles north of Potosi, (38.0976°N, 90.7445°W)
Washington State Park, (38.0857°N, 90.6725°W); (38.0850°N, 90.6983°W); (38.0881°N, 90.6860°W); (38.0854°N, 90.6789°W); bluff, (38.0792°N, 90.6833°W);

Wayne County
Coldwater State Forest, (37.2808°N, 90.4158°W)
1.5 miles north of Wappapello, (36.9558°N, 90.2743°W)
Lake Wappapello State Wildlife Area, fen, (37.0267°N, 90.2850°W)
Saint Francois River at Coldwater Access, (37.3059°N, 90.4660°W)
University State Forest, (36.9471°N, 90.3637°W)

Webster County
Compton Hollow State Forest, (37.2260°N, 93.0120°W)
Niangua State Forest, (37.4230°N, 92.9123°W); (37.4297°N, 92.8338°W)

Worth County
Denver Access, (40.3893°N, 94.3203°W)
Emmett and Leah Seat Memorial

Wildlife Area,
(40.4098°N, 94.2285°W);
(40.4012°N, 94.2438°W)

Wright County

Little Smittle Cave around entrance, (37.4575°N, 92.6270°W)

Hartville, 1 mile southwest of, (37.2405°N, 92.5268°W)

Smittle Cave, nearby hillside, (37.4536°N, 92.6266°W)

Wilbur Allen Memorial Wildlife Area, (37.3988°N, 92.3860°W)

APPENDIX B: SYNONOMIES

Each snail has a list of other names, termed synonymies, which have been used for that species in the past. Often these names were given by researchers who did not know that someone else had already described and named the species. Synonymies can cause confusion when one looks at older publications and sees the same snail with different names. The genus name may be changed to better reflect its relationship with other snails, but the original species name is never changed unless it is later found to be inappropriately used.

Clade Cycloneritimorpha
> Family Helicinidae Férussac, 1822

Helicina orbiculata (Say 1818)
GLOBULAR DROP

Olygyra orbiculata Say 1818, Jour. Acad. Nat. Sci. Phila., part 2, p. 283; H. B. Baker, 1922, Proc. Acad. Nat. Sci, Phila., 74: 44; Turgeon et al., 1998, p. 63 (as *Oligyra*); (*Oligyra* of many authors is a misspelling for *Olygyra*).

Helicina hanleyana Pfeiffer, 1848, Proc. Zool. Soc. London, p. 122; 1852, Mon. Pneum. Viv. 1: 376; Conchyl, Cab., p. 38, pl. 9, figs. 7, 8.

Helicina suborbiculata Say (unpublished name cited as a synonym of *H. orbiculata* by Wagner, 1907–1911).

Helicina orbiculata tropica Pfeiffer, Pilsbry, 1948, 2: 1084, fig. 579 f–h.

Helicina orbiculata (Say), American Conchology, Pl. 46 figs. 1, 2, 3; Gould in A. Binney, 1852, Terr. Moll., 2: 352, Pl. 73, Pl. 74, fig. 3; W. G. Binney, 1865, Land & Freshwater Shells of N. A., part 3, Smiths Misc. Coll., 144: 108, fig. 217; Wagner, 1907–1911, Syst. Conchyl. Cab., Helicinidae, p. 301, pl. 61 figs. 1–6; Pilsbry, 1909, Nautilus, 23: 89 (subspecies); Pilsbry, 1948, p. 1082, fig. 579, a–e; Burch, 1962, pp. 37, 188, fig. 58; Hubricht, 1985, p. 3; Strenth and Littleton, 2000, Texas Jour. of Sci., 52(1): 25–32.

Hendersonia occulta (Say 1831)
CHERRYSTONE DROP

Helicina occulta Say, 1831, Transylvania Jour. of Medicine, 4: 528; Amer. Conch., No. 5, pl. 46, figs. 4–6; A. Binney, 1851, Terr. Moll., 1: 182; 2: 356, pl. 74, figs. 1 (Recent), 2 (fossil); W. G. Binney, 1865, Land and Fresh-water Shells N. A., Part 3, p. 111; Leland, 1869, Amer. Jour. Conch., 5: 118; Tryon, 1870, Amer. Jour. Conch., 4: 12; Witter, 1883, Mollusca of Muscatine County and vicinity, P. 24; R. E. Call, 1887, Bull. Washburn College, 2: 18; Holzinger, 1888, 16th Ann. Rep. Geol. and Nat. Hist. Surv. Minn., p. 491; Pilsbry, 1896, Proc. Acad. Nat. Sci. Phila., p. 491; 1900, same Proc., p. 116; Walker & Pilsbry, 1902, Proc. Acad. Nat. Sci. Phila., p. 421; Shimek, 1904, Proc. Davenport Acad. Sci., 9: 173; 1905, Jour. Geol. 13: 232; Proc. Iowa Acad. Sci., 26: 385; 1930, Nautilus, 43: 111.

Helicina rubella Green, 1832, Doughty's Cabinet Nat. Hist. and Rural Sports, 2: 291.

Helicina occulina Say, D. D. Owen, 1852, Rep. Geol. Surv. Wis., Iowa, and Minn, p. 132, (misspelling).

Helicina occulata Say, R. E. Call, 1881, Amer. Nat., 15: 586, 784, (misspelling).

Hendersonia occulta (Say), H. B. Baker, 1922, Proc. Acad. Nat. Sci. Phila., 74: 41; *ibid*. 77, 273; 1926, *ibid*. 78: 35 (anatomy); Pilsbry, 1948, p. 1087, fig. 581; Burch, 1962, pp. 36, 188, fig. 56; Hubricht, 1985, p. 3. Turgeon et al., 1998, p. 63.

Helicina occulta rubella Green Morrison, 1928, Nautilus, 43: 45.

Clade Littorinimorpha
> Family Pomatiopsidae Stimpson, 1865

Pomatiopsis lapidaria (Say 1817)
SLENDER WALKER

Cyclostoma lapidaria Say, 1817, Jour. Acad. Sci. Phila., 1: 13.

Pomatiopsis hinkleyi Pilsbry, 1896, Nautilus, 10: 37.

Pomatiopsis scalaris F. C. Baker, 1927, Nautilus, 40: 119.

Pomatiopsis praelonga Brooks & MacMillan, 1940, Nautilus, 53: 96.

Pomatiopsis lapidaria (Say), W. G. Binney, 1865, Land & Freshwater Shells of North America, III: 93; Hubricht, 1985, p. 4; Turgeon et al., 1998, p. 77.

Clade Eupulmonata
> Family Carychiidae Jeffreys 1830

Carychium exiguum (Say 1822)
OBESE THORN

Pupa exigua Say, 1822, Jour. Acad. Nat. Sci. Phila., 2: 375

(Harrigate, Philadelphia); Gould 1841, Bost. J. Nat. Hist., 3:398, pl. 3, fig. 20; Invert. Mass, p. 191, fig 122.

Carychium existelium Bourguignat, 1857, Revue et Mag. de Zoologie (2) 9: 220; Aménités Malacologiques, 2: 50, pl. 10, figs. 7–8.

Carychium euphaeum Bourguignat, 1857, Revue et Mag. de Zoologie (2) 9: 221; Aménités Malacologiques, 2: 251, pl. 10, figs. 5–6.

Carychium perexiguum F. C. Baker, 1938, Nautilus, 51: 128; Taylor, 1960, U.S. Geol. Surv. Prof. Paper, 337: 51.

Carychium exile H. C. Lea, Branson, 1961, Proc. Okla. Acad. Sci., 41: 61.

Carychium exiguum (Say), Gould, 1852, in A. Binney, Terr. Moll., 2: 286, pl. 53, fig. 1.; W. G. Binney, 1865, Land and Fresh Water Shells of North America, 2: 6, figs 5–9; Pilsbry, 1891, Proc. Acad. Nat. Sci. Phil., p. 319, pl. 14, figs. 1–3, pl 15, fig 16; Nautilus, 8:63, figs. 1–3; Clapp, 1905, Nautilus, 19: 139; Winslow, 1922, Occas. Pap. Mus. Zool. Univ. Mich., No. 128, p. 3, pl. 2, figs. 8–11, pl. 3, figs. 12–15; Brooks and Kutchka, 1937, Ann. Carnegie Mus., 25: 159; Pilsbry, 1948, p. 1052; Burch, 1962, p. 41, fig. 69; Hubricht, 1963a; 1985: 6; Nekola and Barthel, 2002; Turgeon et al., 1998, p.136.

Carychium exile H. C. Lea 1842
ICE THORN

Carychium exile H. C. Lea, 1842, Amer. Jour. Science & Arts, 42: p. 109, Pl. 1, fig. 5; Pilsbry, 1891, Proc. Acad. Nat. Sci. Phila., 1891, p. 319, Pl. 14, figs. 10–14; Clapp, 1906, Nautilus, 19: 138, pl. 8, figs. 3–5; Winslow, 1922, Occas. Pap. Mus. Zool. Univ. Mich., No. 128, p. 3, pl. 1; Walker, 1928, Terr. Moll. Alabama, p. 173, figs. 275, 276; Brooks & Kutchka, 1937, Ann. Carnegie Mus., 25: 157; Pilsbry, 1948, p. 1058, fig. 561; Nekola, 2002; Hubricht, 1985, p. 5; Turgeon et al., 1998, p.136.

Carychium exile canadense Clapp, 1906, Nautilus, 19:139, pl. 8, figs. 1,2,6,7; Winslow, 1922, Occas. Pap. Mus. Zool. Univ. Mich., No. 128, p. 4, pl. 2, figs. 6–7; Pilsbry, 1948, p. 1059; Hubricht, 1963a; 1985: 5.

Carychium canadense Clapp, Leonard, Fyre and Johnson, 1971, Ill. St. Geol. Survey, Circ. 461: 11.

Clade Stylommatophora
Subclade Elasmognatha (=Heterurethra) > Family Succineidae Beck, 1837

Oxyloma retusa (I. Lea 1834), New State Record
BLUNT AMBERSNAIL

Succinea retusa I. Lea, 1834, Trans. Amer. Philos. Soc., 5:117, pl. 19, fig. 86; Obs. Genus Unio, 1: 229. pl. 19, fig. 86.

Succinea higginsi "Bland, nov. spec.", Tryon, July, 1866, Amer. Jour. Conch., 2: 237, pl. 17, (2), fig. 24; Bland, October, 1866, same volume, p. 373, pl. 17, fig. 24; W. G. Binney, 1885, Man. Amer. Land Shells, p. 198, fig. 206.7.

Succinea retusa magister Pilsbry, 1899, Nautilus, 12: 103; 19: 109, fig. 2; Walker, 1906, Moll. Mich., p. 502, fig. 110; F. C. Baker, 1939, Fieldbook Illinois Land Snails, p. 125, fig. B.

Succinea calumetensis Calkins, 1878, Valley Naturalist 1, No. 11. p. 57, text fig.; cf. Walker, 1906, Moll. Mich., p. 502, fig. 108.

Oxyloma decampi (Tryon), Pilsbry, 1948, p. 779; Grimm, 1971, Sterkiana, 41: 56.

Oxyloma decampi gouldi Pilsbry, Pilsbry, 1948, p. 782.

Oxyloma retusum Turgeon et al., 1998 p. 145.

Oxyloma retusa (I. Lea). Pilsbry, 1948, p. 785; Hubricht, 1985, p. 13.

Oxyloma salleana (Pfeiffer 1849)
LOUISIANA AMBERSNAIL

Succinea salleana Pfeiffer, 1849, Proc. Zool. Soc. London, p. 133; Mon. Hel. Viv., 3: 16; Conchyl Cab., p. 49, pl. 5, figs. 7, 8; W. G. Binney, 1878, Terr. Moll., 5: 429, pl. X, fig. 306, fig. N (teeth); 1885, Man. Amer. Land Shells, p. 443, fig. 488; Frierson, 1900, Nautilus, 14: 68; F. C. Baker, 1939, p. 127.

Oxyloma salleana (Pfeiffer), Pilsbry, 1948, p. 792, fig. 424; Hubricht, 1985, p. 14.

Oxyloma salleanum (Pfeiffer), Turgeon et al., 1998, p. 145.

Succinea bakeri Hubricht 1963
Succinea bakeri Hubricht, 1963c: 136; 1969; 1985: 15.

Succinea forsheyi I. Lea 1864
SPOTTED AMBERSNAIL

Succinea forsheyi I. Lea, 1864, Proc. Acad. Nat. Sci. Phila., p. 109; Jour. Acad. Nat. Sci. Phila., (2), 6: 178, pl. 24, fig. 107. Hubricht, 1974: 33; 1985: 15; Turgeon et al., 1998, p. 146.

Succinea concordialis Gould, Pilsbry, 1948, p. 833, figs. 452, a–h; 453, 454 (and of other authors; misidentified; see Hubricht 1974: 33).

Succinea witteri Shimek, 1913, Nat. Hist. Bull. State Univ. Iowa, 6: 31, pl. 1, figs. I–IV.

Succinea indiana Pilsbry 1905
XERIC AMBERSNAIL

Succinea indiana Pilsbry 1905, Nautilus, 19: 28; Goodrich & Van der Schalie, 1944, Amer. Midland Nat., 32: 382; Pilsbry, 1948, p. 815, fig. 441 (as var. of S. aurea); Hubricht, 1962, Nautilus, 75: 123; Hubricht, 1985, p. 15; Turgeon et al., 1998, p. 146.

Succinea vaginacontorta Lee, 1951, Univ. Mich. Mus. Zool., Occ. Pap., 533: 2; Hubricht, 1962, Nautilus, 75: 123.

Novisuccinea chittenangoensis
(Pilsbry 1908)
CHITTENANGO AMBERSNAIL

Succinea ovalis chittenangoensis Pilsbry, 1908, Proc. Acad. Nat. Sci. Phila., p. 49, fig. 5, pl. 7, figs. 1–8; 1948, p. 807.
Succinea ovalis pleistocenica F. C. Baker, Pilsbry, 1948, p. 808.
Succinea chittenangoensis Pilsbry, Hubricht, 1972, Sterkiana, 45: 33; Hubricht, 1985, p. 14.
Succinea ovalis form *chittenangoensis* Pilsbry, Solem, 1976, Nautilus, 90: 108.
Novisuccinea chittenangoensis (Pilsbry), Hoagland, K. E. and G. M. Davis, 1987, Proc. Acad. Nat. Sci. Phila, 139: 465–526; Turgeon et al., 1998, p. 145.

Novisuccinea ovalis (Say 1817)
OVAL AMBERSNAIL

Succinea ovalis Say, 1817, Jour. Acad. Nat. Sci. Phila., 1:15; DeKay, in part, 1844, Nat. Hist. New York, Mollusca, p. 53, pl. 4, fig. 52; Pilsbry, 1908, Proc. Acad. Nat. Sci. Phila., p. 45, with var. *optima*, p. 47, and var. *chittenangoensis*, p. 49; Walker, 1904, Sixth Rep. Mich. Acad. Sci., p. 187, (variation of jaw); Walker, 1928, Terr. Moll. Alabama, p. 167; Ingram, 1943, Nautilus, 56: 92, (*Leucochloridium*); Pilsbry, 1948 p. 801, figs. 430 a–e, 433; Burch, 1962, pp. 68, 191, fig. 140; Hubricht, 1985: 14.
Helix (Cochlohydra) ovalis (Say), Férussac, 1822, Tabl. Syst. Limacons, p. 26; Hist. Nat. Moll., pl. 11 A, fig. 1.
Succinea obliqua Say, 1824, in Appendix to Keatings Narrative Exped. Source St. Peters River, etc., Major Long's Second Expedition, 2: 260, pl. 15, fig. 7; W. G. Binney, 1878, Terr. Moll., 5: 423 (and of many authors in the last half of the 19th century).
Succinea campestris (Say), Gould, 1841, Invert. of Mass., p. 195, fig. 126; DeKay, t. c., p. 53, pl. 4, fig. 54 (not *S. campestris* Say).
Succinea totteniana Lea, 1841, Trans. Amer. Philos. Soc., 2: 32; W. G. Binney, 1878, Terr. Moll., 5: 425, pl. 67b, fig. 2.
Succinea ovatis Leidy, 1851, in Terr. Moll., 1: 213, 231, pl. 13, figs. I–III (genitalia, jaw).
Helix (Cochlohydra) putris var. δ, Férussac, Tableau Syst. fam. Limacons, p. 26, No. 9.
Succinea putris Linnaeus, Cockerell, Nautilus, 6: 30.
Novisuccinea ovalis (Say), Hoagland, K. E. and G. M. Davis, 1987, Proc. Acad. Nat. Sci. Phila, 139: 465–526; Turgeon et al., 1998, p. 145.

Catinella avara (Say 1824)
SUBOVAL AMBERSNAIL

Succinea avara Say, 1824, in Appendix to Keating's Narrative Exped. Source St. Peter's River, etc., Major Long's Second Expedition, 2: 260, pl. 15, fig. 6 Pilsbry, 1948, p. 837, fig. 454 a–k.
Succinea vermeta Say, 1829, New Harmony Disseminator, 2: 230; W. G. Binney, 1885, Man. Am. Land Shells, p. 343.
Succinea wardiana Lea, 1841, Proc. Amer. Philos. Soc., 2: 31.
Succinea venusta W. G. Binney, cited as a typographical error. Man. Amer. Land Shells, p. 343.
Succinea avara var. *major* W. G. Binney, 1858, Proc. Acad. Nat. Sci. Phila., p. 199. (Nude name); Cockerell, 1893, Nautilus, 7: 44.
Succinea poeyensis Wolff, W. G. Binney, 1885, Man. Amer. Land Shells., p. 497. (without description; name cited as a form or synonym of *S. avara* Say; but name is apparently an error for *peoriensis* Wolff).
Succinea illinoisensis Wolff, W. G. Binney, 1885, Man. Amer. Land Shells, p. 447, (as a form or synonym of S. avara Say, from Illinois, No. 39768 U. S. N. M., no further description).
Succinea avara var. *compacta* Cockerell, 1892, Jour. of Conch., 7: 39.
Succinea avara forma *alba* Cockerell, 1893, Nautilus, 7: 43.
Quickella oklahomarum loculosa Webb, 1954, Gastropodia 1: 20.
Quickella vermeta (Say), Hubricht, 1960, Nautilus, 72: 60.
Catinella texana Hubricht, 1961, Nautilus, 75: 61.
Catinella parallela Franzen, 1979, Nautilus, 93: 63.
Catinella waccamawensis Franzen, 1981, Nautilus, 95: 116.
Catinella protracta Franzen, 1983, Nautilus, 97: 138.
Catinella vermeta (Say), Grimm, 1960, Nautilus, 74: 12; Patterson, C. M., and J. B. Burch, 1966, Malacologia, 3: 309–325; Turgeon et al., 1998, p. 145.
Catinella avara (Say), Hubricht, 1985, p. 16.

Catinella gelida (F. C. Baker 1927)

Succinea grosvenori gelida F. C. Baker, 1927, Nautilus, 40: 118; Pilsbry, 1948, p. 823, fig. 444.
Catinella gelida (F. C. Baker), Hubricht, 1963, Nautilus, 76: 137; 1985, p. 16.

Catinella oklahomarum (Webb 1953)
DETRITUS AMBERSNAIL

Quickella oklahomarum Webb, 1953, Jour. Tenn. Acad. Sci., 28: 220.
Catinella pinicola Grimm, 1960, Nautilus, 74: 11; Grimm, 1968, Nautilus, 81: 84.
Catinella oklahomarum (Webb), Hubricht, 1985: 16; Turgeon et al., 1998: 45.

Catinella wandae (Webb 1953)
SLOPE AMBERSNAIL

Quickella wandae Webb, 1953, Jour. Tenn. Acad. Sci., 28: 216.
Catinella wandae (Webb), Hubricht 1985: 16; Turgeon et al., 1998, p. 145.

Clade Stylommatophora
Subclade Orthurethra
> Family Cochlicopidae Pilsbry, 1900

Cochlicopa lubrica (Müller 1774)
GLOSSY PILLAR

Helix lubricus Müller, 1774, Verm. Hist., 2: 101. (Denmark)
Bulimus lubricus Gould, 1841, Invert. Mass., p. 193, fig. 124; A. Binney, 1852, Terr. Moll., 2: 283, pl. 52, fig. 4.
Zua buddü Dupuy, 1849, Hist. Nat. Moll. terr. et d'eau douce France, p. 330, footnote (États-Unis).
Bulimus lubricoides Stimpson, 1851, Shells of New England, p. 54.
Zua lubricoides Stimpson, Morse, 1864, Jour. Portland Soc. Nat. Hist., 1: 30, fig. 79, 81, 84, pl. 10 fig. 82 (jaw, teeth & shell).
Cionella subcylindrica Linn., W. G. Binney & T. Bland, 1869, Land and Freshwater Sh. N. A., 1: 224.
Ferussacia subcylindrica Linn., W. G. Binney, 1878, Terr. Moll. 5: 187, pl. iv, fig. R, (teeth); 1885, Man. Amer. Land Shells, P. 194, figs. 199–202 (jaw, teeth & shell).
Cionella lubrica (Müller), Pilsbry, 1948, p. 1047; Turgeon, et al., 1998, p.137.
Cochlicopa lubrica (Müller), Pilsbry & Johnson, 1898, Nautilus, 11: 127; Dall, 1995, Harriman Alaska Exped., 13: 33; Pilsbry, 1908, Man. Conch. 19: 312: F. C. Baker, 1920, Life of the Pleistocene, p. 388; Henderson, 1924, Univ. Colo. Studies, 13: 140; 1929, same, 17: 94; 1936, same, 23: 105, 255; Chamberlin & Jones, 1929, Bull. Univ. Utah, 19: 90; Mozley, Nautilus, 42: 15; Hubricht, 1985: 6.

Cochlicopa lubricella (Porro 1838)
THIN PILLAR

Bulimus lubricus var. *lubricella* Porro, 1838, Malacologia terrestre e fluvial della Provincia Comasca, pp. 53–54.
Cionella lubrica form *exigua* (Menke), Hubricht, 1962, Sterkiana, 7: 1.
Cionella lubrica form *exigua* (Porro), Kerney & Cameron, 1979, Field Guide to the Land Snails of Britain and North-west Europe, Collins, London, p. 62, pl. 1, fig. 10.
Cochlicopa lubricella (Porro), Hubricht, 1985, p. 6.

Cochlicopa morseana (Doherty 1878)
APPALACHIAN PILLAR

Cionella (Zua) morseana Doherty, 1878, Quart. Jour. Conch., 1: 342, pl. 4, fig. 2.
Ferussacia subcylindrica L. Sargent, 1895, Nautilus, 8: 104.
Cochlicopa lubrica morseana (Doherty), Pilsbry, 1908, Man. Conch., 19: 316, pl. 49, fig. 42.
Cochlicopa lubrica appalachicola Pilsbry, 1908, Man. Conch., 19: 317, Pl. 49, fig. 43; Walker, 1928, Terr. Moll. Alabama, p. 165.
Cionella lubrica morseana Doherty, Pilsbry, 1948, p. 1049, fig. 560 c.
Cionella morseana Doherty, Hubricht, 1961, Sterki, 3: 12; 289; Turgeon et al., 1998, p. 137.
Cochlicopa morseana (Doherty), Hubricht, 1985, p. 6.

Clade Stylommatophora
Subclade Orthurethra
> Family Pupillidae Turton, 1831

Pupilla blandi Morse 1865
ROCKY MOUNTAIN COLUMN

Pupilla blandi Morse, 1865, Ann. Lyc. Nat. Hist. of New York, 8: 5, fig. 8; Henderson, Univ. Colo. Studies, 9: 57; 13: 134; Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 142; Man. Conch., 26: 159, pl. 19, figs, 1–5; Walker, 1915, Occas. Pap. Mus. Zool. Univ. Mich., No. 15, pp. 2–4; Pilsbry, 1948, p. 929, figs. 1–5; Hubricht, 1985, p. 7; Burch, 1965, p. 55; Turgeon et al., 1998, p. 138.
Pupa blandi (Morse), W. G. Binney, 1885, Man. Amer. Land Shells, p. 188.
Pupa blandi forma *obtusa* Cockerell, 1892, Jour. Conch., 7: 39.
Pupilla blandi mut. *alba* Cockerell, 1888 Science Gossip, 24: 257; 1905, Nautilus,.18: 104.
Pupilla blandi pithodes Pilsbry & Ferriss, 1917, Proc. Acad. Nat. Sci. Phila., p. 103; 1918, p. 328.
Pupa sublubrica Ancey, 1881, Naturaliste, 1: 389.
Pupilla blandi charlestonensis Pilsbry, 1921, Man. Conch., 26: 163, pl. 19, figs. 8–9.
Pupa blandi var. *edentata* Squyer, 1894, Nautilus, 8: 64.

Pupilla muscorum (Linnaeus 1758)
WIDESPREAD COLUMN

Turbo muscorum Linnaeus, 1758, Syst. Nat. 10: 767.
Pupa muscorum (Linnaeus), W. G. Binney, 1885, Man. Amer. Land Shells, p. 78.
Pupa badia C. B. Adams, 1840, Boston Jour. Nat. Hist., 3: 331, pl. 3, fig. 18.
Pupilla muscorum xerobia Pilsbry, 1914, Nautilus, 28: 38, pl. 2, figs. 1,2; Henderson, Univ. Colo. Studies, 13: 133.
Pupilla muscorum sinistra Franzen, Bequaert & Miller, 1973, Moll. Arid Southwest, p. 80.
Pupilla muscorum muscorum Hubricht, 1998, p. 7.
Pupilla muscorum (Linnaeus), Pilsbry, 1921, Man. Conch., 26: 156, 173, pl. 18, figs. 12–15; Henderson, 1929, Univ. Colo. Studies, 17: 91; Pilsbry, 1948, p. 933; Burch, 1962, p. 48, 54; Turgeon et al., 1998, p. 138.

Pupoides albilabris (C. B. Adams 1841)
WHITE-LIP DAGGER

Cyclostoma marginata Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 172. (Not *Cyclostoma marginatum*, G. Fischer, 1807, Mus. Demidoff., 3: 219).
Pupa albilabris "Ward's letter" C. B. Adams, 1841, Amer. Jour. Sci., 40: 271, (New name for *Cyclostoma marginata* Say; no other description).
Pupa (Modicella) arizonensis Gabb, 1866, Amer. Jour. Conch., 2: 331, pl. 21, fig. 6.
Pupoides marginatus (Say), Pilsbry & Vanatta, 1900, Proc. Acad. Nat. Sci. Phila., p. 586;
Pilsbry, Man. Conch., 26: 111, pl. 12, figs. 1–7; Hanna, Proc. Cal. Acad. Sci., (4 ser.), 12: 514; Henderson, 1924, Univ. Colo. Studies, 13: 132; 1926, 23: 102; Woodbury, 1929, Nautilus, 43: 57; Franzen, 1947, Trans. Kansas Acad. Sci., 49: 418.
Pupa fallax (Say), Gould, Bost. Jour. Nat. Hist., 4: 357; W. G. Binney, Terr. Moll., 5: 203, pl. 52, fig. 1, pl. V, fig. T (teeth) (and of most authors prior to 1900, not *Pupa fallax* Say).
Pupoides albilabris (C. B. Adams), Pilsbry, 1948, p. 921, fig. 499, 1–7; Burch, 1962, p. 37, 188, fig. 58; Hubricht, 1985, p. 8; Turgeon et al., 1998, p. 138.

Clade Stylommatophora
Subclade Orthurethra
> Family Vertiginidae Fitzinger, 1833

Gastrocopta abbreviata (Sterki 1909)
PLAINS SNAGGLETOOTH

Bifidaria armifera abbreviata Sterki, 1909, Nautilus, 23: 53.
Gastrocopta armifera abbreviata (Sterki), Pilsbry, 1948, p. 877, fig. 474, 1–3.
Gastrocopta abbreviata (Sterki), Hubricht, 1972a: p. 74; 1985, p. 8; Turgeon et al., 1998, p. 137.

Gastrocopta armifera (Say 1821)
ARMED SNAGGLETOOTH

Pupa armifera Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 162; W. G. Binney, 1885, Man. Amer. Land Shells, p. 325.
Bifidaria armifera var. *ruidosensis* Cockerell, 1899, Nautilus, 13: 36.
Bifidaria armifera (Say), Sterki, 1909, Nautilus, 23: 52 (with varieties *interpres* p. 52; *similis*, *affinis*, *abbreviata*, p. 53).
Bifidaria clappi Sterki, 1909, Nautilus, 22: 108, Pl. 8, fig. 4.
Gastrocopta armifera (Say), Pilsbry, 1916, Man. Conch., 24: 15–21; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 66; F. C. Baker, 1939, p. 99, figs. A–D (varieties); Franzen, 1947, Trans. Kansas Acad. Sci., 49: 417, pl. 1, figs, 8, 9, pl. 2, figs. 10, 11; Pilsbry, 1948, p. 874, fig. 472, 1–4; Burch, 1962, pp. 50, 189, fig. 93; Hubricht, 1972a: 73; 1985: 8; Turgeon et al., 1998: 137.

Gastrocopta contracta (Say 1822)
BOTTLENECK SNAGGLETOOTH

Pupa contracta Say, 1822, Jour. Acad. Nat. Sci. Phila., 2: 374; W. G. Binney, 1878, Terr. Moll., 5: 207; Arango, Fauna Mal. Cubana, p. 130.
Pupa deltostoma "Charp." Kuster, 1852, Syst. Conchyl. Cab., p. 181.
Pupa nebraskana W. G. Binney, in Warren's Preliminary Report on Exploration in Nebraska and Dakota in 1855–57, reprint of 1875, p. 107 (name only, quoted as *Pupa nebrascana* by W. G. Binney, Terr. Moll., 5: 213).
Gastrocopta contracta (Say), Pilsbry, Man. Conch., 24: 22 (with *G. c. peninsularis*, p. 24); Proc. Acad. Nat. Sci. Phila., 1906, p. 144; 1906, Proc. Acad. Nat. Acad. Phila., p. 144; Aguayo, 1935, Mem. Soc. Cubana, Hist. Nat., 9: 123; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 67; Franzen 1947, Trans. Kansas Acad. Sci., 49: 416, pl. 1, fig. 5, pl. 2, fig. 1; Pilsbry, 1948, p. 880, fig. 474, 9–12; Burch, 1962, pp. 50, 189, fig. 94; Hubricht, 1985, p. 8; Turgeon et al., 1998, p. 137.

Gastrocopta holzingeri (Sterki 1889)
LAMBDA SNAGGLETOOTH

Pupa holzingeri Sterki, 1889, Nautilus, 3: 37, 96, 119; Proc. Acad. Nat. Sci. Phila., 1889, p. 414, pl. 12, figs. 4–7; B. Walker, Nautilus, 5: 93, 11: 82; Pilsbry, Nautilus, 14: 82.
Gastrocopta holzingeri (Sterki), Pilsbry, 1916, Man. Conch., 24: 25, pl. 2, figs. 4–6; Pilsbry, 1948, p. 883, fig. 474, 4–6, fig. 475; Burch, 1962, pp. 51, 189, fig. 95; Burch, 1962, pp. 54, 189, fig. 95; Hubricht, 1985, p. 9; Turgeon et al., 1998, p. 137.
Gastrocopta holzingeri and *G. h. agna*, Brooks & Kutchka, 1938 Ann. Carnegie Mus., 27 pp. 68, 69, text fig.; Branson, 1961, Proc. Okla. Acad. Sci., 41: 56.

Gastrocopta similis
(Sterki 1909), New State Record
GREAT LAKES SNAGGLETOOTH

Bifidaria armifera var. *similis* Sterki, 1909, Nautilus, 23: 53.
Bifidaria armifera var. *affinis* Sterki, 1909, Nautilus, 23: 53.
Gastrocopta armifera form *similis* (Sterki), Pilsbry, 1948, p. 877, fig. 472, 6.
Gastrocopta armifera form *affinis* (Sterki), Pilsbry, 1948, p. 877, fig. 472, 5.
Gastrocopta similis (Sterki), Hubricht, 1972a: 75; 1985: 8; Turgeon et al., 1998, p. 138.

Gastrocopta pentodon (Say 1821)
COMB SNAGGLETOOTH

Vertigo pentodon Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 376.
Pupa curvidens Gould, 1841, Invert. Mass., p. 109.
Pupa cincinnatiensis Judge, 1878, Quart. Jour. Conch., 1: 343.
Pupa pentodon (Say), W. G. Binney, 1878, Terr. Moll., 5: 200; Stearns, 1893, N. A. Fauna No. 7, p. 273.
Pupilla floridana Dall, 1885, Proc. U. S. Nat. Mus., 8: 261.
Pupa montanella Cockerell, 1889, Jour. Conch., 6: 63.
Pupa curvidens var. *gracilis* Sterki, 1890, Nautilus, 3: 119.
Bifidaria pentodon (Say), Pilsbry & Vanatta, 1906, Nautilus, 19: 121, pls. 6, 7, figs. 1–41, (variation).
Gastrocopta pentodon (Say), Pilsbry, 1916, Man. Conch., 24: 28, pl. 3, figs. 2–3, 5–8; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 70; Pilsbry, 1948, p. 886, fig. 477 2,3, 5–8; Burch, 1962, pp. 54, 189, fig. 105; Hubricht, 1985, p. 9; Turgeon et al., 1998, p. 137.
Gastrocopta carnegiei (Sterki), Pilsbry, 1948, p. 890; Hubricht, 1968, Sterkiana, 32: 6.
Gastrocopta tappaniana (C. B. Adams), Bequaert & Miller, 1973, Moll. Arid Southwest, p. 88.

Gastrocopta tappaniana
(C. B. Adams 1842)
WHITE SNAGGLETOOTH

Pupa tappaniana "Ward" C. B. Adams, 1842, in Thompson's History of Vermont, p. 158.
Pupa tappiana Ward, Pfeiffer, 1842, Symb. Hist. Hel., 2: 55.
Pupa pentodon f. *curta*, Sterki, 1894, Land and Freshwater Moll. New Philadelphia, p. 5, Nautilus, 19: 134.
Gastrocopta tappaniana (C. B. Adams), Pilsbry, 1916, Man. Conch., 24: 33; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 71; Franzen, 1947, Trans. Kansas Acad. Sci., 49: 418, pl. 1, fig. 6, pl. 2, fig. 3; Pilsbry, 1948: 889, fig. 477, 9; Burch, 1962, pp. 54, 189, fig. 104; Clench, 1965: 107; Hubricht, 1976: 106; 1985: 9; Turgeon et al., 1998: 138.

Gastrocopta corticaria (Say 1816)
BARK SNAGGLETOOTH

Odostomia corticaria Say, 1816, Nicholson's American edition British Encyclopedia, ii, pl. 4, fig. 5.
Pupa corticaria Say, W. G. Binney, 1878, Terr. Moll., 5: 209.
Gastrocopta corticaria (Say), Pilsbry, 1916, Man. Conch., 24: 52; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 72; Pilsbry, 1948, p. 894, fig. 480, 1–4; Burch, 1962, pp. 53, 189, fig. 102; Hubricht, 1985, p. 9; Turgeon et al., 1998, p. 137.

Gastrocopta cristata
(Pilsbry & Vanatta 1900), New State Record
CRESTED SNAGGLETOOTH

Pupa hordeacea Gabb, W. G. Binney, 1878, Terr. Moll. 5: 205, fig. 109 (misidentified); Sterki, 1891, Nautilus, 4: 141; 1892, Nautilus, 6: 4, 101 (misidentified, not Pupa hordacea Gabb, 1866).
Bifidaria procera cristata Pilsbry & Vanatta, 1900, Proc. Acad. Nat. Sci. Phila., p. 595, pl. 22, figs. 4, 5.
Gastrocopta cristata (Pilsbry & Vanatta) Pilsbry, 1917, Man. Conch. 24: 68, pl. 13 figs. 6, 8–12; Franzen, 1947, Trans. Kansas, Acad. Sci. 49: 416, pl. 1, fig. 1, pl. 2. fig. 7; Pilsbry, 1948, p. 911, fig. 493, 6, 8–12; Burch, 1962, pp. 52, 189, fig. 99; Hubricht, 1985, p. 10; Turgeon et al., 1998, p. 137.

Gastrocopta procera (Gould 1840)
WING SNAGGLETOOTH

Pupa procera Gould, 1840, Bost. Jour. Nat. Hist., 3: 401: 4: 359.
Pupa carinata Gould, 1842, Bost. Jour. Nat. Hist., 4: on cover, also p. 359.
Pupa minuta "Say," Pfeiffer, 1842, Symbolae ad Hist. Hel., 2: 54.
Pupa gibbosa "Say," Küster, Syst. Conch. Cab., p. 123.
Gastrocopta procera (Gould), Pilsbry, Man. Conch., 24; 62; with G. p. riparia, p. 65; F. C. Baker, 1939, p. 102. figs. A, B; Franzen, 1947, Trans. Kansas Acad. Sci., 49: 416, pl. 1, figs. 2, 3, pl. 2 figs. 5, 8, 9; Pilsbry, 1948, p. 907, fig. 492, 1–5; Burch, 1962, pp. 52, 189, fig. 98; Hubricht, 1985, p. 9; Turgeon et al., 1998, p. 137.

Gastrocopta rogersensis
Nekola & Coles 2001
MIDLAND SNAGGLETOOTH

Gastrocopta rogersensis Nekola & Coles 2001, Nautilus 115: 3, pp. 105–114.

Gastrocopta sterkiana Pilsbry 1917
Bifidaria duplicata Sterki, 1912, Nautilus, 25: 116. Not *G. duplicata* (Preston, Ann. Mag. Nat. Hist. 1911, p. 470).
Gastrocopta procera sterkiana Pilsbry, 1917, Man. Conch., 24: 65, 357, pl. 12, figs. 7, 8 and pl. 13, fig. 7; 1948, p. 908; Hubricht, 1978, Malacol. Rev., 10: 50.
Gastrocopta sterkiana Pilsbry, Hubricht, 1985, p. 9; Turgeon et al., 1998, p. 138.

Vertigo gouldii (A. Binney 1843)
VARIABLE VERTIGO

Pupa gouldii A. Binney, 1843, Proc. Bost. Soc. Nat. Hist. 1: 105.
Vertigo gouldii (A. Binney), Terr. Moll., 2: 332, pl. 51, fig. 2; W. G. Binney, 1878, Terr. Moll., 5: 214; Pilsbry, 1919, Man. Conch., 25: 98.

Vertigo gouldi (A. Binney), Pilsbry, 1948, p. 971, fig. 515; 4, 5 & 8; Burch, 1962, pp. 57, 190, fig. 112, 128; Hubricht, 1985, p. 11; Turgeon et al., 1998, p. 138; (gouldi, with one "i," is an incorrect subsequent spelling).

Vertigo hubrichti Pilsbry 1934
HUBRICHT'S VERTIGO

Vertigo gouldi hubrichti Pilsbry, 1934, Man. Conch., 28: 99, pl. 22, figs. 12–14; 1948, p. 973, fig. 521.
Vertigo hubrichti Pilsbry, Leonard & Frye, 1960, Ill. State Geol. Surv., Circ. 304: 9; Hubricht, 1985, p. 11.

Vertigo meramecensis Van Devender 1979
BLUFF VERTIGO

Vertigo meramecensis A. S. Van Devender, 1979, Nautilus, Vol. 93 (2–3), p. 70, figs. 71–72; Hubricht, 1985, p. 11; Turgeon et al., 1998, p. 138

Vertigo milium (Gould 1840)
BLADE VERTIGO

Pupa milium Gould, 1840, Boston Jour. Nat. Hist., 3: 402; 4: 359.
Vertigo milium (Gould), W. G. Binney, 1878, Terr. Moll., 5: 215, pl. 71, fig. 1; Sterki, 1888, Proc. U. S. Nat. Mus., 11: 377, pl. 42. figs. 10, 13; Pilsbry, Man. Conch., 25:147, 378; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 80; Pilsbry, 1948, p. 944, fig. 509; Burch, 1962, pp. 56, 190, fig. 110; Hubricht, 1985, p. 10; Turgeon et al., 1998, p. 138.

Vertigo modesta (Say 1824)
CROSS VERTIGO

Pupa modesta Say, 1824, Long's Second Exped., Appendix, p. 259, pl. 15, fig. 5.
Pupa decora Gould, 1848, Proc. Boston Soc. Nat. Hist., 2; 263; W. G. Binney, Terr. Moll. 5: 201.
Vertigo modesta ultima Pilsbry 1919, Man. Conch., 25: 128, figs. 4, 4a.
Vertigo modesta modesta Hubricht, 1985, p. 12.
Vertigo modesta (Say), Pilsbry & Vanatta, 1900, Proc. Acad. Nat. Sci. Phila., p. 600, pl. 23, figs. 2, 3, 6; Dall, 1905, Alaska Land & Freshwater Moll., p. 29; Pilsbry, 1919, Man. Conch., 25: 123; Berry, 1922, Canada Dept. Mines Bull., 36, p. 13; Pilsbry, 1948, p. 982; Burch, 1962, p. 57, 58; Turgeon et al., 1998, p. 138.

Vertigo oscariana Sterki 1890
CAPITAL VERTIGO

Vertigo oscariana Sterki, 1890, Proc. Acad. Nat. Sci. Phila., p. 33; Nautilus, 3: 136, 4: 39, pl. 1, fig. 5; Clapp, Nautilus, 28: 137, pl. 6, fig. 8; Pilsbry, Man. Conch., 25: 144, pl. 8, figs. 8, 10, 11; Walker, 1928, Terr. Moll. Alabama, p. 147; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 79 (text, Fig.); Pilsbry, 1948, p. 946, fig. 509 a, fig. 510, 8, 10–11; Burch, 1962, pp. 56, 190, fig. 111; Hubricht, 1985, p. 10; Turgeon et al., 1998, p.138.

Vertigo ovata Say 1822
OVATE VERTIGO

Vertigo ovata Say, 1822, Jour. Acad. Nat. Sci. Phila., 2: 375; W. G. Binney, 1885, Man. Amer. Land Shells, p. 334; Sterki, Proc. U. S. Nat. Mus., 11: 375; Nautilus, 22: 52 (locomotion); Henderson, Univ. Colo. Studies, 13: 136; Dall, Moll. Harriman Alaska Expedition, 32; Pilsbry, Man. Conch., 25: 82–88; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 76; Franzen, 1947, Trans. Kansas Acad. Sci., 49: 416. pl. 1, fig. 7, pl. 2, fig. 2; Pilsbry, 1948, p. 952, fig. 513, 1–3, 4, 7; Burch, 1962, pp. 57, 190, figs. 112, 119; Hubricht, 1985, p. 11; Turgeon et al., 1998, p.138.
Zonites upsoni Calkins, 1880, Valley Naturalist, 2: 53 (immature stage).
Pupa ovata f. *antiquorum* Cockerell, 1891, Zoe, 2: 18.

Vertigo pygmaea (Draparnaud 1801), New State Record
CRESTED VERTIGO

Pupa pygmaea Draparnaud, 1801. Tableau Moll. Terr. et Fluv. de la France, p. 57.
Vertigo callosa Sterki, 1890, Proc. Acad. Nat. Sci. Phila., p. 31 (not of Reuss, 1849).
Pupa (Nearctula) superioris Pilsbry, 1899, Nautilus, 12: 103.
Vertigo pygmaea (Draparnaud) Sterki, 1892, Nautilus, 6: 5; Pilsbry, 1919, Man. Conch., 25: 96; Pilsbry, 1948, p. 961, figs. 515, 11–12; Burch, 1962, pp. 57, 190, figs. 112, 113; Hubricht, 1985, p. 11; Turgeon et al., 1998, p. 139.

Vertigo teskeyae Hubricht 1961
SWAMP VERTIGO

Vertigo teskeyae Hubricht, 1961, p. 62; 1985, p. 11.

Vertigo tridentata Wolf 1870
HONEY VERTIGO

Vertigo tridentata Wolf, 1870, Amer. Jour. Conch. 5: 198, pl. 17, fig. 1; Sterki, 1888, Proc. U. S. Nat. Mus., 11: 375; Pilsbry, Man. Conch., 25: 100; Brooks & Kutchka, 1938, Ann. Carnegie Mus., 27: 78, (text, figs.); F. C. Baker, 1939, p. 106; Pilsbry, 1948, p. 965, fig. 518, 1–3; Burch, 1962, pp. 57, 190, fig. 112, 124; Hubricht, 1985, p. 11; Turgeon et al., 1998, p. 139.

Vertigo ventricosa (Morse 1865)
FIVE TOOTH VERTIGO

Isthmia ventricosa Morse, 1865, Ann. Lyc. Nat. Hist. of New York, 8: 207.
Vertigo approximans Sterki, 1890, Nautilus, 3: 136.
Vertigo ventricosa (Morse), W. G. Binney, 1878, Terr. Moll., 5: 218; Pilsbry, 1919, Man. Conch., 25: 94; Tomlin & Bowell, 1909, Jour. of Conch., 12: 297, pl. 5, third fig. (dentition); Pilsbry, 1948, p. 957; Hubricht, 1985, p. 11; Burch, 1962, p. 60; Turgeon et al., 1998, p. 139.

Columella columella alticola
(Ingersoll 1875)

Pupilla alticola Ingersoll, 1875, Bull. U. S. Geol. Surv. Terr., 1: 128; 8th Ann. Rep. Hayden Surv., p. 391.
Pupa alticola (Ingersoll), W. G. Binney, 1878, Terr. Moll., 5: 212, fig. 166.
Sphyradium alticola (Ingersoll), Hanna, Proc. U. S. Nat. Mus., 41: 373, fig. 2.
Columella alticola (Ingersoll), Pilsbry, 1926, Man. Conch., 27: 243, pl. 31, figs. 6–8; Henderson, 1924, Univ. Colo. Studies, 13: 140; Berry, 1922, Viet. Mem. Mus. Bull., 36: 14; W. O. Gregg, Nautilus, 55: 143; F. C. Baker, 1939, p. 109; Franzen, 1974, Trans. Kansas Acad. Sci., 49: 414; Pilsbry, 1948, p. 1003.
Columella columella alticola (Ingersoll), Bequaert & Miller, 1973, Moll. Arid Southwest, p. 190; Hubricht 1985, p. 12.
Columella columella (Martens 1830), Turgeon, et al. 1998: 137.

Columella simplex (Gould 1841)
TOOTHLESS COLUMN

Pupa simplex Gould, 1841, Boston Jour. Nat. Hist., 3: 403, pl. 3. fig. 21.
Vertigo simplex (Gould), W. G. Binney, 1878, Terr. Moll., 5: 219, pl. 73, fig. 3; W. S. Teator, 1890, Nautilus, 4: 66; G. W. Taylor, 1891, Nautilus 5: 92.
Columella edentula (Draparnaud), Pilsbry, 1948, p. 1002, fig. 535, 12–17 (and other authors on the American fauna).
Columella simplex (Gould), Hubricht, 1971, Sterkiana, 42: 45; 1985, p. 12.

Clade Stylommatophora
Subclade Orthurethra
> Family Valloniidae Morse, 1864

Vallonia excentrica Sterki 1893
IROQUOIS VALLONIA

Vallonia excentrica Sterki, 1893, Man. Conch. 8: 249, pl. 32. figs. 6, 9; Proc. Acad. Nat. Sci. Phila., 1893, p. 252, pl. 8, figs. B, M, (teeth & jaw); Walker, 1906, Ill. Cat. Moll. Mich., 1: 521; F. C. Baker, 1939, p. 118; Henderson, 1929, Univ. Colo. Studies, 17: 76; H. Watson, 1920, Proc. Malacol. Soc. London, 14: 28, figs. 6 h, g, j, pl. 1, 6; Pilsbry, 1948, p.1025, fig. 545 b; Hubricht, 1985, p. 7; Turgeon et al., 1998, p. 139.
Vallonia pulchella Müller, var. *excentroides* Sterki, A. Weiss, 1894, Nachr. d. m. Ges., 26: 154, (Pleistocene).
Vallonia pulchella form *excentrica* Sterki, Hubricht, 1950, Nautilus, 64: 35.

Vallonia gracilicosta
Reinhardt 1883, New State Record
MULTIRIB VALLONIA

Vallonia gracilicosta Reinhardt, 1883, Sitzungs-Ber. Ges. Naturforsch. Freunde Berlin, p. 42; Sterki, 1893, in part, Man. Conch., 8: 256, not plate 33, figs. 48, 49; 1893, Proc. Acad. Nat. Sci. Phila., pp. 269, 278; Henderson, 1924, Univ. Colo. Studies, 13: 102; Pilsbry, 1948, p. 1028, fig. 549a; Burch, 1962, pp. 45, 189, fig. 79; Hubricht, 1985, p. 7; Turgeon et al., 1998, p. 139.
Vallonia costata var. *montana* Sterki, 1893, Man. Conch., 8: 254; Proc. Acad. Nat. Sci. Phila., p. 263.

Vallonia parvula Sterki 1893
TRUMPET VALLONIA

Vallonia parvula Sterki, 1893, Man. Conch., 8: 254, pl. 32, figs. 23–26; 1893, Proc, Acad. Nat. Sci. Phila., p. 265, pl. 8, fig. R; Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 559; Walker, 1897, Nautilus, 11: 82; F. C. Baker, 1939, p. 119, figs; Pilsbry, 1948, p. 1027, fig. 547; Burch, 1962, pp. 44, 189, fig. 77; Hubricht, 1985, p. 7. Turgeon et al., 1998, p. 139.
Vallonia americana Ancey, MS., in Sterki, 1893, Proc. Acad. Nat. Sci. Phila., p. 266; Cockerell, 1893, Nautilus, 7: 94.
Vallonia costata var. *minor* Cockerell, Sterki, 1893, Proc. Acad. Nat. Sci. Phila., p. 267.

Vallonia perspectiva Sterki 1893
THIN-LIP VALLONIA

Vallonia perspectiva Sterki, in Sargent, 1892, Nautilus, 6: 77, (name only); Sterki, 1893, Man. Conch., 8: 257, pl. 33, figs. 39–45; 1893, Proc. Acad. Nat. Sci. Phila., p. 271, pl. 8, fig. F, (teeth); Walker, 1928, Terr. Moll. Alabama, p. 163, fig. 252; Pilsbry, 1948, p. 1033, fig. 553; Burch, 1962, pp. 45, 189, fig. 80; Hubricht, 1985, p. 7; Turgeon et al., 1998, p. 139.

Vallonia pulchella (Müller 1774)
LOVELY VALLONIA

Helix pulchella Müller, 1774, Vermium terr. et. fluv. Hist., 2: 30; Leidy, 1851, Terr. Moll., 1: 256, pl. 9, figs. 7–9.
Helix minuta Say, 1817, Jour. Acad. Nat. Sci. Phila., 1: 123.
Vallonia minuta (Say), Morse, 1864, Jour. Portland Soc. Nat. Hist., 1: 21, figs. 54–59.

Vallonia pulchella (Müller), W. G. Binney, 1878, Terr. Moll., 5: 344, pl. 17, fig. 1; Man. Amer. Land Shells. p. 77, fig, 39; Sterki, 1893, Man. Conch., 8: 248, pl. 32. figs. 1–5; Proc. Acad. Nat. Sci. Phila., p. 247. pl. 8, figs. A, G, H, I, K, L (jaw and teeth); Henderson, 1924, Univ. Colo. Studies, 13: 107; 1929, 17: 76, fig. 30; 1936, 23: 101; Stearns, 1900, Nautilus, 14: 65; Williamson, 1898, Nautilus, 12: 71; F. C. Baker, 1920, Life of the Pleistocene or Glacial Period, p. 388; M. E. Whitney, 1941, Pap. Mich. Acad. Sci, etc., 26: 311–338 (hermaphrodite gland and germ cells). Pilsbry, 1948, p. 1023, fig. 454a; Burch, 1962, pp. 44, 189, fig. 76; Hubricht, 1985, p. 7; Turgeon et al., 1998, p. 139.

Clade Stylommatophora
Subclade Orthurethra
> Family Strobilopsidae Wenz, 1915

Strobilops aeneus Pilsbry 1926
BRONZE PINECONE

Strobilops labyrinthica strebeli (Pfeiffer), Pilsbry, 1893, Nautilus, 7: 57; 1900, Proc, Acad. Nat. Sci. Phila., p. 133; 1902, p. 429; Ferriss, Nautilus, 14: 56. (Not *Helix strebeli* Pfeiffer).

Strobila labyrinthica (Say), Dall, 1885, Proc. U. S. Nat. Mus., 8: 262, (excl. syn).

Strobilops labyrinthica (Say), Walker, 1906, Ill. Cat. Moll. Mich., p. 506, fig. 119 (excl. syn).

Strobilops aenea Pilsbry, 1926, Nautilus, 40: 69; 1927, Man. Conch., 28: 29; Walker, 1928, Terr. Moll. Alabama, p. 155, fig. 247; F. C. Baker, 1939, p. 114; F. Haas, 1945, Fieldiana, Zoology, 31, No. 2, p. 14; Pilsbry, Pilsbry, 1948, p. 862, fig. 465, 6–12; Burch, 1962, pp. 65, 190, fig. 134; Hubricht, 1985, p. 13.

Strobilops aeneus Pilsbry, Turgeon et al., 1998, p. 139.

Strobilops affinis Pilsbry 1893
EIGHTFOLD PINECONE

Strobilops affinis Pilsbry, 1893, Nautilus, 7: 57; Pilsbry, 1927, Man. Conch., 28: 27; F. C. Baker, 1939, p. 113; Pilsbry, 1948, p. 860, fig. 465 , 1–5; Burch, 1962, pp. 66, 191, fig. 135; Hubricht, 1985, p. 13; Turgeon et al., 1998, p. 139.

Strobilops labyrinthicus (Say 1817)
MAZE PINECONE

Helix labyrinthica Say, 1817, Jour. Acad. Nat. Sci. Phila., 1: 124.

Strobila labyrinthica (Say), Morse, 1864, Terr. Pulm. Maine, in Jour. Portland Soc. Nat. Hist., 1: 26, figs. 64–67 pl. 8, fig. 68; W. G. Binney, 1878, Terr. Moll., 5: 259, pl. 5, fig. O (teeth).

Strobila labyrinthica var. *virgo* Pilsbry, 1892, Nautilus, 6: 94.

Strobilops labyrinthica (Say), Pilsbry, 1927, Man. Conch., 28: 20, pl. 1 figs. 1–11; Pilsbry, 1948, p. 854, fig. 463; Hubricht, 1985, p. 13.

Strobilops labyrinthicus (Say), Burch, 1962, pp. 66, 191, fig. 137; Turgeon et al., 1998, p. 139.

Strobilops texasianus Pilsbry & Ferriss 1906
SOUTHERN PINECONE

Strobilops labyrinthica texasiana Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., pp. 147, 557; Strecker, Nautilus, 22: 65; Wheeler, Nautilus, 31: 114.

Strobilops texasiana floridana Pilsbry, Pilsbry 1948 p. 858.

Strobilops labyrinthica form *parietalis* Pilsbry, Pilsbry 1948, p. 856.

Strobilops aenea spiralis Pilsbry, Pilsbry 1948, p. 865.

Strobilops parietalis Pilsbry, Hubricht, 1971, Sterkiana, 42: 45.

Strobilops lonsdalei Ho & Leonard, 1961 Nautilus, 75: 43.

Strobilops texasiana Pilsbry & Ferriss, Pilsbry, 1927, Man. Conch., 28: 24; Pilsbry, 1948, p. 856; Hubricht, 1985, p. 13; Burch 1962, p. 66.

Strobilops texasianus Turgeon et al., 1998, p. 139.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Orthalicidae Ibers, 1860

Rabdotus dealbatus (Say 1821)
WHITEWASHED RABDOTUS

Helix dealbata Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 159.

Bulimus liquabilis Reeve, 1848, Conch. Icon., 5: pl. 57, fig. 387.

Bulimus confinis Reeve, 1850, Conch. Icon., 5: pl. 86, fig. 643.

Bulimus dealbatus (Say), A. Binney, 1851, Terr. Moll., 2: 276, pl. 51, fig. 1; pl. 51a, except upper and lower figs.; Leidy, 1851, Terr. Moll. 1: 229, pl. 15. fig. 1.

Bulimulus scheideanus (Pfeiffer), W. G. Binney, 1878, Terr. Moll., 5; 391, fig. 276, (not the description).

Bulimulus dealbatus (Say), W. G. Binney, 1878, Terr. Moll., 5: 393, fig. 269, pl. X, fig. E, (jaw and teeth); Man. Amer. Land Shells, p. 401 fig. 441; Singley, 1893, 4th Ann. Rep. Geol. Surv. Texas, p. 309; Pilsbry, Man. Conch., 11: 128, pl. 17 fig. 1, pl. 18, figs. 27–30, 48; 1906, Proc. Acad. Nat. Sci. Phila., p. 136, pl. 6, fig. 13; Walker, 1928, Terr. Moll. Ala., p. 61, figs. 74–77; F. C. Baker, 1933, Nautilus, 47: 4; Pilsbry, 1946, p. 7, figs. 4 a–d; Burch, 1962, pp. 133, 197, fig. 322;

Bulimulus dealbatus liquabilis (Reeve), Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 134, pl. 6, figs. 7–12.

Rabdotus dealbatus dealbatus (Say), Pratt, 1969, Amer. Malacol. Union Ann, Rep. p. 47; Hubricht, 1985, p. 35.

Rabdotus dealbatus (Say), Turgeon et al., 1998, p. 141.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Subulinidae P. Fischer & Crosse, 1877

Opeas pyrgula
Schmacker and Boettger 1891, New State Record
SHARP AWLSNAIL

Opeas pyrgula Schmacker & Boettger, 1891, Nachrbl. D. Malak. Ges., 23: 179–180; Pilsbry, 1906, Man. Conch., 18: 173; H. B. Baker, Nautilus, 58: 86 (anatomy); Pilsbry, 1946, p. 182, figs. 85e, 86b; Burch, 1962, pp. 125, 197, fig. 306; Turgeon et al., 1998, p. 140.

Opeas pumilum Pfr., Vanatta, 1919, Nautilus, 33: 31.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Haplotrematidae H. B. Baker, 1925

Haplotrema concavum (Say 1821)
GRAY-FOOT LANCETOOTH

Helix concavum Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 159; Leidy, A. Binney's Terr. Moll., 1:258, pl. xii, figs. 9–11 (anatomy).

Helix planorboides Rafinesque, Férussac, 1821, Tabl. Syst. Limacons, p. 41, No. 211 (nude name); 1832, Hist., pl. 82, fig. 4; Deshayes, 1850, in Férussac Hist., p. 87.

Helix dissidens Deshayes, 1850, in Férussac, Hist. p. 97, pl. 84, figs. 1, 2, Macrocyclis concava (Say), Morse, 1864, Jour. Portland Soc., 1: 12, pl. V, lower fig.; W. G. Binney, 1878, Terr. Moll., 5: 92; 1885, Man. Amer. Land Shells, p. 199, fig. 209.

Selenites concava var. *minor, major, albina* Ancey, 1882, Le Naturaliste, 4me année, 2: 111.

Circinaria concava (Say), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 133; 1903, *ibid*., p. 204; 1906, *ibid*. p. 557; Sampson, 1913, Trans, St. Louis Acad. Sci., 22: 101; H. B. Baker, 1912, Nautilus, 26: 3.

Haplotrema (Geomene) concavum concavum (Say), H. B. Baker, 1930, Proc. Acad. Nat. Sci. Phila., 82: 411, pl. 33, fig. 8 (with H. c. minus Anc., p. 412).

Haplotrema concavum (Say), Pilsbry, 1946, p. 208, fig. 100; Burch, 1962, pp. 120, 196, fig. 295; Hubricht, 1985, p. 33; Turgeon et al., 1998, p. 140.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Punctidae Morse, 1864

Punctum minutissimum (I. Lea 1841)
SMALL SPOT

Helix minutissima Lea, 1841, Trans. Amer. Philos. Soc., 9: 17.

Punctum minutissimum (Lea), Morse, 1864, Terr. Pulm. Maine Jour. Portland Soc. Nat. Hist., 1: 27, figs. 69, 70, pl. 8, fig. 71; W. G. Binney, 1869, Land and Freshwater Shells North America, 1: 222; Bland, 1873, Ann. Lyc. Nat. Hist. New York, 10: 306 (history); H. B. Baker, 1930, Occas. Pap. Mus. Zool. Univ. Mich., 220: 5; Pilsbry, 1948, p. 644, fig. 350; Burch, 1962, pp. 80, 192, fig. 179; Hubricht, 1985, p. 22; Turgeon et al., 1998, p. 141.

Punctum pygmaeum Draparnaud, W. G. Binney, 1878, Terr. Moll., 5: 411 (and most American authors from that time to 1930; not Helix pygmaea Draparnaud).

Microphysa pygmaea (Draparnaud), W. G. Binney, 1885, Man. Amer. Land Shells, p. 71, fig. 31.

Punctum vitreum H. B. Baker 1930
GLASS SPOT

Punctum (Toltecia) vitreum H. B. Baker, 1930, Occas. Pap. Mus. Zool, Univ. Mich., No. 220, p. 9, pl. 7, figs. 3–6; Pilsbry, 1948, p. 649, fig. 356; Burch, 1962, pp. 80, 193, fig. 177; Hubricht, 1985, p. 22; Turgeon et al., 1998, p. 141.

Punctum pygmaeum (Draparnaud), Pilsbry and Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 158.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Discidae Thiele, 1931

Anguispira alternata (Say 1816)
FLAMED TIGERSNAIL

Helix radiata Müller, 1774, in part, Verm. Hist., 2: 23.

Helix alternata Say, 1816, Nicholson's British Encyclopedia, article Conchology, species No. 4, pl. 1, fig. 2; W. G. Binney, 1858, Proc. Acad. Nat. Sci. Phila., p. 200, (with vars. *albina, australis, carinata* and *laevigatior*, Nude names).

Helix scabra Lamarck, 1822, Hist. Nat. Anim. sans Vert., 6 me Part, p. 88.

Carocolla dubia Sheppard, 1829, Trans. Lit. and Hist. Soc. Quebec, 1: 194.

Helix infecta "Parreyss," Pfeiffer, 1857, Malak. Blätter, 4:86.

Anguispira alternata var. *alba* Tryon, 1866, Amer. Jour. Conch., 2: 261

Patula alternata (Say), W. G. Binney, 1878, Terr. Moll., 5: 161, pl. 25, pl. 4, fig. E (teeth).

Pyramidula alternata (Say), F. C. Baker, 1904, Amer. Nat., 38: 661, (variation in height/diameter ratio).

Pyramidula alternata eriensis Clapp, 1916, Ann. Carnegie Mus., 10: 535, pl. 32, figs. 9–12.

Anguispira alternate palustris Clapp, Walker, 1928, Terr. Moll. Alabama, p. 112, fig. 163.

Anguispira clarki Vanatta, Pilsbry, 1948, p. 585; Hubricht, 1974: 33.

Anguispira alternata (Say), Jones, 1935, Jour. of Morph., 57: 547, (formation of shell); 1935, Nautilus, 48: 140, (burrowing); Pilsbry, 1948, p. 568, fig. 305; Burch, 1962, pp. 75, 192, fig. 159; Hubricht, 1985, p. 18. Turgeon et al., 1998, p. 142.

Anguispira kochi (Pfeiffer 1845)
BANDED TIGERSNAIL

Helix solitaria Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 157; (not Helix solitaria Poiret, 1800); A. Binney, 1851, Terr. Moll., 2: 208, pl. 24; Leidy, 1851, Terr. Moll., 1: 254, pl. 8, figs. 7–10 (anatomy); Binney & Bland, Land & Freshwater Shells North America, 1: 71, fig. 119.

Helix kochi Pfeiffer, 1845, Proc. Zool. Soc. London, p. 127; 1848, Mon. Hel. Viv., 1:101; Reeve, 1853, Conch. Icon., *Helix*, pl. 167, fig. 1120.

Patula solitaria (Say), W. G. Binney, 1878, Terr. Moll., 5: 156, fig. 59 and 63 (var. albino); 1883, Suppl., Bull. Mus. Comp. Zool. Mich., 1: 492, fig. 80 (with var. *albino* W. G. Binney, fig. 81).

Pyramidula solitaria (Say), Walker, 1906, Ill. Cat. Moll. Michigan, 1: 492, fig. 80; (with var. *albina*, W. G. Binney, fig. 81).

Pyramidula solitaria albina Walker, in Clapp, Ann. Carnegie Mus. 10: 533.

Anguispira kochi (Pfeiffer), Pilsbry, 1948, p. 591, fig. 325, a–b; Burch, 1962, pp. 74, 192, fig. 158; Hubricht, 1985, p. 19; Turgeon et al., 1998, p. 142.

Anguispira strongylodes (Pfeiffer 1854)
SOUTHEASTERN TIGERSNAIL

Helix strongylodes Pfeiffer, 1854, Proc. Zool. Soc. London, p. 53 (Texas); 1859, Mon. Hel. Viv., 4:91; Reeve, 1854, Conch. Icon., Vol. 7, pl. 186, fig. 1296. (Spelled *strongyloides* by some authors).

Pyramidula alternata rarinotata Pilsbry, 1900, Nautilus, 13: 114.

Anguispira alternata strongylodes (Pfeiffer), Pilsbry, 1948, p. 577.

Anguispira alternata crassa Walker, Pilsbry, 1948, p. 579.

Anguispira alternata macneilli Walker, Pilsbry, 1948, p. 576; Hubricht, 1974: 33.

Anguispira crassa Walker, Hubricht, 1953, Nautilus, 66: 125.

Anguispira macneilli Walker, Hubricht, 1965, Sterkiana, 17: 3.

Anguispira strongylodes (Pfeiffer), Hubricht, 1960, Nautilus, 74: 82; Hubricht, 1985: 18.

Discus macclintocki (F. C. Baker 1928)
PLEISTOCENE DISC

Gonyodiscus macclintocki F. C. Baker, 1928, Nautilus, 41: 133; 1931, Jour. of Paleontology, 5: 279, pl. 32, figs., 3a, 3b.

Discus macclintocki (F. C. Baker), Morrison, 1940, Nautilus, 53: 123; Macmillan, 1941, Nautilus, 55: 21; (F. C. Baker), Pilsbry, 1948, p. 606; Hubricht, 1985, p. 19; Burch, 1962, p. 76; Turgeon, et al., 1998, p. 142.

Discus macclintocki angulata (F. C. Baker), Pilsbry, 1948, p: 607.

Discus nigrimontanus (Pilsbry 1924)
BLACK MOUNTAIN DISC

Gonyodiscus bryanti nigrimontanus Pilsbry, 1924, Proc. Acad. Nat. Sci. Phila., 76: 4, 9, figs. 2c, 3c.

Discus bryanti forma *tuberculatus* Kutchka, 1938, Nautilus 52: 14, fig 51.

Discus nigrimontanus forma *edentulus* Pilsbry, 1948: 610.

Discus nigrimontanus edentulus Hubricht, 1963b: 63.

Discus bryanti nigrimontanus (Pilsbry), Pilsbry, 1948: 613, fig. 332, c.

Discus nigrimontanus (Pilsbry), Hubricht, 1963b: 63; 1985: 20; Turgeon et al., 1998: 142.

Discus patulus (Deshayes 1830)
DOMED DISC

Helix perspectiva Say, 1817, Jour. Acad. Nat. Sci. Phila., (1), 1: 18; Leidy, 1851, Terr. Moll., I, pl. 7, figs. 4–7; A. Binney, 1851, Terr. Moll., 2: 256, pl. 30, fig. 1; (name preoccupied, not *Helix perspectiva* Megerle von Mühlfeld, 1816).

Helix patula Deshayes, 1830, Encycl. Méth., 2: 217.

Patula perspectiva (Say), W. G. Binney, 1878, Terr. Moll., 5: 164, pl. 30, fig. I, pl. IV, fig. A.

Pyramidula (Gonyodiscus) perspectiva (Say), Pilsbry, Man. of Conch., 9: 46, pl. 14 figs. 19, 22, 26; Walker, 1906, Ill. Cat. Moll. Michigan, 1:493.

Gonyodiscus perspectivus (Say), Walker, 1928, Terr. Moll. Alabama, p. 118, fig. 173.

Goniodiscus patula (Deshayes), Kennard and Woodward, 1925, Nautilus, 38: 86.

Discus patulus angulatus Kutchka, 1938, Nautilus, 52: 13, pl. 2, fig. 4. (Not *D. macclintocki angulatus* F. C. Baker, 1928).

Discus patulus brooksi Kutchka, 1948, p. 610; Hubricht, 1963b, p. 62.

Discus patulus carinatus MacMillan, 1940, Nautilus, 53: 143 (new name for *D. p. angulatus* Kutchka. Not *Helix (Patula) perspectiva* var. *carinata* Gratacap, 1901).

Discus bryantwalkeri (Pilsbry), Pilsbry, 1948, p. 611; Hubricht, 1963b, p. 62.

Discus patulus (Deshayes), Pilsbry, 1948, p. 608, fig. 330, a–b; Burch, 1962, pp. 74, 192, fig. 162; Hubricht, 1963b: 62; 1985, p. 19; Turgeon et al., 1998, p. 142.

Discus shimeki (Pilsbry 1890)
STRIATE DISC

Zonites shimekii Pilsbry, 1890, Nautilus 4: 3; Proc. Acad. Nat. Sci. Phila., 42: 297, pl. 5, figs. 9–11.

Patula ruderata cronkhitei form *viridula* Cockerell,

1890, Nautilus 3: 102.
Pyramidula cockerelli Pilsbry, 1898, Nautilus, 12: 85.
Zonites randolphi Pilsbry, 1898, Nautilus, 12: 87.
Pyramidula shimekii cockerelli, Pilsbry & Ferriss, 1909, Proc. Acad. Nat. Sci. Phila., 61: 514; Chamberlin & E. Berry, Nautilus, 42: 125; Bull. Univ. Utah, 19: 107, 110, fig. 51; Pilsbry, 1924, Nautilus, 38: 65; Henderson, 1924, Univ. Colo. Studies, 13: 155.
Pyramidula cronkhitei cockerelli Pilsbry, Hanna & Johnston, 1913, Kansas Univ. Sci. Bull., 7: 118.
Pyramidula shimekii (Pilsbry), Shimek, 1901, Bull. Lab. N. H. State Univ. Iowa, 5: 139; F. C. Baker, 1920, pp. 252–389; 1931 Jour. of Paleontology, 5: 280 pl. 32, fig. 4.
Gonyodiscus shimekii (Pilsbry), F. C. Baker, 1927, Nautilus, 40:117; S. S. Berry, 1922, Canada Dept. Mines, Bull. No. 36, p. 10.
Discus shimeki cockerelli (Pilsbry), Henderson, 1936, Univ. Colo. Studies, 23: 107.
Discus shimekii (Pilsbry), H. B. Baker, 1934, Nautilus, 48: 71; Turgeon et al., 1998, p. 142.
Discus shimeki (Pilsbry) Pilsbry, 1948, p. 617; Hubricht, 1985, p. 20;

Discus whitneyi (Newcomb 1864)
FOREST DISC

Helix whitneyi Newcomb, 1864, Proc. Cal. Acad. Nat. Sci., 3: 118.
Helix cronkhitei Newcomb, 1865, Proc. Cal. Acad. Sci., 3: 180; Gabb, 1868, Amer. Jour. Conch., 4: 228.
Gonyodiscus cronkhitei (Newcomb), Berry, 1922, Vict. Mem. Mus. Bull. No. 36, pl. 7; Henderson, 1924, Univ. Colo. Studies, 13: 153; *ibid*., 17: 113; Chamberlin & Jones, 1929, Univ. Utah Bull., 19: 107; Vanatta, Nautilus, 38: 92.
Pyramidula cronkhitei (Newcomb), Dall, 1905 Harriman Alaska Exped., 13: 50; Hanna, 1925, Nautilus, 38: 124.
Gonyodiscus cronkhitei anthonyi (Pilsbry), Henderson, 1924, Univ. Colo. Studies, 13: 154; *ibid*. 17: 113; Mozley, 1928, Nautilus, 42: 15.
Discus cronkhitei cronkhitei (Newcomb), Henderson, 1936, Univ. Colo. Studies, 23: 106.
Discus cronkhitei anthonyi (Pilsbry), Henderson, 1936, *ibid*. 23: 107; S.T. & B. W. Brooks, 1940 Ann. Carnegie Mus., 28: 61; Goodrich, 1933, Nautilus, 47: 8.
Helix striatella Anthony, 1849, Boston Jour. Nat. Hist., 3: 278; Not *Helix striatella* Rang. 1831, Ann. Sci. Nat., 24:38.
Patula striatella (Anthony) Morse, 1864, Jour. Portland Soc. Nat. Hist., 1: 21; W. G. Binney, 1878, Terr. Moll. 5: 105; Sterki, 1893, Proc. Acad. Nat. Sci. Phila., p. 395, pl. 11 figs. vii–ix (development of teeth).
Patula striatella form *albino* "Morse", Cockerell, 1890, Nautilus, 3: 102.
Pyramidula striatella var. *alba* Walker, 1894, Rev. Moll. Fauna Mich., p. 16.
Pyramidula striatella var. *albina* "Morse," (Cock.), Walker, 1906, Ill. Cat. Moll. Mich., 1: 493.
Pyramidula cronkhitei anthonyi Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 153.
Discus cronkhitei catskillensis (Pilsbry) Branson, 1964, Proc. Okla. Acad. Sci., 44: 33.
Discus cronkhitei (Newcomb) Pils., 1948, p. 600; Burch, 1962, p. 76–77; Hubricht, 1985, p. 19.
Discus whitneyi (Newcomb), Roth, 1987, p. 129–132; Turgeon et al., 1998, p. 142.

Clade Stylommatophora
Informal Group Sigmurethra
> Family Helicodiscidae H. B. Baker, 1927

Lucilla scintilla (Lowe 1852)
OLDFIELD COIL

Helix scintilla Lowe, 1852: 115.
Helicodiscus singleyanus inermis H. B. Baker, 1929, Nautilus, 42: 86, pl. 3, figs. 1–3; Proc. Acad. Nat. Sci. Phila., 81: 263, pl. 9, figs. 2–3; Pilsbry, 1948, p. 637, fig. 347.
Helicodiscus inermis H. B. Baker, Hubricht, 1968, Nautilus, 82: 68. Hubricht, 1985, p. 22; Turgeon et al., 1998, p. 142.
Helicodiscus intermedius Morrison, Pilsbry, 1948, 2: 638; Hubricht, 1962, Nautilus, 82: 68.
Lucilla scintilla (Lowe), Horsák et al., 2009, p. 24–27.

Lucilla singleyanus
(Pilsbry 1890), New State Record
SMOOTH COIL

Zonites singleyanus Pilsbry, 1890, Proc Acad. Nat. Sci. Phila., for 1899, p. 84; *ibid*. 1888, pl. 17, fig. M.
Hyalinia laeviuscula Sterki, 1892, Nautilus, 6: 53; Vanatta, 1899, Proc. Acad. Nat. Sci. Phila., p. 424.
Hyalinia texana Sterki, 1892, Nautilus, 6: 54, name only (apparently an error for *laeviuscula*).
Zonitoides singleyanus (Pilsbry), Pilsbry and Ferriss 1906, Proc. Acad. Nat. Sci. Phila., p. 150, Walker, 1928, Terr. Moll. Alabama, p. 97.
Helicodiscus singleyanus inermis H. B. Baker, Bequaert & Miller, 1973, Moll. Arid Southwest, p. 87.
Helicodiscus intermedius Morrison, Bequaert & Miller, 1973, Moll. Arid Southwest, p. 87.
Helicodiscus (Hebetodiscus) singleyanus singleyanus, (Pilsbry), H. B. Baker, 1929, Proc. Acad. Nat. Sci Phila., 81: 264, pl. 10, figs 13–15; Pilsbry, 1948, p. 636; Hubricht, 1985, p. 22; Burch, 1962, p. 79; Turgeon et al., 1998, p. 142.
Lucilla singleyanus (Pilsbry), Roth & Sadeghian, 2003, p. 9; Horsák et al., 2009, p. 24–27.

Helicodiscus notius Hubricht 1962
TIGHT COIL

Helicodiscus notius Hubricht, 1962, Nautilus, 75(3): 104, pl. 9, figs. N–P; 1985, p. 21; Turgeon et al., 1998, p. 142.

Helicodiscus parallelus (Say 1817)
COMPOUND COIL

Helix lineata Say, 1817, Jour. Acad. Nat. Sci. Phila., 1: 18, 2: 373 (Not *Helix lineata* Olivi, 1792, Zool. Adriatico, p. 177).

Planorbis arallellus Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 164 (misspelling of *parallelus*).

Helicodiscus lineatus Morse, 1864, Jour. Portland Soc. Nat. Hist., 1: 25, figs. 61, 62, pl. 2, fig. 3, pl. 7, fig. 63; 1907, Nautilus, 21: 73 (eyes); W. G. Binney, 1885, Man. Amer. Land Shells, p. 75; Pilsbry, Man. Conch. 9: 51, pl. 11, fig. 24 (teeth); Hugh Watson, 1920, Proc. Malac. Soc. London, 14: 12, fig. 4 (teeth).

Helicodiscus parallelus (Say), Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 156; H. B. Baker, 1927, *ibid*. 79: 234, pl. 18, figs. 41, 42 (anatomy); F. C. Baker, 1939, Fieldbook Illinois Land Snails, p. 88, (figs. of living animal and shell); Pilsbry, 1948, p. 625, fig. 339; Hubricht, 1985, p. 21; Burch, 1962, pp. 78, 192, fig. 171; Turgeon et al., 1998, p. 142.

Helicodiscus theresa Thiele, 1927, Abhandl. Senckenb. nat. Ges., 40: 323, pl. 26, figs. 28 a–c; *cf* H. B. Baker, 1928, Nautilus, 41: 128.

Clade Stylommatophora
"Limacoid Clade"
> Family Gastrodontidae Tryon, 1866

Ventridens brittsi Pilsbry 1892
WESTERN DOME

Zonites brittsi Pilsbry, 1892, Nautilus 5: 99.

Zonites acerra Lewis, Simpson, 1888, Proc. U. S. Nat. Mus., 11: 451.

Zonites demissa W. G. Binney, *brittsi* Pilsbry & *gularis* Say, Sampson 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 182, 183.

Gastrodonta demissa var. *lamellata* Pilsbry 1900, Nautilus, 13: 107.

Gastrodonta demissa and var. *brittsi* and *lamellata* Pilsbry, 1900, Proc. Acad. Sci. Nat. Hist. Phila., p. 456; 1903, *ibid*, p. 213; Ferriss, 1900, Nautilus, 14: 31.

Gastrodonta demissa brittsi Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 558, figs. 2, 3.

Ventridens demissus brittsi (Pilsbry), Pilsbry, 1946, p. 460.

Zonitoides (Ventricallus) demissus ssp? *brittsi* (Pilsbry), Reidel, 1980, Genera Zonitidarum, Backhuys, Rotterdam, p. 19.

Ventridens brittsi (Pilsbry), Dundee, 1955, Nautilus, 69: 17; Hubricht, 1985, p. 31; Turgeon et al., 1998, p. 148.

Ventridens ligera (Say 1821)
GLOBOSE DOME

Helix ligera Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 157.

Helix rafinesquia Férussac, 1821, Tableau Syst. No. 311, p. 46, (corrected to *Helix rafinesquea* on p. 68 (72), (nude name); 1832, Hist. Nat. Moll. Terr., pl. 51 A, fig. 5.

Helix wardiana Lea, 1836, Trans. Amer. Philos. Soc., 6: 67, pl. 23, fig. 82; Obs. Gen. Unio, 2: 67.

Zonites ligerus (Say), W. G. Binney, 1878, Terr. Moll. 5: 105, pl. 35, pl. ii, fig. M, (teeth); Sampson, 1885, Bull. Sedalia Nat. Hist., 1: 17.

Zonites ligerus var. *stonei* Pilsbry, 1889, Nautilus, 3: 46.

Zonites (Gastrodonta) ligerus var. *sagdinoides* Gratacap, 1901, Bull. Amer. Mus. Nat. Hist., 14: 344.

Gastrodonta ligera (Say), Walker, 1906, Ill. Cat. Moll. Mich., 1: 488; Walker, 1928, Terr. Moll. Alabama, p. 103; Sampson, 1913, Trans. St. Louis Acad. Sci, 22: 104.

Ventridens ligerus (Say), Brooks, 1935, Ann. Carnegie Mus., 24: 67; F. C. Baker, 1939, p. 81.

Ventridens ligera Pilsbry, 1946, p. 465, fig. 253; Burch, 1962, pp. 113, 196, fig. 276; Hubricht, 1985, p. 31; Turgeon et al., 1998, p. 149.

Zonitoides arboreus (Say 1816)
QUICK GLOSS

Helix arboreus Say, 1816, Nicholson's Amer. Edit. British Encycl., Vol. 2, art. Conchology, species No. 2, pl. 4, fig. 4.

Helix ottonis Pfeiffer, 1840, Arch. Naturg., 6: 251; Gould, 1851, Terr. Moll., 2: 238.

Helix breweri Newcomb, 1864, Proc. Cal. Acad. Sci., 3: 118; *cf* H. B. Baker, Occas. Pap. Mus. Zool. Univ. Mich., 269: 13.

Helix whitneyi Newcomb, 1864, Proc. Cal. Acad. Sci., 3: 118.

Hyalina breweri (Newcomb), W. G. Binney, 1869, Land & Freshwater Shells of North America, 1: 43, fig. 66.

Hyalina whitneyi (Newcomb), W. G. Binney, 1869, Land & Freshwater Shells of North America, 1: 32, fig. 37; H. B. Baker, 1931, Nautilus, 44: 98 (identical with *Z. arborea*); (Say), W. G. Binney, 1878, Terr. Moll., 5: 114, pl. 29, fig. 3, pl. iii, fig. F, (teeth).

Hyalina arborea var. *viridula* Cockerell, 1888, Science-Gossip. 24: 257.

Hyalina arborea (Say), Von Martens, 1892, Biol. Centrali-Amer. Moll., p. 116, pl. 6, figs. 13–13c.

Hyalinia (Polita) roseni Lindholm, 1911, Nachrbl. D. d. mal. Ges., 43: 98; (*cf.* Lindholm 1922).

Zonitoides arboreus (Say), J. Henderson, 1924, Univ. Colo. Studies, 13: 147; 1929, 17: 102; 1936, 23: 109, 258; Sterki, 1893, Proc. Acad. Nat. Sci. Phila., p. 394 (development of teeth); Chamberlin & Jones, 1929, Descr. Cat. Moll. Utah, p. 101; Bartsch &

Quick, 1926, Jour. Agric. Research, 32: 783–791, pls. 1–4 (anatomy); Bishop, Nautilus, 37: 70; Lindholm, 1922, Ann. Mus. Zool. Acad. Sci. Russie, 23: 307; H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 39, pl. 8, figs. 6–9; 1929; 81; 255, pl. 8, fig. 7 (anatomy); 1930, Occas. Pap. Mus. Zool. Univ. Mich., 220: 39; Connolly, Ann. S. Afr. Mus., 33: 173. Pilsbry, 1946, p. 480, figs. 261–262; Burch, 1962, pp. 117, 196, fig. 289; Hubricht, 1985, p. 32; H. B. Baker, Occas. Pap. Mus. Zool. Univ. Mich., 269: 13; Turgeon et al., 1998, p. 149.

Zonitoides kirbyi R. W. Fullington 1974
SHADOW GLOSS

Zonitoides kirbyi Fullington, 1974: 91; Hubricht, 1985, p. 32; Turgeon et al., 1998, p. 149; Gardner, 1986, p. 11

Zonitoides limatulus (A. Binney 1840)
DULL GLOSS

Helix limatula "Ward," A. Binney, 1840, Boston Jour. Nat. Hist., 3: 434, pl. 21, fig. 2; 1851, Terr. Moll., 2: 220, pl. 30, fig. 3.

Zonites limatulus (Ward), W. G. Binney, 1878, Terr. Moll., 5: 117, pl. ii, fig. N, (teeth).

Zonitoides limatula (Ward), Walker, 1906, Ill. Cat. Moll. Mich., p. 484, fig. 59.

Zonitoides limatulus ("Ward" A. Binney), F. C. Baker, 1939, p. 80; Pilsbry, 1946, p. 484, fig. 263; Burch, 1962, pp. 118, 196, fig. 292; Hubricht, 1985, p. 32; Turgeon et al., 1998, p. 149. (name attributed to Ward by A. Binney and many subsequent authors; however, the first description was provided by A. Binney in 1840).

Striatura meridonalis (Pilsbry & Ferriss 1906)
MEDIAN STRIATE

Vitrea milium meridonalis Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 152.

Zonitoides milium meridonalis (Pilsbry & Ferriss), Pilsbry & Ferriss, *ibid*., 1910, p. 130.

Radiodiscus orizabensis Pilsbry, 1921, Nautilus, 35: 49 (no description); *cf.* Nautilus, 39: 28.

Striatura (Pseudohyalina) meridonalis (Pilsbry & Ferriss), H. B. Baker, 1930, Occ. Pap. Mus. Zool, Univ. Mich., 220: 36, pl. 11, figs. 2, 4, 5.

Striatura meridonalis (Pilsbry & Ferriss), Pilsbry, 1946, p. 493, fig. 270; Burch, 1962, pp. 88, 196, fig. 198; Hubricht, 1985, p. 32; Turgeon et al., 1998, p. 148.

Clade Stylommatophora
"Limacoid Clade"
> Family Euconulidae H. B. Baker, 1928

Euconulus chersinus (Say 1821)
WILD HIVE

Helix chersina Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 156.

Euconulus chersinus (Say), Pilsbry, 1946, p. 239, figs. 119, a–b; Hubricht, 1985, p. 33; Burch, 1962, p. 103; Turgeon et al., 1998, p. 146.

Euconulus dentatus (Sterki 1893)
TOOTHED HIVE

Conulus fulvus Müller var. *dentatus* Sterki, 1893, Nautilus, 7: 4.

Euconulus chersinus dentatus (Sterki), Pilsbry, 1899, Nautilus, 12: 116, 131; Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 563; Walker, 1928, Terr. Moll. Alabama, p. 92. Pilsbry, 1946, p. 242, fig. 119 d–e.

Euconulus dentatus (Sterki), Hubricht, 1965b: 5; 1985: 33; Turgeon et al., 1998, p. 146.

Euconulus fulvus
(Müller 1774), New State Record
BROWN HIVE

Helix fulva Müller, 1774, Hist. Vermium, 2: 56; Draparnaud, 1801, Tabl. Moll. terr. et fluv. de la France, p. 72; 1805, Hist. Nat. Moll. de la France, p. 81, pl. 7, figs. 12, 13.

Helix egena Say, 1825, Jour. Acad. Nat. Sci. Phila., 5: 120.

Helix martoni Jeffreys, 1830, Trans. Linn. Soc., 16: 332.

Conulus chersina Say, Morse, 1864, Jour. Portland Soc. N. H., 1: 19, fig. 46. Not *Helix chersina* Say.

Conulus fabricii "Beck" Mörch, 1868, Amer. Jour. Conch., 4 : 29, pl. 3, fig. 5, not *Petasia fabricii* of Beck 1837.

Zonites (Conulus) fulvus (Müller), W. G. Binney, 1885, Man. Amer. Land Shells, p. 67.

Euconulus trochiformis Montagu, Dall, 1905, Harriman Alaska Exped. Mollusca, 13: 40.

Euconulus fulvus (Müller), Pilsbry, 1908, Nautilus, 22: 25; 1926, Nautilus, 40: 68; 1946, 2: 235; Pilsbry, 1946, p. 235; Burch, 1962, p. 102; Hubricht, 1985, p. 33; Turgeon et al., 1998, p. 146.

Euconulus trochulus (Reinhardt 1883)
SILK HIVE

Conulus trochulus Reinhardt, 1883, Sitzung-Ber. Ges. Nat. Freunde zu Berlin. Jahrg., 1883, p. 41.

Conulus chersinus trochulus (Reinhardt), Pilsbry, 1899, Nautilus, 12: 116.

Euconulus chersinus trochulus (Reinhardt), Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 153; Pilsbry, 1946, p. 241, fig. 119, f.

Euconulus trochulus (Reinhardt), Hubricht, 1983, Gastropodia, 2: 13; Hubricht, 1985, p. 33; Turgeon et al., 1998, p. 146.

Guppya sterkii (Dall 1888)
STERKI'S GRANULE

Hyalina sterkii Dall, 1888, Proc. U. S. Nat. Mus., 11: 214, figs 1–3.
Conulus sterkii (Dall), Sterki, 1893, Nautilus, 6: 106.
Zonites sterkii (Dall), W. G. Binney, 1890, 3rd Suppl., Mus. Comp. Zool. Bull., 19: 187, fig.; Vaughn, 1893, Nautilus, 6: 118.
Euconulus sterkii (Dall), Wheeler, 1912, Nautilus, 25: 125; Walker, 1928, Terr. Moll. Alabama, p. 94, fig. 129.
Guppya sterkii (Dall), Vanatta, 1920, Nautilus, 34: 28; H. B. Baker, 1922, Occas. Pap. Mus. Zool. Univ. Mich., 206: 46, pl. 17. fig. 2 (teeth); Pilsbry, 1946, p. 245, fig. 121; Burch, 1962, pp. 103, 195, fig. 245; Hubricht, 1985, p. 33; Turgeon et al., 1998, p. 146.

Clade Stylommatophora
"Limacoid Clade"
> Family Oxychilidae Hesse, 1927

Glyphyalinia indentata (Say 1823)
CARVED GLYPH

Helix indentata Say, 1823, Jour. Acad. Nat. Sci. Phila., 2: 372.
Zonites indentatus (Say), W. G. Binney, 1885, Man. Amer. Land Shells, p. 62, fig. 15.
Vitrea indentata (Say) of most American authors, 1900 to 1930.
Glyphyalinia indentata (Say), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 20, pl. 3, figs. 6–8, (anatomy); Zilch, 1959, Handb. Pälaozool. 6(2): 253; Burch, 1962, pp. 101, 194, figs. 238b, 239; Hubricht, 1985, p. 24; Turgeon et al., 1998, p. 146.
Retinella (Glyphyalinia) indentata (Say), H. B. Baker, 1930, Proc. Acad. Nat. Sci. Phila., 82: 209.
Retinella indentata (Say), Pilsbry, 1946, p. 288, fig. 146a.

Glyphyalinia lewisiana (G. H. Clapp 1908)
PALE GLYPH

Vitrea lewisiana G. H. Clapp, 1908, Nautilus, 21: 129, upper text figs.; Walker, 1928, Terr. Moll., Alabama, p. 75, fig. 104.
Retinella (Glyphyaloides) lewisiana (G. H. Clapp), H. B. Baker, 1930, Proc. Acad. Nat. Sci. Phila., 82; 207, pl. 11, figs. 4–5, (anatomy); Pilsbry, 1946, p. 279, fig. 140.
Glyphyalinia lewisiana (G. H. Clapp), Burch, 1962, pp. 99, 193, fig. 233; Hubricht, 1962, Sterkiana, 18: 3; Hubricht, 1985, p. 24; Turgeon et al., 1998, p. 146.

Glyphyalinia luticola Hubricht 1966
FURROWED GLYPH

Glyphyalinia luticola Hubricht, 1966, p. 54; 1985, p. 25; Turgeon et al., 1998, p. 146.

Glyphyalinia solida (H. B. Baker 1930)
IMPERFORATE GLYPH

Retinella cryptomphala solida H. B. Baker, 1930, Proc. Acad. Nat. Sci. Phila., 82: 213, pl. 13, figs. 1–8; Pilsbry, 1946, p. 298, figs. 149, 1–3, 4–8.
Glyphyalinia solida (H. B. Baker), Hubricht, 1964b, p. 7; 1965, p. 134; 1985, p. 24.

Glyphyalinia wheatleyi (Bland 1883)
BRIGHT GLYPH

Zonites wheatleyi Bland, 1883, Ann. New York Acad. Sci., 2: 368, fig. 1; W. G. Binney, 1885, Man. Amer. Land Shells, p. 222, fig. 237.
Vitrea wheatleyi (Bland), Walker, 1899, Ill. Cat. Moll. Michigan, p. 478.
Glyphyalinia burringtoni (Pilsbry), Zilch, 1959, Handb. Pälaozool., 6(2): 253; Hubricht, 1976, Nautilus, 90: 105.
Retinella (Glyphyalus) wheatleyi (Bland), H. B. Baker, 1930, Proc. Acad. Nat. Sci. Phila., 82: 204, pl. 10, figs. 1–8.
Retinella wheatleyi (Bland), Pilsbry, 1946, p. 272, figs., 134, 141 1–3.
Retinella burringtoni (Pilsbry), Pilsbry, 1946, p. 266.
Retinella circumstriata (Taylor), Pilsbry, 1946, p. 271.
Glyphyalinia circumstriata (Taylor), Hubricht, 1963, Sterkiana, 10: 2.
Retinella zikmundi Branson 1964, Proc. Okla. Acad. Sci. 44: 27; Hubricht, 1967, Nautilus, 81: 60.
Glyphyalinia wheatleyi (Bland), Burch, 1962, pp. 98, 193, fig. 230; Hubricht, 1964a: 12; 1976: 105; 1985: 23; Turgeon et al., 1998, p. 147.

Nesovitrea electrina (Gould 1841)
AMBER GLASS

Helix electrina Gould, 1841, Invert. Mass. p. 183, fig. 111; A. Binney, 1841, Jour. Bost. Soc. Nat. Hist., 3: 423, pl. 22, fig. 2.
Helix janus C. B. Adams, 1841, Amer. Jour. Sci., 40: 274 (as synonym of *H. electrina* Gould).
Zonites radiatulus Alder, var. *alba* Jeffreys, 1872, Ann. Mag. Nat. Hist. (4) 10: 245.
Zonites viridulus Mke., W. G. Binney, 1878, Terr. Moll., 5: 115, pl. 29 fig. 1.
Hyalina pellucida Lehnert, 1884, Sci. Rec. 2: 172.
Vitrea radiatula Alder, Dall, 1905, Harriman Alaska Exped., Mollusca, 13: 38.
Hyalinia radiatula electrina (Gould) Taylor, 1908, Monograph British Land and Freshwater Mollusca, 3: 97, fig. 139.
Vitrea hammonis (Ström), Pilsbry, Nautilus, 11: 129; 1902, Proc. Acad. Nat. Sci. Phila., p. 431, pl. 23, fig. 10–12.
Retinella electrina (Gould), Pilsbry, 1946, p. 256; Burch, 1962, p.101.
Nesovitrea hammonis electrina (Gould), Bequaert &

Miller, 1973, Moll. Arid Southwest, p. 145.
Nesovitrea electrina (Gould), Zilch, 1959, Handb. Paläozool., 6(2): 246; Hubricht, 1985, p. 23; Turgeon et al., 1998, p. 147.

Mesomphix capnodes (W. G. Binney 1857)
DUSKY BUTTON

Helix kopnodes W. G. Binney, 1857, Proc. Acad. Nat. Sci. Phila., p. 186; 1859, Terr. Moll., 4: 104, pl. 80, fig. 14.
Zonites capnodes W. G. Binney, 1874, Ann. Lyc. Nat. Hist. of N. Y. 11: 24; 1878, Terr. Moll., 5: 98, pl. 2, fig. K; (teeth); 1880, Ann. New York Acad. Sci., 1: 357, pl. 14, fig. C (genitalia); 1883, Bull. Mus. Comp. Zool., 11: 137, pl. 3 fig. C; 1885, Man. Amer. Land Shells, pp. 205, 476, figs. 215, 216.
Omphalina kopnodes (W. G. Binney), Pilsbry, 1911, Proc. Acad. Nat. Sci. Phila., p. 474, fig. 3, pl. 38, figs. 3–5 (teeth).
Mesomphix cupreus ozarkensis (Pilsbry & Ferriss), Pilsbry, 1946, p. 337; Hubricht, 1962, Sterkiana, 8: 2.
Mesomphix cupreus miktus Pilsbry, 1946, p. 339; Hubricht, 1965, Nautilus, 78: 134.
Mesomphix capnodes (W. G. Binney), Pilsbry, 1946, p. 339, fig. 176; Burch, 1962, pp. 91, 194, fig. 209; Hubricht, 1985, p. 26; Turgeon et al., 1998, p. 147.

Mesomphix friabilis (W. G. Binney 1857)
BRITTLE BUTTON

Helix friabilis W. G. Binney, 1857, Proc. Acad. Nat. Sci. Phila., p. 187; 1859, Terr. Moll., 4: 106. pl. 80, fig. 2; Bland, Ann. Lyc. Nat, Hist., of New York, 7: 129.
Zonites friabilis (W. G. Binney), W. G. Binney, 1878, Terr. Moll., 5: 101. fig. 21, pl. ii, fig. J, pl. xi, fig. D (anatomy); Sampson, 1893, Ann. Rep. Geol Surv. Arkansas for 1891, 2: 181; Singley, 1893, 4th Ann. Rep. Geol. Surv. Texas for 1892, p. 302.
Omphalina friabilis (W. G. Binney), Pilsbry, 1906, Proc. Acad. Nat. Sci. Phila., p. 563; 1911, p. 476, pl. 37, fig. 5, pl. 38, figs. 2, 4 (anatomy).
Mesomphix friabilis (W. G. Binney), F. C. Baker, 1939, p. 67; Pilsbry, 1946, p. 328; Burch, 1962, pp. 92, 194, fig. 212; Hubricht, 1985, p. 26; Turgeon et al., 1998, p. 147.

Mesomphix globosus (MacMillan 1940)
GLOBOSE BUTTON

Omphalina pilsbryi globosa MacMillan, 1940, Amer Midl. Nat., 23: 732, fig. 1.
Mesomphix pilsbryi globosus (MacMillan), Pilsbry, 1946, p. 343; Hubricht, 1962, Nautilus, 76: 6.
Mesomphix globosus (MacMillan), Hubricht, 1985, p. 25; Turgeon et al., 1998, p. 147.

Paravitrea capsella (Gould 1851)
DIMPLE SUPERCOIL

Helix rotula Gould 1848, Proc. Bos. Soc. Nat. Hist., 3: 38 (not Lowe 1833).
Helix capsella Gould 1851, in A. Binney's Terr. Moll., 2: 239, pl. 29a, fig. 1.
Zonites capsella (Gould), W. G. Binney, 1878, Terr. Moll., 5: 123, fig. 43; 1885, Man. Amer. Land Shells, p. 221.
Vitrea capsella (Gould), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., 55: 210; Walker, 1928, Terr. Moll. Ala., p. 86.
Paravitrea placentula (Shuttleworth), Hubricht, 1974: 34.
Paravitrea capsella (Gould), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 29, pl. 6, figs. 4–7; F. C. Baker, 1939, p. 73.; MacMillan, 1939, Nautilus, 53: 48; Pilsbry, 1946, 2: 374, figs. 195a–b; Burch, 1962, p. 110, fig. 268; Hubricht, 1985, p. 28; Turgeon et al., 1998, p. 147.

Paravitrea multidentata (A. Binney 1840)
DENTATE SUPERCOIL

Helix multidentata A. Binney 1840, Jour. Boston Soc. Nat. Hist., 3: 425, pl. 22, fig. 5; 1851, Terr. Moll., 2: 258, pl. 48, fig. 3.
Hyalina multidentata (A. Binney), Morse, 1864, Jour. Portland Soc. Nat. Hist. 1: 15, figs. 30, 31, pl. 6 fig. 32.
Zonites multidentatus (A. Binney), W. G. Binney, 1878, Terr. Moll, 5: 133, pl. 3, fig. N.
Gastrodonta multidentata umbilicaris Ancey, 1887, Conch. Exch., 1: 55.
Vitrea multidentata (A. Binney), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 208, pl.10, fig. 6; 1906, p. 560.
Vitrea (Paravitrea) multidentata (A. Binney), G. H. Clapp, 1920, Nautilus, 33: 115, pl. 3, figs. 2, 4, 6–12, 14, 16.
Paravitrea (Paravitreops) multidentata (A. Binney), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 31, pl. 6, figs. 1–3; 1931, same, Proc., 83: 100.
Paravitrea (Paravitreops) lamellidens (Pilsbry), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 31, pl. 4, figs. 9–10.
Paravitrea multidentata lamellata H. B. Baker, 1929, Nautilus, 42: 88.
Paravitrea (Paravitreops) multidentata lamellata H. B. Baker, 1931, Proc. Acad. Nat. Sci. Phila., 83: 100.
Gastrodonta multidentata (A. Binney), Latchford, 1935, Ottawa Field-Nat., 49: 60.
Paravitrea multidentata (A. Binney), Pilsbry, 1946, 2: 352, figs. 184(6, 6a), 185 (1, 4, 6, 8, 12, 14, 16); Hubricht, 1985, p. 26; Burch, 1962, p. 105, fig. 252: Turgeon et al., 1998, p. 148.

Paravitrea significans (Bland 1866)
DOMED SUPERCOIL

Helix significans Bland, 1866, Amer. Jour. Conch., 2: 372, pl. 21, fig. 9.

Zonites significans (Bland), W. G. Binney, 1878, Terr. Moll., 5: 132.
Vitrea significans (Bland), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 212, pl. 11, figs. 7, 8; F. C. Baker, 1912, Trans. Illinois Acad. Sci., 5: 145.
Paravitrea significans (Bland), H. B. Baker, 1931, Proc. Acad. Nat. Sci. Phila., 83: 106; F. C. Baker, 1939, p. 74 (text, figs.); Pilsbry, 1946, p. 380, fig. 190, 7–8a; Burch, 1962, pp. 109, 194, fig. 263; Hubricht, 1985, p. 28; Turgeon et al., 1998, p. 148.

Paravitrea simpsoni (Pilsbry 1889)
AMBER SUPERCOIL

Zonites simpsoni Pilsbry, 1889, Proc. Acad. Nat. Sci. Phila., 41: 412, pl. 12, figs. 8–10; W. G. Binney, 1892, 4th Suppl. Bull. Mus. Comp. Zool., 22: 168, pl. 1, fig. 8.
Vitrea simpsoni (Pilsbry), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 456; 1903, p. 212, pl. 11, figs. 6–6b; 1906, *ibid*. p. 560.
Paravitrea (Parmavitrea?) simpsoni (Pilsbry), H. B. Baker, 1931, Proc. Acad. Nat. Sci. Phila., 83: 109.
Paravitrea simpsoni (Pilsbry), Pilsbry, 1946, p. 383, fig. 196, 6–6b; Burch, 1962, pp. 109, 194, fig. 264; Hubricht, 1985, p. 29; Turgeon et al., 1998, p. 148.

Oxychilus cellarius (Müller 1774)
CELLAR GLASS-SNAIL

Helix cellaria Müller, 1774, Hist. Verm., 2: 28.
Helix glaphyra Say, 1816, Nicholson's Amer. Edit. British Encycl., art. Conchology, No. 5, pl. 1, fig. 3.
Zonites cellarius (Müller), Leidy, 1851, Terr. Moll., 1: 233, pl. 7 fig. 1; W. G. Binney, 1878, Terr. Moll., 5: 112, pl. 2, fig. G (teeth); 1885, Man. Amer. Land Shells, p. 448, figs. 493, 494.
Oxychilus pulchro-striatum MacMillan, 1940, Amer. Midland Nat., 23: 731, figs. 2–4.
Oxychilus cellarius (Müller), Ellis, 1926, British Snails, p. 245, pl. 12, figs. 10–12. Pilsbry, 1946, p. 249, fig. 123c; Burch, 1962, pp. 93, 195, fig. 215; Turgeon et al., 1998, p. 147.

Oxychilus draparnaudi
(Beck 1837), New State Record
DARK-BODIED GLASS-SNAIL

Helix lucida Draparnaud, 1801, Tabl. Des Moll. France, p. 96 (not *H. lucida* Pulteney, 1799).
Helix nitida Draparnaud, 1805, Hist. Nat. Moll. France, p. 117 (not *H. nitida* Müller, 1774).
Helicella draparnaldi Beck, 1837, Index Moll., p. 6 (substitute for *H. nitida* Draparnaud).
Hyalinia lucida (Draparnaud), Taylor, Mon. Brit. Land and Freshwater Moll., Zonitidae, p. 18, 456.
Vitrea draparnaldi (Beck), Soelner, 1902, Nautilus, 16: 94.
Polita draparnaldi (Beck), F. C. Baker, 1928, Nautilus, 42:59
Oxychilus lucidum (Draparnaud), F. C. Baker, 1939, p. 140, (text, fig).
Oxychilus draparnaldi (Beck), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 18 (anatomy); Pilsbry, 1946, p. 250, fig. 123 a; Burch, 1962, pp. 91, 93, 195, figs. 208, 216
Oxychilus draparnaudi (Beck), 1955, Turgeon et al., 1998, p. 147.
Opinion 336 of the International Commission on Zoological Nomenclature, (the specific name draparnaldi has been ruled an incorrect original spelling).

Clade Stylommatophora
"Limacoid Clade"
> Family Milacidae Ellis, 1926

Milax gagates
(Draparnaud 1801), New State Record
GREENHOUSE SLUG

Limax gagates Draparnaud, 1801, Tabl. Moll. France, p. 100; 1805, Hist. Moll. France, p. 122.
Limax (Amalia) hewstoni J. G. Cooper, 1872, Proc. Acad. Nat. Sci. Phila., p. 147, pl. 3, fig. B 1–5; W. G. Binney, 1874, Ann. Lyc. Nat. Hist. New York, 11: 22; 1878, Terr. Moll., 5: 150, pl. I, fig. J (teeth).
Amalia gagates var. *hewstoni* (J. G. Cooper), Cockerell, 1891, Ann. Mag. Nat. Hist., (6), 7: 337 (var. *plumbea*)
Milax hewstoni (J. G. Cooper), J. Henderson, 1929, Univ. Colo. Studies, 17: 107.
Milax gagates (Draparnaud), Lovett & Black, 1920, Oregon Agric. Coll. Exper. Sta. Bull. 170. p. 37, pl. 1, figs. A, D, pl. 2, fig. 2; H. Watson, 1930, Jour. Conch., 19: 72–83 (anatomy); G. D. Hanna, 1939, Bull. Dept. Agri. Cal., 28: 305; W. O. Gregg, 1944, Nautilus, 57: 113; Lange, 1944, Bull. So. Cal. Acad. Sci., 43: 40; Pilsbry, 1948, p. 563, figs. 301–302; Burch, 1962, pp. 81, 193, fig. 181; Turgeon et al., 1998, p. 149.

Clade Stylommatophora
"Limacoid Clade"
> Family Limacidae Lamarck, 1801

Limax maximus
Linnaeus 1758, New State Record
GIANT GARDENSLUG

Limax maximus Linnaeus, 1758, Syst. Nat., (10), 1: 652; W. G. Binney, 1878, Terr. Moll., 5:143, fig. 57; Pilsbry, 1948, p. 524, fig. 282; Burch, 1962, pp. 82, 193, fig. 183; Chichester & Getz, 1973, p, 34, fig. 6, a–b; Turgeon et al., 1998, p. 149.

Lehmannia valentiana
(Férussac 1823), New State Record
THREEBAND GARDENSLUG

Limax valentiana Férussac, 1823, Hist. Nat. Moll., Suppl. Fam. Limaces, p. 96.
Limax poirieri Mabille, 1883, Bull. Soc. Philom. Paris 7(7), p. 39–53; Walden, 1961, Arkiv Zoologi, (15) 3: 71–95.
Lehmannia poirieri (Mabille), Quick, 1960, Bull. Brit. Mus. Nat. Hist., 6(3): p. 197.
Lehmannia valentiana (Férussac), Chichester & Getz, 1973, p. 35–36, fig. 1u, fig. 2, E, fig. 6, d; Turgeon et al., 1998, p. 149.

Clade Stylommatophora
"Limacoid Clade"
> Family Agriolimacidae H. Wagner, 1935

Deroceras laeve (Müller 1774)
MEADOW SLUG

Limax laevis Müller, 1774, Verm. Terr. et. Fluv. Hist., 2: 2.
Limax gracilis Rafinesque, 1820, Ann. of Nat., 1: 10.
Limax campestris A. Binney, 1842, Proc. Bost. Soc. Nat. Hist., 1:52; 1842, Boston Jour. Nat. Hist., 4;169; 1851, Terr. Moll., 2: 41, pl. 64, fig. 3; Leidy, 1851 Terr. Moll., 1: 207, 218, pl. 2, figs. v, vi; W. G. Binney, 1878, Terr. Moll., 5: 149, pl. 1 fig. I (teeth); Sterki, 1893, Proc. Acad. Nat. Sci. Phila., p. 389, pl. 10, figs. i–v (development of radula).
Limax laevis var. *americana* Von Ihering, 1885, Nachrbl. D. Malak. Ges., 12: 217.
Limax weinlandi Heynemann, 1862, Zeits. f. Malak. 10: 212, pl. 3, fig. 1.
Limax (Eulimax) campestris var. *occidentalis* Cooper, 1872, Proc. Acad. Nat. Sci. Phila., p. 146, pl. 3, figs. c, 1–5; cf. W. G. Binney, Terr. Moll., 5: 150, pl. 1,fig. L; 3rd Suppl., Bull. Mus. Comp. Zool., 19: 206, pl. 8, fig. H (living animal).
Limax montanus Ingersoll, 1875, Bull. U. S. Geol. and Geogr. Surv. Terr. (2) No. 1: 130; W. G. Binney, 1878, Terr. Moll., 5: 152, pl. xii, fig. B (genitalia); (Not *Limax montanus* Leydig, 1871).
Limax castaneus Ingersoll, 1875, l. c., p. 131.
Limax ingersolli W. G. Binney, 1875, Proc. Acad. Nat. Sci. Phila., p. 176; ann. Lyc. Nat. Hist. New York, 10: 169.
Limax hyperboreus Westerlund, 1876, Nachrbl. d. Malak. Ges., 8: 97; 1877, K. Svenska Vet.-Akad. Handl., 14, No. 12, p. 21; W. G. Binney, 1885, Man. Amer. Land Shells, p. 473, fig. 516 (teeth); 1886, Second Suppl., Bull. Mus. Comp. Zool., 13: 42; 1890, same Bull., 19: 205, pl. 8, fig. F (teeth and whole animal).
Agriolimax montanus (Ingersoll), Cockerell, 1888, Jour. of Conch., 5: 358 (with forms *typicus*, *intermedius*, & *tristis*, p. 359).
Limax Hemphilli W. G. Binney, 1890, 3rd Suppl. Bull. Mus. Comp. Zoöl., 19: 205, pl. viii, fig. E; pl. I, fig. 13; pl. ii, fig. 3; 1892, Suppl. Bull. M.C.Z., 22: 166, pl. 3, fig. I (with var. *pictus*).
Agriolimax campestris var. *zonatipes* Cockerell, 1892, The Conchologist, 2: 72.
Agriolimax laevis campestris forma *nigrescens* Cockerell, 1893, The Conchologist, 2: 203.
Agriolimax berendti var. *pictus* Cockerell, 1897, Jour. of Malac., 6: 4.
Agriolimax campestris montanus formae *castaneus* Ingersoll, *typicus, intermedius, tristis* Cockerell, 1900, Nautilus, 3: 100.
Agriolimax campestris (A. Binney), Henderson, 1904, Univ. Colo. Studies, 4: 176; 1907, 13:150.
Agriolimax hyperbolus (Westerlund), Dall, 1905, Harriman Alaska Expedition, 13: 45.
Agriolimax campestris var. *plumbeus* Sterki, 1907, Proc. Ohio State Acad. Sci., 4: 375; Agriolimax hemphilli ashmuni Pilsbry & Vanatta, in Pilsbry & Ferriss, 1910, Proc. Acad. Nat. Sci. Phila., for 1909, 61: 512, fig. 11 a–c; Pilsbry & Ferriss, 1910, same Proc., 62: 130.
Deroceras laeve (Müller), H. B. Baker, 1930, Occas. Pap. Mus. Zool. Univ. Mich., No. 220: 41, pl. 11, figs. 1, 6, 7 (teeth and genitalia); Brooks, 1936, Ann. Carnegie Mus., 25: 92; Pilsbry, 1948, p. 539, figs. 289–291; Burch, 1962, pp. 83, 193, fig. 186; Chichester & Getz, 1973, pp. 36–37, fig. 8, a–b; Hubricht, 1985, p. 22; Turgeon et al., 1998, p. 149.

Deroceras reticulatum
(Müller 1774), New State Record
GRAY FIELDSLUG

Limax reticulatus Müller, 1774, Verm. Terr. et fluv. Hist., 2: 10.
Limax tunicata Gould, 1841, Invert. Mass., p. 3.
Limax agrestis Leidy, 1851, in A. Binney, Terr. Moll., 1:250, pl. 2, figs, 7–9 (anatomy); A. Binney, 1851, Terr. Moll., 2: 36, pl. 64, fig. 2; W. G. Binney, 1878, Terr. Moll., 5: 146 (not *Limax agrestis* Linnaeus, 1758, Syst. Nat., (10) p. 652, as restricted by Luther).
Agriolimax agrestis (Linnaeus), of most authors prior to Pilsbry, 1948 (incorrect identification)
Agriolimax reticulatus (Müller), Luther, 1915, Actes fauna et flora Fennica, 40, No. 2; Ingram, 1943, Nautilus, 55: 67.
Deroceras reticulatum (Müller), Pilsbry, 1948, p. 534, figs. 287–288; Burch, 1962, pp. 83, 193, fig. 185; Chichester & Getz, 1973, p. 37–38, fig. 7, a–d; Turgeon et al., 1998, p. 149.

Clade Stylommatophora
"Limacoid Clade"
> Family Vitrinidae Fitzinger, 1833

Hawaiia alachuana
(Dall 1885), New State Record
SOUTHEASTERN GEM

Zonites minusculus var. *alachuana* Dall, 1885, Proc. U. S. Nat. Mus., 8: 270.
Hawaiia minuscula alachuana (Dall), Pilsbry, 1946, p. 424, fig. 229, 4–6.
Helicodiscus jacksoni Hubricht, 1962, Nautilus, 75: 106.
Helicodiscus alachuana (Dall), Hubricht, 1978, Malacol. Rev. 10: 48.
Hawaiia alachuana (Dall), Hubricht, 1985, p. 29; Turgeon et al., 1998, p. 147.

Hawaiia minuscula (A. Binney 1840)
MINUTE GEM

Helix minuscula A. Binney, 1840, Boston Jour. Nat. Hist., 3: 435, pl. 22, fig. 4.
Helix lavalleana Orbigny, 1845, Hist. fis. polit. y nat. de la isla de Cuba, Moluscos, p. 84, French edit. p. 161, pl. 8, figs. 20–23.
Helix minutalis Morelet, 1851, Test. Noviss. 2: 7, (=*minuscula* according to Fischer & Crosse).
Helix kawaiensis Pfeiffer, 1855, Proc. Zool. Soc. London for 1854, p. 52.
Pseudohyalina minuscula (A. Binney), Morse, 1864, Jour. Portland Soc. Nat. Hist., 1:16, fig. 34, jaw; pl. 7, fig. 35, (teeth).
Zonites minusculus (A. Binney), W. G. Binney, 1878, Terr. Moll., 5: 118, pl. 17, fig. 2, pl. iii, fig. H, (teeth); Dall, 1885, Proc. U. S. Nat. Mus., 8: 270, (synonymy: distribution).
Chanomphalus minusculus (A. Binney), Strebel, 1880, Beitrag, etc., 4: 19, pl. 4, fig. 10.
Zonites minusculus var. *alachuana* Dall, 1885, Proc. U. S. Nat. Mus., 8: 270.
Zonitoides minusculus (A. Binney), Pilsbry, 1898, Nautilus, 11: 131; Walker, 1928, Terr. Moll. Alabama, p. 99; Dall, 1905, Harriman Alaska Expedition, 13:43; Henderson, 1924, Univ. Colo. Studies, 13: 148; Johnson, 1915, New England Fauna, Occas. Pap. Boston Soc. Nat. Hist., 7 (No. 13): 203.
Pseudovitrea minusculus alachuana (Dall), H. B. Baker, Proc. Acad. Nat. Sci. Phila., 81: 262, pl. 10, figs. 4–6.
Pseudohyalina kauaiensis (Pfeiffer), Sykes, 1900, Fauna Hawaiiaensis, 2: 279 (emendation).
Pseudovitrea minusculus minusculus (A. Binney), H. B. Baker, 1928, Proc. Acad. Nat. Sci. Phila., 80: 25, pl. 5, figs. 1–4; 1929, 81: 261, pl. 10, figs. 1–3.
Pseudovitrea minuscula permodesta (Strebel & Pfeiffer), H. B. Baker, 1929, Proc. Acad.;. Nat. Sci. Phila., 81: 262, pl. 10, figs. 10–12 (not Hyalinia permodesta Strebel & Pfeiffer, 1884).
Hawaiia minuscula (A. Binney), H. B. Baker, 1941, B. P. Bishop Mus. Bull., 166: 322, pl. 61, figs, 13–15; A. J. Peile, 1936, Jour. of Conch., 20: 281 (synonymy); Pilsbry, 1946, p. 420, figs. 228 a, b; 229, 1–3; Burch, 1962, pp. 106, 195, fig. 245; Hubricht, 1985, p. 29; Turgeon et al., 1998, p. 147.

Clade Stylommatophora
"Limacoid Clade"
> Family Arionidae Gray, 1840

Arion hortensis Férussac 1819,
New State Record
BLACK FIELD SLUG

Arion hortensis Férussac. 1819, Hist. Nat. Moll., 2: 65. Sharff, 1891, Trans. Roy. Dublin Soc., (2), 4: 545; Pilsbry & Vanatta, 1898, Proc. Acad. Nat. Sci. Phila., p. 239, pl. 14, fig. 72, Pl. 15, figs. 79, 82–83; Taylor, 1905, Monograph, 2: 210, 288; Vanatta, 1927, Nautilus, 40: 113; Lange, 1944, Bull. So. Cal. Acad. Sci., 43: 36; Pilsbry, 1948, p. 671, figs. 364 b, d, f, 366; Turgeon et al., 1998, p. 144.
Arion rubellus Sterki, 1911, Nautilus, 25: 64.

Arion intermedius (Normand 1852),
New State Record
HEDGEHOG ARION

Limax intermedius Normand, 1852, Descr. six. limaces nouv., p. 6.
Arion minimus Simroth, 1885, Z. Wiss. Zool., 42 (2), p. 237.
Arion intermedius (Normand), Taylor, 1907, Mon. Moll. Brit. Isles, (Testacellidae, Limacidae, Arionidae), p. 240; Hesse, 1926, Abh. Archiv. f. Mollusk, 2: 66. 128; Pilsbry, 1948, p. 676, fig. 367, b; Burch, 1962, pp. 73, 192, fig. 153; Chichester & Getz, 1973, p. 22–23, figs. 2 F, 5 c ; Turgeon et al., 1998, p. 144.

Arion subfuscus (Draparnaud 1805),
New State Record
DUSKY ARION

Limax subfuscus Draparnaud, 1805, Hist. Moll. France, p. 125, pl. 9, fig. 8.
Arion hortensis Férussac, A. Binney, 1851, Terr. Moll. 2: 27. pl. 64, fig. 1; Leidy, *ibid*. 1: 209, 220, 236, pl. 2, figs. 1–4.
Arion fuscus Müller, W. G. Binney, 1878, Terr. Moll. 5: 224, pl. v, fig. c, (teeth).
Arion subfuscus (Draparnaud), Scharff, 1891, Trans. Roy. Dublin Soc., 4: 542; Taylor, Mon. Brit., etc., 2: 193; Cockerell, 1905, Nautilus, 19: 84. Pilsbry, 1948, p. 670, fig. 346 i; Burch, 1962, pp. 74, 192, fig. 156; Chichester & Getz, 1973, p. 18–22, fig. 2 G, figs. 3 a–d; Turgeon et al., 1998, p. 144.

Clade Stylommatophora
"Limacoid Clade"
> Family Philomycidae Gray, 1847

Megapallifera mutabilis (Hubricht 1951)
CHANGEABLE MANTLESLUG

Eumelus lividus Rafinesque, Webb, 1950, Trans. Amer. Microscop. Soc., 69: 56.
Pallifera mutabilis Hubricht, 1951a: 57.
Megapallifera mutabilis (Hubricht), Hubricht, 1976, Nautilus, 90(3): 106; Burch, 1962, pp. 79, 192, fig. 173; Hubricht, 1985, p. 17; Fairbanks, 1990; Turgeon et al., 1998, p. 144.

Megapallifera ragsdalei (Webb 1950)
OZARK MANTLESLUG

Eumelus wetherbyi ragsdalei Webb, 1950: 62.
Pallifera ragsdalei (Webb), Hubricht, 1956, Nautilus, 69: 126.
Pallifera mutabilis Hubricht, Branson, 1962, Trans. Kans. Acad. Sci., 65: 114.
Megapallifera ragsdalei (Webb), Hubricht, 1976, Nautilus, 90: 106; Hubricht, 1985, p. 17; Fairbanks, 1990; Turgeon et al., 1998, p. 144.

Pallifera fosteri F. C. Baker 1939
FOSTER MANTLESLUG

Pallifera fosteri F. C. Baker, 1939, p. 133; Pilsbry, 1948, p. 768; Burch, 1962, p. 71; Hubricht, 1985, p. 18. Turgeon et al., 1998, p. 144.
Pallifera fosteri oughtoni Webb, 1952, Gastropodia, 1: 6.
Pallifera megaphallica Grimm, 1961, Nautilus 74: 104; Hubricht, 1974: 33.

Pallifera marmorea Pilsbry 1948
MARBLED MANTLESLUG

Pallifera hemphilli marmorea Pilsbry, 1948, p. 766, fig. 410.
Pallifera marmorea Hubricht, 1956, Nautilus, Vol. 69, p. 125; Hubricht, 1985, p. 17; Turgeon et al., 1998, p. 144.

Philomycus carolinianus (Bosc 1802)
CAROLINA MANTLESLUG

Limax carolinianus Bosc, 1802, Hist. Nat. Vers., 1: 80, pl. 3, fig. 1.
Limax caroliniensis (Bosc), Férussac, Historie, p. 77, pl. 6, fig. 3.
Limacella lactiformis Blainville, 1817, Jour. de Phys., 85: 444, pl. 2, fig. V; Cockerell, 1890, Ann. Mag. Nat. Hist., (6) 6: 380; Nautilus 5: 5; Pilsbry & Cockerell. 1899, Nautilus 13: 24.
Limacella lactescens Férussac, Historie, pl. 7, fig. 1.
Limacella elfortiana Blainville, 1825, Man. De Malac., p. 464.
Limax marmoreus De Kay, 1840, Cat. Anim. New York, p. 31. (Nude name).
Limax togata Gould, 1841, Invert. of Mass., p. 3.
Tebennophorus caroliniensis A. Binney, 1842, Bost. Jour. Nat. Hist., 4: 171; 1851, Terr. Moll., 2; 220, pl. 63, figs. 1 & 2; W. G. Binney, Terr. Moll., 5: 181; Wyman, Boston Jour. Nat. Hist., 4: 410; Leidy, Terr. Moll., 1: 220, 236, 250, pl. 3 (anatomy) (and of many other authors).
Limacella nebulosa Cockerell, 1890, Ann. Mag. Nat. Hist. (6 ser), 6: 382; 1891 Nautilus, 5: 6 (based upon A. Binney, 1851, p. 20, and ? =Eumelus nebulosus Rafinesque, 1820, Ann. Nat., p. 10.)
Philomycus biseriatus Sterki, 1908, The Ohio Nat., 8: 266; 1920, Nautilus, 33; 81.
Eumelus nebulosus Rafinesque, Pilsbry, 1948, p. 770: Hubricht, 1952, Nautilus, 66: 46.
Eumelus lividus Rafinesque, Pilsbry, 1948, 2: 770; Hubricht, 1952, Nautilus, 66: 47.
Philomycus quadrilus Rafinesque, Pilsbry, 1948, p. 770; Hubricht, 1952, Nautilus, 66: 46.
Philomycus batchi Branson, 1968, Nautilus, 81: 129; Hubricht, 1974: 33.
Philomycus carolinianus (Bosc), W. F. Clapp, Nautilus, 33: 83, figs. 1–3. Pilsbry, 1948, p. 753, fig. 404; Chichester & Getz, 1973, p. 32–33, fig. 5 d; Burch, 1962, pp. 71, 191, fig. 150; Hubricht, 1985, p. 16; Turgeon et al., 1998, p. 145.

Clade Stylommatophora
"Limacoid Clade"
> Family Polygyridae Pilsbry, 1895

Daedalochila deltoidea (Simpson 1889)
OKLAHOMA LIPTOOTH

Helix (Polygyra) jacksoni var. *deltoidea* Simpson, 1889, Proc. U. S. Nat. Mus., 11: 450.
Polygyra jacksoni deltoidea (Simpson), Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906, p. 539, pl. 20, figs. 6, 7; Pilsbry, 1940, p. 632.
Polygyra jacksoni simpsoni (Pilsbry), Branson, 1962, Proc. Okla. Acad. Sci., 42: 69.
Polygyra deltoidea (Simpson), Branson, 1962, Sterkiana, 7: 5; Hubricht, 1985, p. 38.
Millerelix deltoidea (Simpson), Emberton, 1995, p. 91; Turgeon et al., 1998, p. 152.

Daedalochila dorfeuilliana (I. Lea 1838)
OAKWOOD LIPTOOTH

Polygyra dorfeuilliana I. Lea, 1838, Trans. Amer. Philos. Soc., 6: 107, pl. 24, fig. 118; W. G. Binney, 1878, Terr. Moll., 5: 278, fig. 178, Pl. vi, fig. I (teeth); 1885, Man. Am. Land Shells, p. 374, with var. *sampsoni*, p. 375; F. A. Sampson, 1893, Nautilus, 7: 34; 1894, 8: 18; 1912, 26: 91–92; 1893, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 185, with var. sampsoni; 1913, Trans. St. Louis Acad. Sci., 22: 99;

F. C. Baker, 1898, Nautilus, 12: 36; 1933, Nautilus, 47: 4–7; Ferriss, 1900, Nautilus, 14: 28, with var. *percostata* and *sampsoni*; Strecker, 1908, Nautilus, 22: 65, with *P. d. sampsoni*; 1910. Nautilus, 24: 5; Hanna, 1909, Nautilus, 23: 82; Wheeler, 1918, Nautilus, 31: 115; Walker, 1928, Terr. Moll. Alabama, p. 19, fig. 21; Pilsbry, 1940, p. 634, fig. 398, (upper four Fig.s); Burch, 1962, pp. 153, 198, fig. 379; Hubricht, 1985, p. 39.

Helix dorfeuilliana (I. Lea), Bland, 1858, Ann. Lyc. Nat. Hist. New York, 6: 294, pl. 9, figs. 24–26; Sargent, 1892, Nautilus, 6: 77.

Polygyra sampsoni Wetherby, 1881, Jour. Cincinnati Soc. Nat. Hist., 4: 332.

Polygyra dorfeuilliana percostata Pilsbry, 1899, Nautilus, 13: 37; 1907, Proc, Acad. Nat. Sci. Phila., p. 538, pl. 20, fig. 23.

Polygyra dorfeuilliana perstriata Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906, p. 538, pl. 20, figs. 20, 21, 24.

Polygyra dorfeuilliana sampsoni (Wetherby), Pilsbry, 1940, p. 636, fig. 398 (lower line left and middle Fig.s).

Millerelix dorfeuilliana (I. Lea) Emberton, 1995, Malacologia, 37 (1), p. 91, fig. 5 (lower reproductive tract anatomy); Turgeon et al., 1998, p. 152.

Daedalochila dorfeuilliana (I. Lea) Coles & Walsh, 2006, Amer. Malacological Bull., 21(1–2): p. 109, figs. 35–36.

Daedalochila dorfeuilliana sampsoni (Wetherby), Coles & Walsh, 2006, Amer. Malacological Bull., 21(1–2): 109.

Daedalochila jacksoni (Bland 1866)
OZARK LIPTOOTH

Helix jacksoni Bland, 1866, Amer. Jour. Conch., 2: 371, pl. 21, fig. 8.

Polygyra jacksoni (Bland), W. G. Binney, 1878, Terr. Moll., 5: 275, fig. 174; F. A. Sampson, 1893, Nautilus 7: 34; (and many other articles, 1883, 1887, 1893, 1894, 1911, 1913); Ferriss, 1900, Nautilus, 14: 28; Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 196; Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906, p. 538, pl. 20, figs. 1–5; Pilsbry, 1940, p. 631, fig. 397, 10, 11; Burch, 1962, p. 152, fig. 374; Hubricht, 1985, p. 38.

Helix (Polygyra) jacksoni (Bland), Simpson, 1889, Proc. U. S. Nat. Mus., 11: 449.

Millerelix jacksoni (Bland), Emberton, 1995, Malacologia, 37(1), p. 91; Turgeon et al., 1998, p. 152.

Daedalochila jacksoni (Bland), Coles & Walsh, 2006, Amer. Malacological Bull., 21(1–2): p. 107, figs. 29–30 (genitalia).

Daedalochila leporina (Gould 1848)
GULFCOAST LIPTOOTH

Helix leporina Gould, 1848, Proc. Bost. Soc. Nat. Hist., 3: 39; A. Binney, 1851, Terr. Moll., 2: 199, pl. 40a, fig. 1; Bland, 1858, Ann. Lyc. Nat. Hist., New York, 6: 348; Simpson, 1888, Proc. U. S. Nat. Mus., 11; 450; Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 306. (Gould), W. G. Binney, 1878, Terr. Moll., 5: 288, pl. vi, fig. F, (teeth); Sampson, 1893, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 186; 1913, Trans. St. Louis Acad. Sci., 22; 89; Hinkley, 1906, Nautilus, 20: 34; Walker, 1928, Terr. Moll. Alabama, p. 16, fig. 19; F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 114; Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 449; 1903, p. 195; Pleas, 1893, Nautilus, 7: 68; Daniels, 24th Ann. Rep. State Geol. Indiana, p. 579; Strecker, 1910, Nautilus, 24: 5; Pilsbry, 1940, p. 611, fig. 391; Burch, 1962, p. 154, fig. 381; Hubricht, 1985, p. 38.

Lobosculum leporinum (Gould), Hubricht, 1938, Missouri Botanical Garden Bull., 26: 56.

Daedalochila leporina (Gould), Emberton, 1995, Malacologia, 37 (1), p. 91; Turgeon et al., 1998, p. 151.

Daedalochila lithica (Hubricht 1961)
STONE LIPTOOTH

Polygyra lithica Hubricht, 1961, Nautilus, 75: 28; 1985, p. 39.

Millerelix lithica (Hubricht), Emberton, 1995, p. 91;Turgeon et al., 1998, p. 152

Daedalochila lithica (Hubricht), Coles and Walsh, 2006, pp. 99–112.

Daedalochila simpsoni (Pilsbry & Ferriss 1907)
WYANDOTTE LIPTOOTH

Polygyra jacksoni simpsoni Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906, p. 539, pl. 20, figs. 8–11; Pilsbry, 1940, p. 633, fig. 397 (14, 15).

Polygyra simpsoni (Pilsbry & Ferriss), Hubricht, 1985, p. 38;

Millerelix simpsoni (Pilsbry & Ferriss), Emberton 1995a, p. 91;Turgeon et al., 1998, p. 152.

Daedalochila simpsoni (Pilsbry & Ferriss), Coles & Walsh. 2006, p. 100.

Linisa texasiana (Moricand 1833)
TEXAS LIPTOOTH

Helix (Helicodonta) texasiana Moricand, 1833, Mém. Soc. Phys. et Hist. Nat. de Génève, 6: 538, pl. 1, fig. 2.

Triodopsis tridonta "Chr. et J.", Beck, 1837, Index Moll., p. 32 new name for texasiana Moric. and plicata Say; restricted to the former by Pilsbry, 1940, p. 617.

Helix texasiana Moricand, A. Binney, 1851 Terr. Moll., 2: 1991, pl. 45, fig. 1; W. G. Binney, 1869, L. & Fr.

W. Sh. N. A. 1: 93; Roemer, 1859, Texas, p. 455; Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 306; Auclair, 1889, Revue Sci. du Bourbonnais et du Centre France, 2: 86.

Polygyra texasiana (Moricand), W. G. Binney, 1878, Terr. Moll. 5: 270, pl. vi, fig. G (teeth); Von Martens, 1892, Biol. Centr-Amer. Moll., p. 170; Pilsbry & Ferriss, 1896, Proc. Acad. Nat. Sci. Phila., p. 534; 1906, *ibid*, p. 128, pl. 5, figs. 16, 17, 20; Crandall, 1893, Nautilus, 6: 103, (Belton, Texas, subfossil); Ferriss, 1900, Nautilus, 14: 28 (Ark); 1906, 20: 17, (Oklahoma City); Strecker, 1908, Nautilus, 22: 65; *Ibid*, 24: 4,5; Greger, 1915, Nautilus, 29: 89; B. Walker, 1815, Occ. Pap. Mus. Zool. Univ. Mich., No. 15, pp. 6–8.

Polygyra texasiana tillandsiae Cockerell, 1917, Nautilus, 21: 36.

Polygyra texasiana (Moricand), Pilsbry, 1940, p. 617; Hubricht, 1985 p. 37.

Polygyra rexroadensis Taylor, 1960, U. S. Geol. Surv. Prof. Paper, 337: 82; Hubricht, 1974: 34.

Polygyra tamaulipasensis Lea, Branson, 1962, Proc. Okla. Acad. Sci., 42: 67.

Polygyra scintilla Pilsbry & Hubricht, Branson, 1962, Proc. Okla. Acad. Sci., 42: 67.

Polygyra polita Pilsbry & Hinkley, Branson, 1962, Proc. Okla. Acad. Sci., 42: 67.

Polygyra triodontoides (Bland), Branson, 1962, Proc. Okla. Acad. Sci., 42: 67.

Linisa texasiana (Moricand), Emberton, 1995, p. 90; Turgeon et al., 1998, p. 151

Stenotrema barbatum (G. H. Clapp 1904)
BRISTLED SLITMOUTH

Polygyra (Stenotrema) barbata G. H. Clapp, 1904, Nautilus, 18: 85; Walker, Terr. Moll. Alabama, p. 50, fig. 59.

Stenotrema hirsutum barbatum (G. H. Clapp), Pilsbry, 1940, p. 665.

Stenotrema hirsutum Burch, 1962, p. 147, fig. 360.

Stenotrema barbatum (G. H. Clapp), Archer, 1948, Geol. Surv. Ala. Misc. Paper. 28: 30; Hubricht, 1985, p. 40; Turgeon et al., 1998, p. 153.

Stenotrema blandianum (Pilsbry 1903)
MISSOURI SLITMOUTH

Polygyra blandianum Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 203, pl. 9, figs. 11–13; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 98.

Stenotrema blandianum (Pilsbry) Pilsbry, 1940, p. 669, fig. 416; Burch, 1962, pp. 143, 199, fig. 347; Hubricht, 1985, p. 40; Turgeon et al., 1998, p. 153.

Stenotrema labrosum (Bland 1862)
OZARK SLITMOUTH

Helix labrosa Bland, 1862, Ann. Lyc. Nat. Hist. New York, 7: 430, pl. 4, fig. 19.

Stenotrema labrosa (Bland), Tryon, 1867, Amer. Jour. Conch., 3: 59; W. G. Binney, 1878, Terr. Moll., 5: 292, fig. 19; Sampson, 1893, Ann. Rep. Geol. Surv. Ark., 2: 186; 1893, Nautilus, 7: 34; 8: 19;

Polygyra labrosa (Bland), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 202, pl. 9, figs. 4–6; Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 540; Sampson, 1911, Nautilus, 25: 40; Walker, 1928, Terr. Moll. Alabama, p. 46, fig. 54.

Polygyra labrosa fimbriata Clapp, 1917, Nautilus, 30: 139.

Stenotrema glassi Branson, 1964, Nautilus, 66: 100; Hubricht, 1974: 34.

Stenotrema labrosum (Bland), Pilsbry, 1940, p. 650, fig. 406, 4–6; Burch, 1962, pp. 143, 199, fig. 337; Hubricht, 1985, p. 39; Turgeon et al., 1998, p. 153.

Stenotrema stenotrema (Pfeiffer 1842)
INLAND SLITMOUTH

Stenotrema convexa Rafinesque, 1819, Jour. de Phys., Chim., d'Hist. Nat., 85: 425, in Binney & Tryon, Complete Writings of C. S. Rafinesque, p. 28 (not defined).

Helix hirsuta var. *α Stenotrema convexa* (Rafinesque), Férussac, 1821, Tabl. Syst. Fam. Limacons, No. 101, p. 34 (nude name).

Stenostoma convexa Rafinesque, 1831, Enum. and Account, etc., p. 2; Binney & Tryon, Complete Writings, p. 67 {Not *Helix convexa* (Rafinesque)}; Deshayes, 1830, Encycl. Méth., 2: 253 (=*H. fraterna* Say); cf. Pilsbry, 1930, Proc. Acad. Nat. Sci. Phila., 82: 325–6 (footnotes).

Helix stenotrema (Férussac) Mus., Pfeiffer, 1842, Symbolae ad Hist. Hel., 2: 39; Bland, 1864, Ann. Lyc. Nat. Hist. New York, 7: 427; Harper & Wetherby, 1872, Land & Freshwater Shells, p. 2; Wetherby, 1881, Jour. Cincin. Soc. Nat. Hist., 3: 34, 4: 32.

Helix hirsuta varietät, Helix stenotrema (Férussac) Mus., Pfeiffer, 1846, Syst. Conchyl. Cab., Helix, 1: 375, pl. 65, figs. 12–14.

Stenotrema stenotremum (Férussac), W. G. Binney, 1878, Terr. Moll., 5: 295, pl. viii, fig. E, (teeth); Sampson, 1893, Nautilus, 7: 34; 1893, Ann. Rep. Geol. Surv. Ark., 2: 186; Call, 1900, Indiana Geol. Surv. Rep. for 1899, p. 383, pl. 5, fig. 6.

Polygyra stenotrema nuda Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 129.

Polygyra stenotrema (Férussac), Daniels, 1903, 27th Ann. Rep. Dept. Geol. and Nat. Resources Ind. p. 630; Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., 540; F. C. Baker, 1906, Ill. State Lab. Nat. Hist., 7: 117; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 97; Walker, 1928, Terr. Moll. Alabama,

Polygyra stenotrema seminuda Clapp, 1904, Nautilus, 18: 86.

Polygyra (Stenotrema) voluminosa Clench & Banks, 1932, Nautilus, 46: 16, pl. 2 figs. 6–7.

Stenotrema stenotrema (Pfeiffer), Pilsbry, 1940, p. 655, fig. 409, a–e; Burch, 1962, pp. 143, 199, fig. 347; Burch, 1962, pp. 143, 146, 199, figs. 349, 358; Hubricht, 1985, p. 40; (species name S. stenotrema was attributed to Férussac by many authors prior to Pilsbry, 1940, however, first description was published by Pfeiffer in 1842); Turgeon et al., 1998, p. 153.

Euchemotrema fraternum (Say 1824)
UPLAND PILLSNAIL

Helix fraterna Say, 1824, App. Maj. Long's Expedition to St. Peters River, p. 257, pl. 15, fig. 3.
Helix convexa (Rafinesque), Deshayes, 1830, Encycl. Méth., 2: 253.
Helix monodon of many authors, not of Rackett.
Stenotrema monodon (Rackett), W. G. Binney, 1878, Terr. Moll., 5: 298, pl. 41, upper figs. pl. xi, fig. L, (genitalia), pl. vii, fig. H, (teeth). S. monodon and Helix monodon of many authors were incorrectly identified; *S. monodon* is a distinct species, now considered synonymous with *E. leai leai* A. Binney, 1840).
Polygyra monodon fraterna (Say), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 454; Walker, 1928, Terr. Moll. Alabama, p. 57.
Polygyra fraterna (Say), Walker, 1906, Ill. Cat. Moll. Mich., 1: 470, fig. 23.
Polygyra fraterna var. *albida* Walker, 1906, Ill. Cat. Moll. Mich., 1: 471.
Stenotrema fraternum (Say) Pilsbry, 1940, p. 681, fig. 422, a; Burch, 1962, pp. 141, 169, figs. 341, 427.
Stenotrema fraternum fraternum Hubricht, 1985, p. 41.
Euchemotrema fraternum (Say), Emberton, 1995, Malacologia, 37(1), p. 88; Turgeon et al., 1998, p. 151.

Euchemotrema hubrichti (Pilsbry 1940)
CARINATE PILLSNAIL

Stenotrema hubrichti Pilsbry, 1940, p. 687; Hubricht, 1985, p. 41.
Euchemotrema hubrichti (Pilsbry), Emberton, 1995, p. 88; Turgeon et al., 1998, p. 151.

Euchemotrema leai aliciae (Pilsbry 1893)
ALICE'S PILLSNAIL

Helix monodon var. *aliciae* Pilsbry, 1893, Man. Conch. 8: 152.
Polygyra monodon friersoni Pilsbry, 1899, Nautilus, 13: 36; 1900, Proc. Acad. Nat. Sci. Phila., p. 454; Ferriss, 1900, Nautilus, 14: 30; Clench, 1925, Nautilus, 39: 12.
Polygyra monodon aliciae (Pilsbry), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 455, 1894, Man. Conch., 9: 78, pl. 3, figs. 22–24; Ferriss, 1900, Nautilus, 14: 30; Walker, 1928, Terr. Moll. Alabama, p. 56, fig. 66.
Polygyra fraterna friersoni (Pilsbry), Pilsbry & Ferriss, 1906, Proc. Acad. Nat. Sci. Phila., p. 542; Strecker, 1910, Nautilus, 24: 5.
Polygyra fraterna aliciae (Pilsbry), Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., 1906, p. 542; Vanatta, 1926, Nautilus, 40: 16.
Stenotrema monodon aliciae (Pilsbry), Pilsbry, 1940, p. 679, fig. 421, c.
Stenotrema leai aliciae (Pilsbry), Hubricht, 1985, p. 41.
Euchemotrema leai aliciae (Pilsbry), Emberton, 1995, Malacologia, 37 (1), p. 88.

Euchemotrema leai leai (A. Binney, 1840)
LOWLAND PILLSNAIL

Helix monodon Rackett, 1821, Trans. Linn. Soc. London, 13: 42, pl. 5, Fig. 2.
Helix leai "Ward. Ms", A. Binney, 1840, Boston Jour. Nat. Hist., 3: 362; 1851, Terr. Moll., 2: 149, pl. 41, Figs. 4-9.
Polygyra monodon (Rackett), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 454; Dall, Alaska Land & Freshwater Moll., p. 26; Walker, 1906, Ill. Cat. Moll. Mich., 1; 471, Fig. 24.
Stenotrema monodon var. *leaii* (Ward), W. G. Binney, 1878, Terr. Moll., 5: 299, pl. 41, middle Fig.s.
Polygyra monodon peoriensis F. C. Baker, 1927, Nautilus, 40: 115; 1928, Trans. Illinois State Acad. Sci., 20: 271-292.
Stenotrema monodon (Rackett), Pilsbry, 1940, p. 676, Fig. 421, a-b.
Stenotrema leai (A. Binney), Burch, 1962, pp. 140, 169, 199, Fig. 340, 426; Hubricht, 1985, p. 41.
Euchemotrema leai (A. Binney), Emberton, 1995, Malacologia, 37(1), p. 88; Turgeon, et al., 1998, p. 151.

Mesodon clausus (Say 1821)
YELLOW GLOBELET

Helix clausa Say, 1821, Jour. Acad. Nat, Sci. Phila., 2: 154; 1832, Amer. Conch., pl. 37, fig. 1; A. Binney, 1851, Terr. Moll., 2: 107; Bland, 1858, Ann. Lyc. Nat. Hist. New York, 6: 336; Shuttleworth, (text by Fischer), 1877, Notitiae Malac., 2: 10, pl. 3, fig. 1, (with var. *subalbolabris*, pl. 3 fig. 2.
Triodopsis thyroidus edentula Beck, 1837, Index Moll., p. 23.
Helix jugallsiana Shuttleworth, von Martens, 1860, in Albers, Die Heliceen, p. 99 (nude name).
Helix ingallsiana Shuttleworth, 1877, Notitiae Malac., 2: 10, pl. 3, fig. 5.
Mesodon clausa (Say), W. G. Binney, 1878, Terr. Moll., 5: 332; Sampson, 1894, Ann. Rep. State Geol. Surv. Ark. for 1891, 2: 192; Call, 1900, Indiana Dept. Geol. & Nat. Res., 24th Ann. Rep., p. 392.
Polygyra clausa (Say), Sargent, Nautilus, 9: 89; Pilsbry, 1898, Nautilus, 11: 95; Ferriss, Nautilus, 14: 31, 55;

Greger, Nautilus, 30: 64, Sampson, 1913, trans. St. Louis Acad. Sci., 22: 96; Nautilus, 26; 91, 93; 28: 16; Hanna, Nautilus, 23: 82; Price, Nautilus, 14: 75; Walker, 1906, Ill. Cat. Moll. Mich., p. 469; 1928, Terr. Moll. Alabama, p. 42; 1902, Proc. Acad. Nat. Sci. Phila., p. 427; Wheeler, Nautilus, 31: 116.

Mesodon clausus (Say), Pilsbry, 1940, p. 712, fig. 434, a–b; Burch, 1962, pp. 176, 199, fig. 442; Hubricht, 1985, p. 45; Turgeon et al., 1998, p. 151.

Mesodon elevatus (Say 1821)
PROUD GLOBE

Helix elevatus Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 154; 1832 Amer. Conch., pl. 37, fig. 2; A. Binney, 1851, Terr. Moll., 2: 126, pl. 9; Leidy, 1851, Terr. Moll., 1: 256, pl. 10, figs. 4, 5 (anatomy); H. Smith, Nautilus, 10: 84; W. G. Binney, 1857, Proc. Acad. Nat. Sci. Phila., p. 192.

Helix knoxvillina Férussac, 1821, Tabl. Syst. Fam. Limacons, p. 33, No. 94 (nude name), (*Mesodon helicinum* Rafinesque cited as a synonym); 1822, Hist. Nat. Moll. Terr. et Fluv., Expl. Pl., p. iii, pl. 49, figs. 5, 6.

Helix tennesseensis Lea, 1841, Proc. Amer. Phil. Soc., 2: 31; Trans. Amer. Phil. Soc., 9: 1.

Helix elevata Say, Shuttleworth, 1877, Notitiae Malac., 2: 11, pl. 13, fig. 2.

Mesodon elevata (Say), W. G. Binney, 1878, Terr. Moll., 5: 324, pl. 9; pl. viii, fig. M, (teeth); Sampson, 1883, Kansas City Rev. Sci. & Ind., p. 551; 1885, Bull. Sedalia Nat. Hist. Soc., p. 19; 1894, Ann. Rep. Geol. Surv. Ark. for 1891, p. 190; Simpson, 1888, Proc. U. S. Nat. Mus., p. 450; Call, 1886, Bull. Washburn Coll. Lab. Nat. Hist., 1: 202; 1899, Indiana Dept. Geol. Etc., 24th Ann. Rept. p. 392; Marshall, 1893, Nautilus, 6: 126.

Polygyra elevata (Say), Pilsbry, 1907, Proc. Acad. Nat. Sci. Phila. for 1906, p. 555, pl. 22, figs. 22–25; Sampson, 1913, Trans. St. Louis Acad. Sci., 22; 95; Walker, 1906, Ill. Cat. Moll. Mich., p. 468; 1928, Terr. Moll. Alabama, p. 39; S. F. Price, Nautilus, 14: 75; Daniels, 1912, Nautilus, 26: 40, pl. 5, fig. 15 (abnormal).

Mesodon elevatus (Say), Pilsbry, 1940, p. 727, figs. 440 a, 441; Burch, 1962, pp. 159, 200, fig. 399; Hubricht, 1985, p. 44; Turgeon et al., 1998, p. 152.

Mesodon thyroidus (Say 1816)
WHITE-LIP GLOBE

Helix thyroidus Say, 1816, Nicholson's Encyclopedia, II, art. "Conchology," under *Helix albolabris*; Jour. Acad. Nat. Sci. Phila., 1: 123; Férussac, 1821, Tabl. Syst. Fam. Limacons, p. 33 with *Mesodon leucodon* Rafinesque in synonymy; Say, 1831, Amer. Conch. No. 2, pl. 13; A. Binney, 1851, Terr. Moll., 2: 129, pl. 11; Leidy, 1851, *ibid*., 1: 257, pl. 11, figs. 7–9, (anatomy); Pilsbry, 1892, Nautilus, 5: 141.

Helix thyroides Say, Pfeiffer, Monogr. Hel. Viv., 1: 345; Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 304.

Mesodon thyroides (Say), Tryon, 1867, Amer. Jour. Conch., 3: 41; W. G. Binney, 1878, Terr. Moll., 5: 330, pl. 11, pl. viii, fig. 8 (teeth); Wetherby, 1895, Nautilus, 9: 94 (reversed); Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 191; Call, 1886, Bull. Washburn Coll. Lab. Nat. Hist., 1: 206.

Mesodon leucodon Rafinesque (in MS. "Conchologia Ohioensis"), Binney & Bland, 1870, Ann. Lyc. Nat. Hist., New York, 9: 294, fig. 12.

Helix thyroides var. *pulchella* Cockerell, 1892, Jour. Conch., 7: 39.

Polygyra thyroidus (Say), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 122, 452; *ibid*., 1903, p. 201; 1906, *ibid*., p. 556; Johnson, 1915, Occ. Pap. Boston Soc. Nat. Hist., 7: 197; R. C. Stearns, N. A. Fauna, 7: 278; T. D. Foster, 1936, Amer. Midland Nat., 17: 978 (size of shell); Van Cleave & Foster, 1937, Nautilus 51: 50 (life history); F. T. & F. A. Wolf, 1939, Bull. Torrey Bot. Club, 66: 1, fig. 1 (food).

Polygyra thyroides (Say), Chadwick, 1905, Nautilus, 19: 58; Walker, 1906, Ill. Cat. Moll. Mich., 1: 468, fig. 19; 1928, Terr. Moll. Alabama, p. 41, fig. 46; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 95.

Mesodon thyroidus, Pilsbry, 1940, p. 706, fig. 432, a–e; Burch, 1962, pp. 170, 176, 200, figs. 428, 443; Hubricht, 1985, p. 45; Turgeon et al., 1998, p. 152.

Mesodon zaletus (A. Binney 1837)
TOOTHED GLOBE

Helix albolabris Say, var. unidentata Férussac, 1822, Hist. Nat. Moll. Terr. et Fluv., pl. 46 A, fig. 6.

Helix zaleta (Say), A. Binney, 1837, Boston Jour. Nat. Hist., 1: 492, pl. 20.

Helix exoleta A. Binney, 1851, Terr. Moll., 2: 131, pl. 10; Leidy, *ibid*, 1: 256, pl. 10, figs. 1–3 (anatomy).

Mesodon exoleta (A. Binney), W. G. Binney, 1878, Terr. Moll., 5: 326, pl. 10; pl. viii, fig. A, (teeth).

Mesodon andrewsi (W. G. Binney), Sampson, 1892, Nautilus, 6: 90.

Polygyra thyroides (A. Binney), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 120; F. C. Baker, Nautilus, 11: 29; Sterki, Nautilus, 24: 91, 29: 122; Goodrich, 1913, Nautilus, 27: 82; Sampson, Nautilus, 26: 91; Daniels, Nautilus, 26: 40, pl. 5 fig. 4 (pathologic); Walker, 1906, Ill. Cat. Moll. Mich., p. 466, fig. 14; 1928, Terr. Moll. Alabama, p. 33; Wheat, Nautilus, 20: 101; Billups, Nautilus, 16: 51; W. Stone, Nautilus, 25: 112; Allen, Nautilus, 29: 19, Price, Nautilus, 14: 75.

Mesodon zaletus ozarkensis Pilsbry & Ferriss, 1907, Proc. Acad. Nat. Sci. Phila., for 1906 p. 553, pl. 22., figs. 26–29; Pilsbry, 1940, p. 725, fig. 438c; Branson, 1962, Proc. Okla. Acad. Sci., 42:63.

Mesodon zaletus (A. Binney), Pilsbry, 1940, p. 722, fig. 438, a–d; Burch, 1962, pp. 160, 175, 200, figs. 400, 440; Hubricht, 1985, p. 45; Turgeon et al., 1998, p. 152.

Patera pennsylvanica (Green 1827)
PROUD GLOBELET

Helix pennsylvanicus Green, 1827, Contrib. Maclurian Lyceum, 1: 8.

Helix pennsylvanica Green, A. Binney, 1837, Boston Jour. Nat. Hist., 1: 483, pl. 16; 1851, Terr. Moll., 2: 105, pl. 7; Bland, 1858, Ann. Lyc. Nat. Hist. New York, 6: 299.

Mesodon pennsylvanica (Green), W. G. Binney, 1878, Terr. Moll., 5: 321, pl. viii, fig. E, pl. XV, fig. G (anatomy).

Polygyra pennsylvanica (Green), Walker, 1906, Ill. Cat. Moll. Mich., p. 468; F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 116; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 95; Nautilus, 26: 91.

Mesodon pennsylvanicus (Green), Pilsbry, 1940, p. 726, fig. 439; Hubricht, 1985, p. 45.

Patera pennsylvanica (Green), Emberton, 1995, Malacologia, 37 (1), p. 92; Burch, 1962, pp. 174, 199, fig. 438; Turgeon et al., 1998, p. 152.

Patera perigrapta (Pilsbry 1894)
ENGRAVED BLADETOOTH

Helix appressa Say, in part, A. Binney, 1851, Terr. Moll., 2: 140, pl. 13, upper and lower figs; Wetherby, in part, 1894, Nautilus, 8: 14.

Triodopsis appressa (Say), in part, W. G. Binney, 1887, Terr. Moll., 5: 305, description and pl. 13, upper and lower figs., pl. 11, fig. K (genitalia); Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2; 187.

Polygyra appressa perigrapta Pilsbry, 1894, Nautilus, 7: 140; 1909, Proc. Acad. Nat. Sci. Phila., p. 122; 1903, *ibid*. p. 201; Walker & Pilsbry, 1902, *ibid*. p. 424; Walker, 1928, Terr. Moll. Alabama, p. 38.

Polygyra appressa tryoniana, Pilsbry, 1904, Nautilus, 18: 89.

Mesodon perigraptus (Pilsbry) Pilsbry, 1940, p. 755, fig. 454, a–d; Burch, 1962, pp. 162, 200, fig. 408, Hubricht, 1985, p. 43.

Patera perigrapta (Pilsbry), Emberton, 1995, Malacologia, 37 (1), p. 92; Turgeon et al., 1998, p. 152.

Inflectarius edentatus (Sampson 1889)
SMOOTH-LIP SHAGREEN

Triodopsis edentata Sampson, 1889, Nautilus, 3: 85; reprinted 1894, in Ann. Rep. Geol. Surv. Ark. for 1891, 2: 188.

Polygyra edentata (Sampson), Pilsbry, 1893, Man. Conch. 8: 154, pl. 50, figs. 16–18, 18a; 1903, Proc. Acad. Nat. Sci. Phila., p. 197; 1906 *ibid*, p 545, pl. 22, figs. 11, 15, 16.

Triodopsis edentula Sampson, W. G. Binney, 1890, 3rd Suppl., Bull. Mus. Comp. Zool., 19: 190.

Mesodon inflectus edentatus (Sampson), Pilsbry, 1940, p. 776.

Mesodon edentatus (Sampson), Hubricht, 1949, Nautilus, 62: 99; Hubricht, 1985, p. 43.

Inflectarius edentatus (Sampson), Emberton, 1995, p. 92; Turgeon et al., 1998, p.151.

Inflectarius inflectus (Say 1821)
SHAGREEN

Helix inflecta Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 153; A. Binney, 1851, Terr. Moll., 2: 143, pl. 45, figs. 2, 3; Bland, 1861, Ann. Lyc. Nat. Hist. New York 7: 425.

Helix clausa Férussac, 1821, Tabl. Syst. Fam. Limacons, p. 38, No. 104 (nude name, *Triodopsis clausa* Raf. in synonymy); Deshayes, 1830, Encycl. Méth., 2: 252.

Xolotrema clausa Rafinesque, 1831, Enum. and Acc. etc., p. 3.

Helix (Triodopsis) inflexa (Say), Von Martens, 1860, Die Heliceen, p. 97 (emendation of *inflecta*).

Triodopsis inflecta (Say), W. G. Binney, 1878, Terr. Moll., 5: 306, fig. 200, pl. vii, fig. S (teeth); Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 187; Call, 1900, Indiana Dept. Geol. & Nat. Res. 24th Ann, Rep., p. 387, fig. 7.

Polygyra inflecta (Say), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 450; 1903, *ibid*., p. 196; 1906, *ibid*., p. 543; Walker, 1902, Proc. Acad. Nat. Sci. Phila., p. 423, 1906, Ill. Cat. Moll. Mich., 1: 463, fig. 8; 1928, Terr. Moll. Alabama, p. 26, figs. 30, 31; Sampson, Nautilus, 26: 91; 1913, Trans. St. Louis Acad. Sci., 22: 90; Archer, 1933, Occ. Pap. Mus. Zool. Univ. Mich., No. 276, p. 1–8 (structure, habits, etc.); Sterki, 1907, Proc. Ohio State, Acad. Sci., 4: 376; F. C. Baker, 1939, p. 47.

Polygyra inflecta var. *media* Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 197; 1906, *ibid*., p. 544, pl. 22, fig. 10.

Polygyra herberti B. Walker, 1928, Terr. Moll. Alabama, p. 43, fig. 50; Clench, 1937, Nautilus, 51: 17, pl. 3, figs. 1–3.

Mesodon inflectus (Say), Pilsbry, 1940, p. 770, fig. 462, a–e; Burch, 1962, pp. 157, 200, fig. 400, Hubricht, 1985, p. 42.

Inflectarius inflectus (Say), Emberton, 1995, Malacologia, 37 (1), p. 92; Turgeon et al., 1998, p. 151.

Triodopsis cragini Call 1886
POST OAK THREETOOTH

Triodopsis cragini Call, 1886, Bull. Washburn Coll. Lab. Nat. Hist., 1: 202, fig. 5; W. G. Binney, 1890, 3rd Suppl. Bull. Mus. Comp. Zool., 19: 199, figs (as syn. of T. copei Weth.); Pilsbry, 1940, p. 821, fig.

484, g–j; Burch, 1962, p.164; Hubricht, 1985, p. 47; Emberton, 1988: 179; Turgeon et al., 1998, p. 153.

Helix vultuosa var. *cragini* (Call), Singley, 1893, Geol. Surv. Texas, 4th Ann. Rep., p. 305.

Polygyra cragini (Call), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 450; 1903, *ibid*, p. 196; Pilsbry & Ferriss, 1907, *ibid*,, for 1906, p. 545; Sampson, 1913, Trans. Acad. Sci. St. Louis, 22: 90 (as *crageni*).

Triodopsis vultuosa cragini Call, Branson, 1962, Proc. Okla. Acad. Sci., 42: 72.

Triodopsis copei cragini Call., Vagvolgyi, 1968: 201.

Triodopsis discoidea (Pilsbry 1904)
RIVERCLIFF THREETOOTH

Helix tridentata polita Wetherby, 1894, Nautilus, 8: 44 (not Helix polita Pulteney, 1797, or of Müller, 1774).

Polygyra tridentata discoidea Pilsbry, 1904, Nautilus, 17: 142; Daniels, 1904, Nautilus 18: 92.

Polygyra tridentata frisoni F. C. Baker, 1933, Nautilus, 47: 58.

Triodopsis tridentata discoidea Pilsbry, 1940, p. 799, fig. 474, o–s.

Triodopsis juxtidens discoidea (Pilsbry), Vagvolgyi, 1968: 171.

Triodopsis discoidea (Pilsbry), Hubricht, 1985, p. 46; Turgeon et al., 1998, p. 153.

Triodopsis (Vagvolgyorbis) discoidea (Pilsbry), Emberton, 1988: 180; Emberton, 1995, Malacologia, 37(1), p. 86.

Triodopsis hopetonensis (Shuttleworth 1852), New State Record
MAGNOLIA THREETOOTH

Helix hopetonensis Shuttleworth, 1852, Mittheil. Naturforsch. Ges. in Bern, nr. 248, p. 198.

Helix tridentata, A. Binney, Boston Jour. Nat. Hist., 3: 382, pl., 18, fig. 2.

Helix tridentata, var. *ephabus* Say, Ravenel, 1834, Catalogue, p. 9 (nude name); W. G. Binney, 1859, Terr. Moll., 4: 71 (as *H. ephebus*).

Triodopsis hopetonensis (Shuttleworth), W.G. Binney, 1878, Terr, Moll., 5: 311. fig. 205, pl. VII, fig. N & XV, fig. A (anatomy); Johnson, Nautilus, 3: 138; Pilsbry, 1940, p. 811, fig. 480 g, h; Burch, 1962, pp. 168, 200, fig. 423, Hubricht, 1985, p. 48; Emberton, 1988: 182; Turgeon et al., 1998, p. 153.

Polygyra hopetonensis (Shuttleworth), Henderson, Nautilus, 21: 7; W. G. Mazyck, 1913, Cat. Moll. South Carolina, Contrib. Charleston Mus., 2: 7.

Polygyra hopetonensis var. *charlestonensis* Mazyck, 1913, Contrib. Charleston Mus., p. 7, No. 102.

Triodopsis fallax hopetonensis (Shuttleworth), Beetle, 1973, Sterkiana, 49: 31.

Triodopsis neglecta (Pilsbry 1899)
OZARK THREETOOTH

Triodopsis fallax Say, var. *minor*, Wetherby, 1881, Jour. Cincinnati Soc. Nat. Hist., 4: 333 (not *T. introferens* var. *minor* Tryon, 1867).

Triodopsis fallax, small variety, Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 189.

Polygyra neglecta Pilsbry, 1899, Nautilus. 13: 40; 1903, Proc. Acad. Nat. Sci. Phila., p. 196; 1907, *ibid*. for 1906, p. 546, pl. 22, figs. 19–21; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 89.

Triodopsis neglecta (Pilsbry), Pilsbry, 1940, p. 807, fig. 479; Burch, 1962, pp. 165, 200, fig. 416, Hubricht, 1985, p. 46; Vagvolgyi 1968: 178; Emberton, 1988: 184; Turgeon et al., 1998, p. 153.

Triodopsis vulgata (Pilsbry 1940)
DISHED THREETOOTH

Helix tridentata Say, in part, A. Binney 1851, Terr. Moll., 3: 183, pl. 28.

Helix fallax (Say), W. G. Binney, 1869, L. & Fr. W. Shells N. A., 1: 131, fig. 222, and of many other authors. Not *H. fallax* Say.

Triodopsis fallax (Say), W. G. Binney, 1878, Terr. Moll., 5: 309, pl. 28, pl. vii, fig. L, pl. xv, fig. B.

Polygyra fraudulenta Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 117; Sampson, Nautilus, 26: 91, 95; Trans. St. Louis Acad. Sci., 22: 89; Sterki, Nautilus, 22: 52; Walker, 1906, Ill. Cat. Moll. Mich., p. 462, fig. 7; Terr. Moll. Alabama, p. 22, figs. 25, 26; F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 114; Archer, 1934, Nautilus, 48: 49, pl. 1, fig. 6; Goodrich, 1916, Ann. Carnegie Mus. 10: 530, 531.

Triodopsis fraudulenta vulgata (Pilsbry), 1940, p. 805.

Triodopsis neglecta vulgata (Pilsbry), Vagvolgyi, 1968: 175.

Triodopsis hopetonensis claibornensis Lutz, Vagvolgyi, 1968, Bull. Mus. Comp. Zool., 136: 175.

Triodopsis vulgata (Pilsbry), Hubricht, 1954, Nautilus, 67: 91; 1985, 46; Emberton, 1988: 187; Turgeon et al., 1998, 154.

Xolotrema denotatum (Férussac 1821)
VELVET WEDGE

Helix denotata Férussac, 1821, Tabl. Syst. Fam. Limacons, p. 34, No.102; (*Triodopsis scabra* Rafinesque cited as a synonym); Hist. Nat. Moll. Terr., pl. 49a, fig. 5; Deshayes, 1838, in Lamarck, Hist. Nat. Anim. s. Vert., (2), 8: 115.

Helix notata "Fér," Deshayes, 1830, Encylopédie Méthodique, Hist. Nat. Vers. 2: 224.

Helix palliata Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 152; A. Binney, 1840, Boston Jour. Nat. Hist., 3: 353, pl. 7; 1851, Terr. Moll., 2: 136, pl. 14; Leidy, Terr. Moll; 1: 253, pl. 7, fig. 8 (anatomy); Not *Helix palliata* Hartmann, 1807, Alpina, 2: 227.

Triodopsis palliata (Say), W. G. Binney, 1878, Terr. Moll. 5: 302, pl. 14, pl. vii, fig. O (teeth); Call, 1900, Indiana Dept. Geol. etc., 24th Ann. Rep., p. 385, fig. 6;

Polygyra palliata (Say), Pilsbry, 1894, Man. Conch., 9: 77; Johnson, 1915, Fauna of New England, Mollusca, p. 197; S. F. Price, Nautilus, 14: 75; Billups, Nautilus, 16: 51; Hinkley, Nautilus, 16: 34; Hanna, Nautilus, 24: 24; Johnson, Nautilus, 26: 59; Pilsbry, 1903, Indiana Dept. Geol. etc. 26th Ann. Rep., p. 581, fig. 4; Walker, 1906, Ill. Cat. Moll. Mich., p. 467; 1928, Terr. Moll. Alabama, p. 34; F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 116.

Triodopsis notata (Deshayes), Pilsbry, 1940, p. 824.

Triodopsis obstricta denotata (Férussac), Vagvolgyi, 1948, Bul. Mus. Comp. Zool., 136: 206.

Triodopsis denotata (Férussac), Pilsbry, 1940, p. 824; 1948, p. 1100; Hubricht, 1985, p. 48.

Xolotrema denotata (Férussac), Webb, 1952, Gastropodia, 1: 8.

Xolotrema denotatum (Férussac), Emberton, 1988: 188, 265; Turgeon et al., 1998, p. 154.

Xolotrema fosteri (F. C. Baker 1932)
BLADETOOTH WEDGE

Helix appressa, var. *a*, Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 151.

Helix appressa and *Triodopsis appressa* Say, in part, (of many authors); Shimek, 1888, Bull. Lab. Nat. Hist. State Univ. Iowa, 1: 63.

Polygyra appressa fosteri F. C. Baker, 1932, Nautilus, 46: 48.

Triodopsis fosteri (F. C. Baker), Pilsbry, 1940, p. 831, fig. 487, a–f; Burch, 1962, pp. 159, 201, fig. 397, Hubricht, 1985, p. 49.

Xolotrema fosteri (F. C. Baker), Webb. 1952, Gastropodia, 1: 8; Emberton, 1988: 188, 264; Emberton, 1995, Malacologia, 37(1), p. 85; Turgeon et al., 1998, p. 154.

Triodopsis hubrichti (F. C. Baker), Leonard & Frye, 1960, Ill. State Geol. Surv. Circ. 304: 9.

Xolotrema obstrictum (Say 1821)
SHARP WEDGE

Helix obstricta Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 154.

Carocolla helicoides Lea, 1834, Trans. Amer. Phil. Soc., 4: 109, pl. 15, fig. 34 a–c.

Helix palliata A. Binney, 1851, Terr. Moll., 2: 137, pl. 15.

Mesodon labiatum Rafinesque (in MS "Conchologia Ohioensis"), Binney and Bland, 1870, Ann. Lyc. Nat. Hist., N. Y. 9: 294, fig. 13.

Triodopsis obstricta (Say), W. G. Binney, 1878, Terr. Moll., 5: 303, pl. 15, pl. vii; fig. P; 1885, Man Amer. and Shells, p. 487, var. *planulata*, nude name; Gratacap, Bull. Amer. Mus. Nat. Hist., 14: 379, with var. *planulata*, nude name; Pilsbry, 1940, p. 827; Burch, 1962, p. 158; Hubricht, 1985, p. 48.

Polygyra obstricta (Say), Pilsbry, 1894, Man. Conch., 9: 77; Hinkley, 1906, Nautilus, 20: 34; Wheeler, Nautilus, 25: 124; Walker, 1928, Terr. Moll. Alabama, p. 35, fig. 39; Billups, 1903, Nautilus, 16: 127; Hinkley, Nautilus 20: 34; Wetherby, 1911, Nautilus, 25: 60; S. F. Price, Nautilus, 14: 75.

Triodopsis caroliniensis (Lea), Vagvolgyi, 1968, Bull. Mus. Comp. Zool., 136: 209.

Xolotrema obstricta (Say), Emberton 1988: 188, 265.

Xolotrema obstrictum (Say), Turgeon et al., 1998, p. 154.

Neohelix alleni (Sampson 1883)
WESTERN WHITELIP

Mesodon albolabris var. *minor* Wetherby, 1881, Jour. Cincinnati Soc. Nat. Hist., 4: 332 (not *Helix albolabris* var. *minor* Shuttleworth).

Mesodon albolabris (Say), Sampson, 1885, Bull. Sedalia Nat. Hist. Soc., No. 1, p. 19; Call, Bull. Washburn Coll. Lab. Nat. Hist., 1: 55 (Sedalia, MO); Call, 1885, Bull. Washburn Coll. Lab. Nat. Hist., 1: 55 (Topeka, KS).

Mesodon albolabris (Say), var. *alleni* Wetherby, Sampson, 1883, Kansas City Rev. Sci., 6: 24; 1887, Amer. Nat., p. 84; 1893, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 189, 190 (first description); 1913, Trans. St. Louis Acad. Sci., 22: 91 (Sampson attributed the name, *M. a. alleni*, to Wetherby; however, Sampson provided the first description in 1883).

Polygyra albolabris alleni (Wetherby), Pilsbry, 1900, Proc. Acad. Nat. Sci. Phila., p. 451; 1903, *ibid*. p. 197; 1907, *ibid*. p. 552; Hanna, Nautilus, 23: 82.

Triodopsis albolabris alleni ('Wetherby', Sampson), Pilsbry, 1940, p. 840, fig. 489, 10–11a.

Triodopsis alleni (Wetherby in Sampson), Hubricht, 1965, Sterkiana, 17: 2; Hubricht, 1985, p. 49.

Neohelix alleni (Sampson), Emberton, 1988: 259; Emberton, 1995, Malacologia, 37(1), p. 85; Turgeon et al., 1998, p. 152.

Neohelix divesta (Gould 1848)
OZARK WHITELIP

Helix abjecta Gould, 1848, Proc. Boston Soc. Nat. Hist., 3: 40; 1851 Terr. Moll., 2: 122, pl. 13a, fig. 2 (not H. abjecta Lowe, 1831).

Helix dejecta Gould, 1851, in A. Binney, Terr. Moll., 2: 91 (nude name) (not *Helix dejecta* Petit, 1842).

Helix divesta Gould, 1851, Terr. Moll., 2: 358, and Terr. Moll., 3: 27 (new name for *H. abjecta* Gould).

Mesodon divesta (Gould), W. G. Binney, 1878, Terr. Moll., 5: 319, pl. 13a, fig. 2; pl. xi, fig. J; pl. xvi, fig. V, (anatomy); Sampson, 1894, Ann. Rep. Geol. Surv. Ark. for 1891, 2: 190.

Polygyra divesta (Gould), Pilsbry, 1903, Proc. Acad. Nat. Sci. Phila., p. 200; Pilsbry & Ferriss, 1907, *ibid*.

for 1906, p. 551; Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 92.

Triodopsis divesta (Gould), Pilsbry, 1940, p. 851, fig. 494; Burch, 1962, pp. 173, 201, fig. 436, Hubricht, 1985, p. 49.

Neohelix divesta (Gould), Emberton, 1988: 175; Emberton, 1995, Malacologia, 37(1), p. 78; Turgeon et al., 1998, p. 152.

Webbhelix multilineata (Say 1821)
STRIPED WHITELIP

Helix multilineata Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 150; A. Binney, 1851, Terr. Moll., 2: 103, pl. 3; Leidy, Terr. Moll. 1: 254, pl. 8, figs. 1–6 (anatomy); W. G. Binney, 1858, Proc. Acad. Nat. Sci. Phila., p. 203 (with vars. *albina. rufa*, *unicolor*, Nude names); Coues, 1871, Proc. Acad. Nat. Sci. Phila., p. 147.

Mesodon multilineata (Say), W. G. Binney, 1878, Terr. Moll., 5: 320, pl. 3, pl. viii, fig. L, (teeth); Wetherby, Nautilus, 9: 94 (sinistral).

Helix multilineata var. *alba* Witter, 1878, Quart. Jour. Conch., 1: 384. (Nude name); Walker, 1906, Ill. Cat. Moll. Mich., p. 467.

Helix multilineata var. *rubra* Witter, 1878, Quart. Jour. Conch., 1: 384 (not *Helix rubra* Nardo, 1847).

Mesodon multilineata var. *alba* and var. *unicolor* Currier, 1868, Shell-bearing Moll. Michigan, p. 5 (nude names).

Polygyra multilineata (Say), Sampson, 1913, Trans. St. Louis Acad. Sci., 22: 93; Walker, 1906, Ill. Cat. Moll. Mich., p. 466; Nautilus, 20: 81; F. C. Baker, 1906, Bull. Ill. State Lab. Nat. Hist., 7: 116; E. D. Crabb, 1928, Nautilus, 42: 35 (eating *Succinea*); Chadwick, Nautilus, 19: 58.

Polygyra multilineata altonensis F. C. Baker, 1920, Nautilus, 34: 65; 1931, Jour. Paleontology, 5: 273; cf. Shimek, Nautilus, 49: 124.

Xolotrema multilineata (Say), Webb, 1952, Gastropoda, 1: 7.

Xolotrema chadwicki (Ferriss), Webb, 1952, Gastropoda, 1: 7.

Triodopsis altonensis (F. C. Baker), Leonard & Frye, 1960, Ill. State Geol. Surv., Circ. 304: 9.

Triodopsis algonquinensis (Nason), Leonard & Frye, 1960, Ill. State. Geol. Surv. Circ., 304: 9.

Triodopsis multilineata (Say), Pilsbry, 1940, p. 847, fig. 493; Burch, 1962, pp. 159, 172, 201, figs. 398, 433, Hubricht, 1985, p. 49.

Webbhelix multilineata (Say), Emberton, 1988: 188, 262; Emberton, 1995a: 78; Turgeon et al., 1998, p. 154.

Allogona profunda (Say 1821)
BROAD-BANDED FORESTSNAIL

Helix profunda Say, 1821, Jour. Acad. Nat. Sci. Phila., 2: 160; 1832, Amer. Conch., pl. 37. fig. 3; Leidy, 1851, Terr. Moll., 1: 255, pl. 9, figs. 1–3 (anatomy); A. Binney, 1851, Terr. Moll., 2: 177,. Pl. 22; Lind, Nautilus, 8: 106.

Helix richardii Férussac, 1821, Tabl. Syst. Fam. Limacons, p. 43, No. 174. (Nude name); 1822 (?) Histoire, pl. 70, 3 lower figs.

Mesodon profunda (Say), W. G. Binney, 1878, Terr. Moll., 5: 338, pl. viii, fig. Q, (teeth); Marshall, Nautilus, 6: 126; Stupakoff, Nautilus, 7: 135; E. Pleas, Nautilus, 7: 68; Wetherby, 1881, Jour. Cincinnati Soc. Nat. Hist., 4: 326.

Polygyra profunda (Say), Ferriss, Nautilus, 14: 53 (and of many, many authors).

Polygyra profunda alba and *unicolor* Walker, 1899, Terr. Moll. Mich., p. 12; 1906, Ill. Cat. Moll. Mich., p. 464; Nautilus, 38: 34.

Polygyra profunda strontiana G. H. Clapp, 1916, Ann. Carnegie Mus., 10: 537, pl. 32, figs. 13–15.

Polygyra profunda pleistocenica F. C. Baker, 1920, Nautilus, 34: 66.

Polygyra profunda efasciata Walker, 1924, Nautilus, 38: 33.

Allogona profunda (Say), Pilsbry, 1940, p. 877, fig. 507; Burch, 1962, pp. 177, 201, fig. 447, Hubricht, 1985, p. 49; Turgeon et al., 1998, p. 150.

APPENDIX C: KEY IDENTIFICATIONS

The following are key identification for genera and species of land snails and slugs in Missouri. For key identifications for families of land snails and slugs, see Page 23.

Key to the genera and species of Helicinidae in Missouri

1a. Surface relatively smooth; color whitish to reddish cinnamon, usually with white band at the periphery; limited in Missouri to southwestern counties ..... ***Helicina orbiculata***

1b. Surface with coarse axial ridges; color uniform reddish brown to yellowish, without peripheral band; known in Missouri only from Boone County..... ***Hendersonia occulta***

Key to the species of *Carychium* in Missouri

1a. Surface of last two whorls with close-spaced distinct axial ridges ..... ***Carychium exile***

1b. Surface of last two whorls smooth or weakly striate..... ***Carychium exiguum***

Key to the genera of Succineidae in Missouri

1a. Sutures very deep and whorls very convex; size relatively small (usually less than 10 mm)..... ***Catinella***

1b. Sutures relatively shallow and whorls less convex; size larger (usually greater than 10 mm)..... **2**

2a. Aperture very broad, about 0.8 times as wide as long ..... ***Novisuccinea***

2b. Aperture narrower and more elongate, about 0.6 times as wide as long..... **3**

3a. Color usually reddish at apex of shell; size usually smaller, less than 17 mm (for shells approaching 17 mm, whorl count is greater than 3)..... ***Succinea***

3b. Color uniformly yellowish brown; size usually larger, up to 20 mm (for smaller shells in the size range of *Succinea*, whorl count is 3 or less)..... ***Oxyloma Genus Oxyloma Westerlund 1885***

Key to the species of Oxyloma in Missouri

1a. Whorls about 3; spire relatively longer than *O. salleana*; widely distributed in Missouri ..... ***O. retusa***

1b. Whorls about 2½; spire relatively shorter than *O. retusa*; limited to eastern Missouri ..... ***O. salleana****

** Known only from historic records; not found in recent collections by the authors.*

Key to the species of *Succinea* in Missouri

1a. Size smaller, length 11 mm or less; found in dry habitats, on bare ground in sunny locations ..... ***S. indiana***

1b Size larger, length greater than 11 mm; found in wet habitats or known only as fossils .. **2**

2a. Found in wet habitats, often on algae covered rocks in creek beds; widespread in Missouri ..... ***S. forsheyi***

2b. Known only as Pleistocene age fossils, St. Louis County ..... ***S. bakeri***

Key to the species of *Novisuccinea* in Missouri

1a. Size smaller, length less than 17 mm; living populations widespread in Missouri ..... ***N. ovalis***

1b. Size larger, length greater than 19 mm; known only from fossil shells in Missouri ..... ***N. chittenangoensis***

Key to the species of *Catinella* in Missouri

1a. Occurs on wet low ground, floodplains, swamps, and margins of ponds and marshes; widespread in Missouri ..... ***C. avara***

1b. Occurs in drier habitats, in leaf litter on wooded hillsides; rare or not yet recorded in Missouri ..... ***C. oklahomarum, C. wandae***

1c. Fossil shells only in Missouri ..... ***C. gelida***

Key to the species of *Cochlicopa* in Missouri

1a. Size usually larger (length usually greater than 6 mm)..... ***C. morseana***

1b. Size usually smaller (length less than 6 mm) **2**

2a. Whorls somewhat more convex, sutures deeper; shape tending toward conical, apex more acute; shell may be darker..... ***C. lubrica***

2b. Whorls somewhat flatter, sutures shallower; shape more parallel-sided, apex more blunt; shell usually pale ..... ***C. lubricella****

** Recorded from Atchison County, but not collected by the authors; see* C. lubrica *Remarks, Page 37.*

Key to the genera of Pupillidae in Missouri

1a. Shell shape elongate-conic, spire acute ..... ***Pupoides***

1b. Shell shape oval-cylindric, spire obtuse..... ***Pupilla***

Key to the species of *Pupilla* in Missouri

1a. Aperture with three prominent lamellae (Parietal, Columellar, Palatal); embryonic whorls finely granulose ..... ***P. blandi****

1b. Apertural lamellae reduced, with one or more lamellae usually absent... ***P. muscorum*****

** Fossil only in Missouri, with nearest living populations in Texas and South Dakota*

*** Fossil only in Missouri, with nearest living populations in Iowa*

Key to the genera of Vertiginidae in Missouri

1a. Shell without reflected lip ..... ***Columella***

1b. Shell aperture with reflected lip..... **2**

2a. Shell white or grayish white, or if brownish colored, then angular and parietal lamellae united into one sinuous structure ..... ***Gastrocopta***

2b. Shell yellowish or reddish brown (or colorless fossils) and angular and parietal lamellae separate or with one or both missing..... ***Vertigo***

Key to the species of *Gastrocopta* in Missouri

1a. Color grayish white; palatal lamellae connected by a thickened ridge..... **2**

1b. Color grayish white; palatal lamellae absent (or rarely with a very small upper palatal). (subgenus *Privatula*) ***G. corticaria***

1c. Color cinnamon-brown; palatal lamellae not connected by thickened ridge. (subgenus *Gastrocopta* s. str.) **7**

2a. Parietal wall and columella with relatively small and simple lamellae..... (subgenus *Vertigopsis*) **3**

2b. Parietal wall and columella with lamellae more strongly developed or complex, in some cases nearly filling the aperture ..... (subgenus *Albinula*) **4**

3a. Size larger (shell length 1.8 to 2.2 mm); lower palatal lamella aligned on a thickened ridge with other palatals; usually associated with wet habitats..... ***G. tappaniana***

3b. Size smaller (shell length 1.83 mm or less); lower palatal lamella more deeply inset; usually associated with dry habitats ..... ***G. pentodon***

4a. Angulo-parietal lamella forked in front, reverse-"y"-shaped; length less than 2 mm ..... ***G. holzingeri***

4b. Angulo-parietal lamella not as above; length greater than 2 mm..... **5**

5a. Shell very wide at base, strongly tapered to narrow apex; aperture lip projecting beyond edge of body whorl; aperture triangular in shape, with lamellae nearly occluding the opening..... ***G. contracta***

5b. Not as above..... **6**

6a. Size larger (diameter usually greater than 2.2 mm); columellar lamella with forward projecting lobe at middle, and small plate-like extensions above and below; lower palatal aligned with other palatals; basal lamella usually small..... ***G. armifera***

6b. Size smaller (diameter usually less than 2.2 mm); columellar lamella forming a simple blunt lamella; lower palatal lamella aligned with other palatals; basal lamella well developed..... ***G. abbreviata***

6c. Size smaller (diameter usually less than 2 mm); columellar lamella forming a large, rounded and rather thin plate, without forward projecting lobe at middle; lower palatal lamella more deeply set; basal lamella small or absent..... ***G. similis***

7a. Angulo-parietal lamella not distinctly bilobed ..... ***G. cristata***

7b. Angulo-parietal lamella distinctly bilobed..... **8**

8a. Angulo-parietal lobes separated by a well-defined groove, and not appearing "crossed" or "X"-shaped in aperture view..... ***G. rogersensis***

8b. Angulo-parietal lobes joined in the middle, and appearing "crossed" or "X"-shaped in aperture view **9**

9a. Outer end of parietal lamella visible as a low callus, directed towards the columellar insertion; not yet found in Missouri ..... ***G. sterkiana****

9b. Outer end of parietal lamella very short or indistinct; common and widespread in Missouri..... ***G. procera***

* G. Sterkiana *has been reported from northwestern Arkansas, but has not yet been found in Missouri.*

Key to the species of *Vertigo* in Missouri

1a. Parietal area with two lamellae (parietal and angular lamellae)..... **2**
1b. Parietal area with a single lamella (parietal lamella only..... **4**

2a. Size smaller, length less than 1.9 mm; parietal and angular lamellae nearly same size lower palatal lamella long and curved..... ***V. milium***
2b Size larger, length greater than 1.9 mm; parietal lamella much larger than the angular, lower palatal lamellae short and straight..... **3**

3a. Size smaller, length 1.9 to 2.3 mm; infraparietal and suprapalatal lamellae sometimes present; widespread ..... ***V. ovata***
3b. Size larger, length 2.1 to 2.9 mm; the infraparietal and suprapalatal lamellae are never present; unknown in Missouri, but occurs in adjacent counties of Arkansas and Illinois ..... ***V. teskeyae***

4a. Surface smooth, granular, or with only a faint trace of axial ridges..... **5**
4b. Surface with distinct axial ridges **8**

5a. Length 1.7 mm or less..... ***V. oscariana***
5b. Length 1.7 or more..... **6**

6a. Aperture with three lamellae, or sometimes four if upper palatal lamella is present; basal lamella always absent; color light yellowish brown ..... ***V. tridentata***
6a. Aperture with five lamellae; color dark reddish brown (or colorless if fossil)..... **7**

7a. Aperture with prominent crest behind the lip; urban/suburban habitats in Missouri..... ***V. pygmaea***
7b. Aperture without crest behind lip; fossil only in Missouri ..... ***V. ventricosa***

8a. Parietal lamella pointing between lower and upper palatal lamellae **10**
8b. Parietal lamella pointing toward lower palatal lamella **9**

9a. Size smaller, length 1.7 to 2 mm; surface with very prominent axial ridges; living populations widespread in eastern Ozark region..... ***V. meramecensis***
9b. Size larger, length about 2.6 mm; surface with weak axial ridges; fossils only in Missouri..... ***V. modesta***

10a. Lower palatal lamella not or little further in than the upper; outside of body whorl with white streaks over palatal lamellae, but not impressed; living populations widespread in Missouri ..... ***V. gouldii***
10b. Lower palatal lamella much more deeply placed than the upper; outside of body whorl with deep impression over the palatal lamellae; fossil only in Missouri..... ***V. hubrichti***

Key to the species of *Columella* in Missouri.

1a. Whorls 5½ to 6½; shape elongate-oval, or in some with middle two whorls nearly equal in diameter, and with body whorl not or only slightly wider than penultimate; widespread in Missouri ..... ***Columella simplex***

1b. Whorls 6½ to 7; shape with middle 3 whorls nearly equal in diameter, and with body whorl noticeably wider; fossils only in Missouri ..... ***Columella columella alticola***

Key to the species of *Vallonia* in Missouri.

1a. Shell with faint growth lines, but not clearly ribbed **2**

1b. Shell ribbed **3**

2a. Outer lip in dorsal view reflected ..... ***V. pulchella***

2b. Outer lip in dorsal view not reflected ..... ***V. excentrica***

3a. Aperture lip thickened within **4**

3b. Aperture lip thin ..... ***V. perspectiva***

4a. Shell diameter about 1.6 to 2.0 mm; major ridges 30 to 38 on the last whorl ..... ***V. parvula***

4b. Shell diameter 2.3 to 2.9 mm; major ridges fine and crowded, with 45 to 55 on the last whorl ..... ***V. gracilicosta***

Key to the species of *Strobilops* in Missouri

1a. Basal lamellae, as seen through the base of the shell, nearly equal in length, arranged in oblique, axial series, with some lamellae above the periphery; tallest of the species occurring in Missouri, shape more conic than S. labyrinthicus ..... ***S. affinis***

1b. Basal lamellae unequal in length **2**

2a. Shell short conic shaped, with periphery somewhat angulate; basal lamellae short, lamella 3 sometimes missing; lamellae not occurring above periphery; color dark brown with a reddish golden luster ..... ***S. aeneus***

2b. Shell beehive shaped, with periphery rounded; basal lamellae longer, with some lamellae often located above the periphery **3**

3a. Shell more finely ribbed; widely distributed and common in Missouri; color light tan ***S. labyrinthicus***

3b. Shell more coarsely ribbed; unknown in Missouri, but likely to occur in southern counties; color reddish brown ..... ***S. texasianus***

Key to the species of *Punctum* in Missouri

1a. Later whorls with major riblets fine and closely spaced, spaces between major riblets with one to three minor ridges; spiral striae very fine, not forming distinct microscopic squares ..... ***P. minutissimum***

1b. Later whorls with major riblets high and widely spaced; spaces between riblets with three to seven minor ridges; spiral striae distinct, crossing riblets and forming microscopic squares (most clearly visible on base) ..... ***P. vitreum***

Key to the genera of Discidae in Missouri

1a. Size larger, shell diameter 15 mm or greater; colored with dark bands, or bands of irregular dark blotches ..... ***Anguispira***

1b. Size smaller, shell diameter less than 10 mm; color uniform reddish brown to whitish, without bands or dark blotches ..... ***Discus***

Key to the species of *Anguispira* in Missouri

1a. Shell decorated with two or three bands of color blotches or "flames" **2**

1b. Shell with two solid brown color bands ..... ***A. kochi***

2a. Axial ridges narrowly spaced, with about five ridges in 2 mm near aperture ..... ***A. alternata***

2b. Axial ridges coarser and more widely spaced ..... ***A. strongylodes***

Key to the species of *Discus* in Missouri

1a. Body whorl rounded; color light brown to dark reddish brown, without pinkish tint ... **2**

1b. Body whorl angular, flattened below the periphery; color tan with a light pinkish tint .. ***D. nigrimontanus***

2a. Aperture with a recessed, blunt lamella on the columellar side of a low callus lining the inner wall; size larger, shell diameter 7 to 8.9 mm ..... ***D. patulus***

2b. Aperture without lamella, size smaller **3**

3a. Whorls 3⅔ to 4½, rather loosely coiled **4**

3b. Whorls 5 to 6, tightly coiled ..... ***D. macclintocki****

4a. Axial ridges relatively coarse, intervals wider than ridges; ridges distinct on the body whorl, continuing onto the base ..... ***D. whitneyi*****

4b. Axial ridges relatively finer, intervals about as wide as the ridges; ridges diminished on the body whorl, disappearing in the peripheral region ..... ***D. shimeki*******

** fossil only in Missouri; living populations known to occur in Iowa*

*** fossil only in Missouri; living populations known to occur in Iowa and Illinois*

**** fossil only in Missouri; nearest living populations in South Dakota*

Key to the genera and species of *Helicodiscidae* and *Lucilla* in Missouri

1a. Shell larger, diameter usually greater than 3 mm; surface with distinct, raised spiral threads; internal lamellae well-developed ..... (genus *Helicodiscus*) **2**

1b. Shell smaller, diameter 3 mm or less; surface glossy, without raised spiral threads; internal lamellae absent ..... (genus *Lucilla*) **3**

2a. Embryonic whorls with distinct spiral threads, similar to those on later whorls; continuous and distinct spiral threads from apex to body whorl and very regular increase in whorl diameter give these shells a pleasingly symmetrical appearance ..... ***H. notius***

2b. Embryonic whorls with spiral threads poorly developed or absent, often missing in irregular areas; spiral threads distinct on later whorls; combination of irregular smooth areas and irregular whorl widths of the embryonic whorls give the shells a somewhat asymmetric appearance ..... ***H. parallelus***

3a. Surface with faint spiral striae ..... ***L. singleyanus***
3b. Surface without any trace of spiral striae (known only from fossils in Missouri) ..... ***L. scintilla***

Key to the genera of the family Gastrodontidae in Missouri

1a. Shell diameter 9 mm or more; aperture with white callus within lip, often visible as an opaque band on the base of the shell ..... ***Ventridens***
1b. Shell diameter less than 9 mm **2**

2a. Embryonic whorl with distinct spiral striae, which continue on later whorls to cut the axial ridges forming coarse granular sculpture; shell diameter less than 2.0 mm ..... ***Striatura***
2b. Embryonic whorl smooth, later whorls without granular sculpture, spiral striae less distinct; shell diameter greater than 4 mm ..... ***Zonitoides***

Key to the species of *Ventridens* in Missouri

1a. Shell shape globose; juveniles without lamella on internal callus ..... ***V. ligera***
1b. Shell shape depressed; juveniles with large lamella on white callus within lip ..... ***brittsi***

Key to the species of *Zonitoides* in Missouri

1a. Shell surface glossy, with weakly sculptured growth wrinkles; diameter 5.0 to 6.3 mm; aperture oval **2**
1b. Shell surface dull, with closely spaced, prominent axial ridges; diameter 4.3 to 5.0 mm; aperture nearly round; rare in Missouri ..... ***Z. limatulus***

2a. Umbilicus smaller (contained 4.5 to 5 times in diameter), evenly expanded throughout; diameter somewhat smaller (4.5 to 6.0 mm); common and widespread in Missouri ..... ***Z. arboreus***
2b. Umbilicus larger (contained about 3.2 times in diameter), abruptly expanded in last whorl; diameter somewhat larger (about 6.3 mm); rare in Missouri, known only from caves and near cave entrances ..... ***Z. kirbyi***

Key to the genera of Euconulidae in Missouri

1a. Umbilicus closed; shell diameter about 1.3 mm ..... ***Guppya***
1b. Umbilicus open; shell diameter 2.4 mm or greater ..... ***Euconulus***

Key to the species of *Euconulus* in Missouri

1a. Immature shell with one to three equally spaced lamellae visible through base of shell (lamellae may be absent in adult shells) ..... ***E. dentatus***
1b. Shell without lamellae **2**

2a. Shape relatively shorter and wider; whorls about 5½, whorls wider in dorsal view; widely distributed in the northern half of Missouri ..... ***E. fulvus***
2b. Shape relatively taller and narrower; whorls 6 or more, whorls narrower in dorsal view; widespread in the southern half of Missouri or known only from fossils **3**

3a. Widespread in the southern half of Missouri ..... ***E. trochulus***
3b. Known in Missouri only from a single fossil record (Hubricht 1964a) ..... ***E. chersinus***

Key to the genera of the family Oxychilidae in Missouri

1a. Shell diameter 9 mm or more **2**
1b. Shell diameter less than 9 mm **3**

2a. Shell strongly depressed; umbilicus wide..... ***Oxychilus***
2b. Shell globose; umbilicus very narrow ..... ***Mesomphix***

3a. Shell with 5 to 7 whorls, with inner whorls very tightly coiled; suture margined..... ***Paravitrea***
3b. Shell usually with less than 5 whorls, and with inner whorls not as tightly coiled; suture margined or not ..... ***Glyphyalinia, Nesovitrea***

Key to the species of *Glyphyalinia* and *Nesovitrea* in Missouri

1a. Umbilicus covered; very rare in Missouri ..... ***G. solida***
1b. Umbilicus open or partially covered..... **2**

2a. Umbilicus very narrow, and partially obscured by leading edge of lip at columella; axial grooves widely and evenly spaced..... **3**
2b. Umbilicus wide open; axial grooves narrowly spaced or irregular **4**

3a. Axial grooves more narrowly spaced (body whorl with about 28 grooves); common and widespread in Missouri ..... ***G. indentata***
3b. Axial grooves more widely spaced (body whorl with about 20 grooves); not yet found in Missouri, but occurs in adjacent counties of Arkansas and Oklahoma ..... ***G. luticola***

4a. Axial grooves irregular throughout; common and widely distributed in Missouri..... ***N. electrina***
4b. Axial grooves irregular on most of shell, but regular and close together near the aperture; relatively rare and known only from southern Missouri..... ***G. wheatleyi***
4c. Axial grooves very regular and close together throughout; very rare in Missouri and known from only two historic records of specimens collected near the entrances of caves..... ***G. lewisiana***

Key to the species of *Mesomphix* in Missouri

1a. Shell surface with dull, pebbly microstructure and traces of ill-defined spiral lines ..... ***M. friabilis***
1b. Shell surface with abundant axial and spiral lines, forming regular pattern of raised papillae; widespread, though uncommon, in southern Missouri ..... ***M. capnodes***
1c. Shell surface with axial growth ridges prominent and regularly spaced; spiral lines very fine; surface with minute granulations; not yet found in Missouri, but occurs in adjacent counties of Arkansas and Tennessee ..... ***M. globosus***

Key to the species of *Paravitrea* in Missouri

1a. Body whorl wide at aperture, more than twice as wide as penultimate whorl, when viewed from above ..... ***P. simpsoni***

1b. Body whorl narrower at aperture, less than twice as wide as penultimate whorl, when viewed from above **2**

2a. Periphery located below the midline of the body whorl; common species in southern Missouri ..... ***P. significans***

2b. Periphery located at or above the midline of the body whorl; species not recorded from Missouri, but occur in bordering counties of Arkansas and Illinois..... **3**

3a. Size smaller, diameter 2.5 to 3 mm; mature shells with one to three rows of lamellae visible through the base of the shell; not recorded from Missouri, but is known from adjacent counties in Arkansas..... ***P. multidentata***

3b. Size larger, diameter about 5.5 mm; mature shells without internal lamellae, young shells rarely with internal lamellae; not recorded from Missouri, but known in bordering counties of Illinois ..... ***P. capsella***

Key to the species of *Oxychilus* in Missouri

1a. Surface glossy; growth lines faint; body relatively narrower at aperture ..... ***O. cellarius***

1b. Surface usually not very glossy; irregular growth lines often well defined especially at the suture; body whorl relatively wider at aperture..... ***O. draparnaudi***

Key to the species of *Deroceras* in Missouri

1a. Border of the breathing pore is darkly colored; size 15 to 30 mm; nucleus on the mantle is located at the left posterior side; slime is clear and watery..... ***D. laeve***

1b. Border of the breathing pore is white; size 35 to 50 mm; nucleus on mantle is on the right of the midline; slime when animal is irritated is milky colored and viscous..... ***D. reticulatum***

Key to the species of *Hawaiia* in Missouri

1a. Umbilicus widely open, inner lip attached to the body whorl outside of the midline of the whorl in ventral view ..... ***H. alachuana***

1b. Umbilicus narrower, inner lip attached to the body whorl inside of the midline of the whorl in ventral view ..... ***H. minuscula***

Key to the species of *Arion* in Missouri

1a. Length about 60 mm extended; color tan, with a dark color band on each side extending onto the mantle, foot fringe yellowish orange ..... ***A. subfuscus***

1b. Slug smaller, length about 30 mm or less extended **2**

2a. Dorsal reticulations display a sharp point when the slug is contracted, color light gray, anteriorly there is a row of black dots just above the pedal groove ..... ***A. intermedius***

2b. Color bluish gray, with a dark median color band and a dark band on each side, foot yellowish orange ..... ***A. hortensis***

Key to the species of Philomycidae in Missouri

1a. Length 75 to 100 mm extended; color gray to brown with two rows of elongated black spots on either side of the dorsal midline..... ***Philomycus carolinianus***

1b. Length usually less than 70 mm extended; color variable, but without dorsal rows of elongated spots **2**

2a. Color gray, sides with dark bands sloping backwards from ventral to dorsal, and attached to a dark band ventrally; there is also a mid-dorsal band with irregular black spots..... ***Megapallifera ragsdalei***

2b. Color brownish, sides either without backwards sloping bands or with bands not attached to a dark band ventrally..... **3**

3a. Length about 20 mm extended; color flesh-colored to whitish, with blackish spots..... ***Pallifera fosteri***

3b. Length extended usually 50 mm or more; color variable..... **4**

4a. Color with distinct darker spots, some spots arranged into irregular back-sloping lines ..... ***Megapallifera mutabilis***

4b. Color marbled, darker pigmented area random, not forming lines or rows ..... ***Pallifera marmorea***

Key to the genera of Polygyridae in Missouri

1a. Shell with one or more brown bands around periphery..... **2**

1b. Shell unicolored **3**

2a. Shell large, umbilicus open, usually with a single, wide color band above the periphery, rarely color bands absent or with many thin bands ..... ***Allogona***

2b. Umbilicus completely closed, usually with several thin color bands above and below the periphery; some individuals without color bands ..... ***Webbhelix***

2c. Umbilicus small in the center, greatly expanded in last ½ whorl (*L. texasiana*, banded form)..... ***Linisa*** (in part)

3a. Aperture slit-like, with parietal lamella and lower lip very narrowly separated; lower lip notched ..... ***Stenotrema, Daedalochila*** in part ***(D. leporina)***

3b. Aperture with parietal lamella and lower lip parallel, but more widely separated; without notch on lower lip ..... ***Euchemotrema***

3c. Aperture rounded or widely open, not slit-like **4**

4a. Umbilicus completely covered..... **5**

4b. Umbilicus open or partially covered..... **8**

5a. Parietal lamella present..... **6**

5b. Parietal lamella absent ..... ***Neohelix, Patera*** **(in part)** ***(P. pennsylvanica)***

6a. Shell globose ..... ***Mesodon*** **(in part)** ***(M. zaletus, M. elevatus)***

6b. Shell moderately or strongly depressed..... **7**

7a. Diameter usually less than 12 mm; outer lip with pair of lamellae separated by a narrow, deep notch; shell moderately depressed (though with lamellae greatly reduced in *I. edentatus*) ..... ***Inflectarius***

7b. Size larger, diameter usually 14 mm or more; outer lip lamellae small or absent, when present, separated by a wide shallow notch; shell strongly depressed ..... ***Xolotrema, Patera*** (in part) ***(P. perigrapta)***

8a. Aperture small, nearly occluded by large parietal and palatal lamellae (*D. jacksoni, D. dorfeuilliana, D. d. sampsoni*) ..... ***Daedalochila (in part)***

8b. Aperture large, not occluded by lamellae **9**

9a. Outer lip without lamellae; umbilicus partially covered; shell globose (*M. thyroidus, M. clausus*) ..... ***Mesodon*** (in part)

9b. Outer lip with two prominent lamellae; umbilicus open; shell depressed or moderately depressed **10**

10a. Parietal lamella blade-like ..... ***Triodopsis***

10b. Parietal lamella triangular, with distinct upper and lower rami (*L. texasiana*, unbanded form ..... ***Linisa*** (in part)

Key to the species of *Daedalochila* in Missouri

1a. Umbilicus partially covered by inner lip; parietal lamella elongate and slender ..... ***D. leporina***

1b. Umbilicus wide open, inner lip attached near middle of body whorl; parietal lamella squarish, triangular or rounded, oriented across aperture of the shell from columella to outer lip attachment **2**

2a. Parietal lamella squarish or rounded; suture of umbilicus visible for ½ turn or more ... **3**

2b. Parietal lamella triangular; suture of umbilicus visible for less than ½ turn **4**

3a Parietal lamella squarish; common and widespread species in southern Missouri ..... ***D. dorfeuilliana***

3b. Parietal lamella rounded; not reported from Missouri, but occurs in northern Arkansas ***D. lithica***

4a. Edge of the parietal callus not elevated at the junction of the upper ramus of the parietal lamella **5**

4b. Edge of the parietal callus elevated in a triangle with highest point at junction of the upper ramus of the parietal lamella ..... ***D. deltoidea***

5a. Umbilicus narrowly open at center; species occurs in southwestern Missouri ***D. jacksoni***

5b. Umbilicus tightly closed at center; species not found in Missouri, but occurs in adjacent counties of Oklahoma ..... ***D. simpsoni***

Key to the species of *Stenotrema* of Missouri

1a. Shell with dense covering of hairs or hair scars **2**
1b. Shell smooth, or with fringe of hairs at sutures and periphery, or with short ridges of periostracal material on upper surface **3**

2a. Embryonic whorls shiny and with thin and widely spaced axial ridges; periostracum with long hairs, about 0.5 mm; size of Missouri shells usually smaller, about 7.5 mm in diameter ..... ***S. barbatum***
2b. Embryonic whorls dull and coarsely granulate, granules sometimes arranged in rows, but not forming distinct axial ridges; periostracum with short hairs, about 0.2 mm; size of Missouri shells usually larger, about 9.5 mm in diameter ..... ***S. stenotrema***

3a. Body whorl angled at the periphery; shape conical; notch of basal lip not protruding ventrally below parietal lamella in lateral view; periostracum on upper surface with short ridges ..... ***S. labrosum***
3b. Body whorl rounded at the periphery; shape depressed-conic; notch of basal lip protruding ventrally, and visible below parietal lamella in lateral view; periostracum smooth ..... ***S. blandianum***

Key to the species of *Euchemotrema* in Missouri

1a. Periphery rounded **2**
1b. Periphery sharply keeled; not found in Missouri, but occurs in adjacent counties of southwestern Illinois ..... ***E. hubrichti***

2a. Size larger, diameter 7.8 to 10.5 mm, umbilicus covered to very slightly perforate; whorls relatively loosely coiled ..... ***E. fraternum***
2b. Size smaller, diameter 6.1 to 9.4 mm; umbilicus partially covered; more tightly coiled **3**

3a. Umbilicus nearly covered or very narrowly open; parietal lamella long and curved toward the umbilicus ..... ***E. leai aliciae***
3b. Umbilicus only slightly covered by lip; parietal lamella short, not prolonged toward the umbilicus ..... ***E. leai leai***

Key to the species of *Mesodon* in Missouri

1a. Umbilicus open or partly covered by reflected lip (very rarely with umbilicus closed) . **2**
1b. Umbilicus closed **3**

2a. Parietal wall usually with small lamella; lip widely reflected and thin along outer edge, reflected surface concave; color brownish; size larger, diameter usually over 18 mm ..... ***M. thyroidus***
2b. Parietal lamella always absent; lip narrowly reflected, and with reflected surface convex; color yellowish; size smaller, diameter usually less than 18 mm ..... ***M. clausus***

3a. Parietal lamella large and curved; shell with 6¾ whorls, and usually with one or two major growth/rest lines stained brownish ..... ***M. elevatus***
3b. Parietal lamella small and straight; shell with 5 to 5¾ whorls, unicolored ..... ***M. zaletus***

Key to the species of *Patera* in Missouri

1a. Shell strongly depressed, with a short high parietal lamella; spiral lines prominent, especially around the umbilicus..... ***P. perigrapta***
1b. Shell depressed-globose, without a parietal lamella; spiral lines present but less distinct..... ***P. pennsylvanica***

Key to species of *Inflectarius* in Missouri

1a. Lip with two well-developed lamellae ..... ***I. inflectus***
1b. Lip with lamellae greatly reduced or absent ..... ***I. edentatus***

Key to the species of *Triodopsis* in Missouri

1a. Size larger, diameter usually greater than 14 mm; found only along the lower Missouri and Meramec rivers and south along the Mississippi River **2**
1b. Size smaller, diameter usually less than 14 mm; found elsewhere in Missouri, and not limited to areas adjacent to the Meramec, Missouri and Mississippi Rivers **3**

2a. Aperture dished in profile view; lip relatively thick; channel behind lip with an arc shaped depression at the position of the outer lip tooth ..... ***T. vulgata***
2b. Aperture flat in profile view; lip relatively thin; channel unmarred behind outer lip tooth..... ***T. discoidea***

3a. Size larger, diameter 11.5 to 14 mm; outer lip lamella squarish and receding or sloping inward..... ***T. neglecta***
3b. Size smaller, diameter 8.5 mm or less..... **4**

4a. Axial ridges prominent on base; outer lip lamella small, triangular and slightly immersed relative to outer lip margin, but not receding; umbilicus larger, contained about 6.5 times in shell diameter; introduced species, known in Missouri only in St. Louis City ..... ***T. hopetonensis***
4b. Axial ridges diminished on base; outer lip lamella wide and immersed relative to outer lip margin; umbilicus smaller, contained about 7.5 times in shell diameter; known in Missouri only from the southwestern quarter ..... ***T. cragini***

Key to the species of *Xolotrema* in Missouri

1a. Periphery rounded; known from Missouri **2**
1b. Periphery of shell keeled; not known from Missouri, but occurs in adjacent counties of Tennessee ..... ***X. obstrictum***

2a. Surface without papillae; widespread and common species in Missouri..... ***X. fosteri***
2b. Surface with close-set papillae bearing stiff hairs; rare in Missouri..... ***X. denotatum***

Key to the species of *Neohelix* in Missouri

1. Shell diameter 20 to 31 mm; aperture with upper and lower lip dissimilar, basal lip with a thickening or low lamella on the columellar end ..... ***N. alleni***
2. Shell diameter is 14.5 to 17.0 mm; aperture elongate "D"-shaped, with upper and lower margins similarly shaped, without thickening in basal lip..... ***N. divesta***

GLOSSARY

Algific—North-facing talus slopes cooled by cold air flows from ice caves or sinkholes.

Axial striae—Striations, or ribs, crossing a whorl.

Buttress—A thickening spanning the space between the parietal lamella and the insertion of the outer lip.

Clade—A grouping of organisms defined by derived (as opposed to primitive) characteristics, and represents a natural unit in evolutionary history that shares a common ancestor.

Columella—A calcareous column in the center of most shells.

Concentric—Having a common center.

Corneous—Resembling horn.

Epiphragm—A temporary cover of dried or calcified mucus over the opening of a shell, secreted to reduce moisture loss. Also see **operculum**.

Eocene—One of the Epochs of the Cenozoic Era from 58 to 37 million years before present.

Globose—Rounded, almost spherical.

Imperforate—Said of shells whose umbilicus is closed by a calcareous pad or reflected lip.

Lamella—Thin or raised layer of shell material, which forms toothlike structures.

Loess—A fine grained yellowish brown loam present in glacial water, deposited along major waterways where it becomes wind deposited on the side of the river opposite the prevailing wind.

Mantle—Outer soft fold of integument next to shell of mollusks, and/or a soft tissue layer covering a part or most of the body of a slug.

Mesozoic—The Era containing the Triassic, Jurassic, and Cretaceous periods from 245 to 66 million years before present.

Margined Suture—Suture with a thickened band visible through translucent shell material.

Miocene—An Epoch of the Tertiary Period from 37 to 24 million years before present.

Operculum—A corneous plate closing the aperture in some shells.

Parietal—The inside wall of the shell aperture.

Parietal callus—A thin calcareous layer deposited on the parietal wall as the snail grows.

Parietal lamella—A lamella formed by a deposit on the body whorl.

Paleocene—An Epoch of the Tertiary Period from 66 to 58 million years before present.

Perforate—Shells having an open umbilicus.

Peristome—The lip bordering the aperture.

Pleistocene—An Epoch of the Quaternary Period from 2.6 million to 10,000 years before present.

Pliocene—An Epoch of the Tertiary Period from 5 to 2 million years before present.

Radula—A rasp-like organ used in feeding.

Rimate—Said of shells with a minute, slit-like opening of the umbilicus.

Spiral striae—Striations parallel to whorls.

Solid—Shell strong, sturdy, not fragile.

Striae—Lines, grooves, ridges or ribs seen on whorls.

Sulcus—Shallow furrow behind the shell lip.

Suture—Line of contact between two whorls.

Teeth—Used by some authors to describe the lamellae that are found around or within the aperture of some snails; however, in this text the term is limited to structures of the mouthparts (radula).

Umbilicus—Basal depression in center of some spiral shells formed as the whorl grows round and round. It may be open to the first whorl at the apex, or may be closed by a callus.

LITERATURE CITED

Ameel, D. J. 1938. Observations on the natural history of *Pomatiopsis lapidaria Say. American Midland Naturalist*, 19: 702–705.

Anderson, F. E. and D. A. Smith. 2005. A Redescription of the carinate pillsnail, *Euchemotrema hubrichti* (Pilsbry, 1940) (Pulmonata: Polygyridae), with notes on habitat and genetics. *Zootaxa*, 807:1–11.

Armbruster, G. and M. Schlegel. 1994. The land-snail species of *Cochlicopa* (Gastropoda: Pulmonata: Cochlicopidae): presentation of taxon-specific allozyme patterns, and evidence for a high level of self-fertilization. *Journal of Zoological Systematics and Evolutionary Research*, 32: 282–296.

Atkinson, J. W. 1998. Food manipulation and transport by a carnivorous land snail, *Haplotrema concavum. Invertebrate Biology*, 117(2): 109–113.

Baker, F. C. 1939. *Fieldbook Illinois Land Snails*. Illinois Natural History Survey Manual Series 2.

Barker, G. M., Ed. 2004. *Natural Enemies of Terrestrial Molluscs*. CABI Publishing, Oxford, UK. 644 pp.

Barnhart, M. C. 1979. Notes on the winter epiphragm of *Pupoides albilabris. Veliger*, 21: 400–401.

Barnhart, M. C. 1983. Gas permeability of the epiphragm of a terrestrial snail, *Otala lactea. Physiological Zoology*, 56: 436–444.

Barnhart, M. C. 1989. Evaporative water loss from minute terrestrial snails (Pulmonata, Pupillidae). *Veliger*, 32: 16–20.

Blinn, W. C. 1963. Ecology of the land snails *Mesodon thyroidus* and *Allogona profunda. Ecology*, 44(3): 498–505.

Boss, K. J. 1974. Oblomovism in the Mollusca. *Transactions of the American Microscopical Society* 93: 460–481.

Bouchet, P. and J.-P. Rocroi. 2005. Classification and Nomenclator of Gastropod Families. *Malacologia*, 47: 1–397.

Burch, J. B. 1962. *How to Know the Eastern Land Snails*. Wm. C. Brown Company Publishers. Dubuque, Iowa, pp. 1–214.

Burch, J. B. and Y. Jung. 1988. Land snails of the University of Michigan Biological Station area, *Walkeriana*, no. 9, pp. 1–177.

Burch, J. B. and A. S. Van Devender. 1980. Identification of eastern North American land snails: The Prosobranchia, Opisthobranchia and Pulmonata (Actophila). *Walkerana*, 1: 33–80.

Cameron, R. 2008. *Land snails in the British Isles*, Field Study Council (FSC), Occasional Publication no. 79, pp. 1–84.

Chase, R. and Blanchard, K. C. 2006. The snail's love-dart delivers mucus to increase paternity. *Proceedings of the Royal Society, Biological Sciences*, 273(1593): 1471–1475.

Chichester, L. F. and L. L. Getz. 1973. The terrestrial slugs of Northeastern North America. *Sterkiana*, No. 51: 11–42.

Clench, W. J. 1965. Note on *Gastrocopta tappaniana* (C. B. Adams). *Nautilus*, 78(3): 106–107.

Coles, B. F. & G. Walsh. 2006. *Daedalochila* sp. nov. from northwest Arkansas, U.S.A., the anatomy of the *Polygyra plicata* group, and the validity of the genus *Millerelix* Pratt, 1981 (Gastropoda: Pulmonata: Polygyridae), *American Malacological Bulletin*, 21: 99–112.

Crabb, Ed. D. 1928. A predatory *Polygyra. Nautilus*, 42(1): 35–36.

Delaney, K. and A. Gelperin. 1986. Post-ingestive food-aversion learning to amino acid deficient diets by the terrestrial slug *Limax maximus. Journal of Comparative Physiology*, 159(3): 281–295.

De Voe, C. 1904. *Legends of the Kaw. The Folklore of the Indians of the Kansas River Valley.* Franklin Hudson Publishing Co, Kansas City, MO, 215 pp, 8 pls.

Dourson, D. and J. Dourson. 2006. *Land Snails of the Great Smoky Mountains National Park (Eastern Region).* Appalachian Highlands Science Learning Center. 60 pp.

Emberton, K. C. 1988. The genitalic, allozymic, and conchological evolution of the eastern North American Triodopsinae (Gastropoda; Pulmonata: Polygyridae). *Malacologia* 28(1–2): 159–273.

Emberton, K. C. 1991. The genitalic, allozymic and conchological evolution of the tribe Mesodontini (Pulmonata: Stylommatophora: Polygyridae). *Malacologia*, 33(1–2): 71–178.

Emberton, K. C. 1995a. When shells do not tell: 145 million years of evolution in North America's Polygyrid land snails, with a revision and conservation priorities. *Malacologia*, 37 (1): 69–109.

Emberton, K. C. 1995b. Land-snail community morphologies of the highest-diversity sites of Madagascar, North America and New Zealand, with recommended alternatives to height diameter plots. *Malacologia*, 36(1–2): 43–66.

Evans, J. G. 1972. *Land Snails in Archaeology, with Special Reference to the British Isles. Studies in Archaeological Science*. Seminar Press, London and New York. 476 pp.

Ewell, A. S. & M. J. Ulmer. 1971. Notes on the Biology of Anguispira alternata (Stylommatophora: Endodontidae). *Malacologia*, 11(1): 199–215.

Fairbanks, H. L. 1990. Morphological comparisons of the species of Megapallifera (Gastropoda: Philomycidae). *Nautilus*, 104(2): 71–75.

Frest, T. J. and L. P. Fay 1981. *Vertigo meramecensis* (Pulmonata: Pupillidae) from the Niagaran escarpment, Iowa. *Nautilus*, 95(1): 33–37.

Frest, T. J., and J. R. Dickson. 1986. Land snails (Pleistocene/recent)of the Loess Hills: A preliminary survey. *Proceedings of the Iowa Academy of Science* 93: 130-157.

Fullington, R. W. 1974. Two new land gastropods from Texas (*Zonitoides* and *Stenotrema*). *Nautilus*, 88(4): 91–93.

Gardner, J. E. 1986. Invertebrate fauna from Missouri caves and springs. *Missouri Department of Conservation, Natural History Series*, No. 3.

Gelperin, A. 1975. Rapid food-aversion learning by a terrestrial mollusk. *Science*, 189(4202): 567–570.

Gelperin, A. 2002. Invertebrate learning: Associative learning in Limax. In: *Learning and Memory*, 2nd. Edition, Ed. J. Byrne, Macmillan Pub. Co., NY, pp. 281–287.

Goodfriend, G.A. 1992. The use of land snail shells in paleoenvironmental reconstruction. *Quaternary Science Reviews*, 11: 665–685.

Greger, D. K. 1933. [as summarized on pages 47–49 in La Rocque. 1963. Late Cenozoic nonmarine molluscan associations in eastern North America. *Sterkiana*, No. 11, pp. 1–50].

Hambach, G. 1890. A preliminary catalogue of the fossils occurring in Missouri. *Missouri Geological Survey Bulletin*, 1: 60–85.

Hammond, R. B., A. Michel, and J. B. Eisley. 2009. Slugs on Field Crops. *Fact Sheet, Agriculture and Natural Resources*, FC-ENT-0020-09, The Ohio State University Extension, 5 pp.

Harper, A. B., 1988. *The Banana Slug*. Bay Leaves Press, Aptos California, pp. 1–32.

Harry, H. W. 1997–1998. *Carychium exiguum* (Say) of Lower Michigan: morphology, ecology, variation and life history (Gastropoda, Pulmonata). *Walkerana*, 9(21): 1–104.

Horsák, M., J. Šteffek, T. Čejka, V. Ložek and L. Juřičková. 2009. Occurrence of *Lucilla scintilla* (R.T. Lowe, 1852) and Lucilla singleyana (Pilsbry, 1890) in the Czech and Slovak Republics with remarks how to distinguish these two non-native minute snails. *Malacologica Bohemoslovaca*, 8: 24–27.

Hubricht, L. 1938. Mollusca of the Missouri Botanical Garden Arboretum. *Missouri Botanical Garden Bulletin*, 26: 57–58.

Hubricht, L. 1941. The cave Mollusca of the Ozark Region. *Nautilus*, 54(4): 111–112.

Hubricht, L. 1951a. Three new land snails from eastern United States. *Nautilus*, 65(2): 57–59.

Hubricht, L. 1951b. The Limacidae and Philomycidae of Pittsylvania County, Virginia. *Nautilus*, 65(1): 20–22.

Hubricht, L. 1961. Eight new species of land snails from the southern United States. *Nautilus*, 75(2): 60–64.

Hubricht, L. 1962. New species of *Helicodiscus* from the eastern United States. *Nautilus*, 75(3): 102–107.

Hubricht, L. 1963a. *Carychium exile* and *Carychium exiguum*. *Nautilus*, 76(3): 108–109.

Hubricht, L. 1963b. Notes on the genus *Discus*. *Nautilus*, 77(2): 62–63.

Hubricht, L. 1963c. Some Succineidae, with a new species. *Nautilus*, 74(4): 135–138.

Hubricht, L. 1964a. Some Pleistocene land snail records from Missouri and Illinois. *Sterkiana*, 13: 7–17.

Hubricht, L. 1965a. Notes on Zonitidae. *Nautilus*, 78(4): 133–135.

Hubricht, L. 1965b. Four new land snails from the southeastern United States. *Nautilus*, 79(1): 4–7.

Hubricht, L. 1966. Four new land snails. *Nautilus*, 80(2): 53–56.

Hubricht, L. 1969. *Succinea bakeri* Hubricht. *Nautilus*, 85(2): 42–43.

Hubricht, L. 1972a. *Gastrocopta armifera* (Say). *Nautilus*, 85(3): 73–78.

Hubricht, L. 1972b. Land snail records from Missouri. *Sterkiana*, no. 45, pp. 34–35.

Hubricht, L. 1974. A review of some land snails of the eastern United States. *Malacological Review*, 7: 33–34.

Hubricht, L. 1976. Notes on some land snails of the eastern United States. *Nautilus*, 90 (3): 104–107.

Hubricht, L. 1985. The distributions of the native land mollusks of the Eastern United States.*Fieldiana, Zoology, New Series*, No. 24, i–viii, pp. 1–191.

Huey, L. M. 1936. Succinea carried by a bird. *Nautilus*, 50(1): 31.

Kerney, M. P. & R. A. D. Cameron. 1979. *A field guide to the land snails of Britain and northwest Europe*. Collins, London, pp. 1–287, 23 plates.

Koester, J. and J. H. Byrne, eds. 1981. *Molluscan Nerve Cells: From Biophysics to Behavior*. Cold Spring Harbor Laboratory. 230 pp.

Leonard, A. B. 1959. Handbook of Gastropods in Kansas. *University of Kansas, Department of Zoology, State Biological Survey*, Misc. Pub., no 20, pp. 1–224, pl. 1–11.

Lewis, M. 1814. *The Lewis and Clark Expedition*. J. B. Lippincott Company, Philadelphia and New York. 3 vols. vii + 899 pp.

Lowe, R. T. 1852. Brief diagnostic notices of new Maderan land shells. *Annals and Magazine of Natural History*, series 2, volume 9: 112–120, 275–279.

Maze, R. J and Johnstone, C. 1986. Gastropod intermediate hosts of the meningeal worm *Parelaphostrongylus tenuis* in Pennsylvania: observations on their ecology. *Canadian Journal of Zoology* 64(1): 185–188.

MDNR. 2006. Whitewater South Fork, Addendum. Resource Management Plan, *Minnesota Department of Natural Resources*. 8 pp.

Miles, C. D. and R. L. Reeder. 1969. Preliminary report on the distribution of land snails in northern Missouri. *Annual Report of the American Malacological Union*, pp. 40–42.

Nekola, J. C. 1999. Terrestrial gastropod richness of carbonate cliff and associated habitats in the Great Lakes Region of North America. *Malacologia*, 41(1): 231–252.

Nekola, J.C. & B.F. Coles. 2001. Systematics and ecology of *Gastrocopta (Gastrocopta) rogersensis* (Gastropoda: Pupillidae), a new species from the midwest of the United States of America. *The Nautilus*. 115:105-114.

Nekola, J. C. 2003a. Terrestrial gastropod fauna of Northeastern Wisconsin and the Southern Upper Peninsula of Michigan. *American Malacological Bulletin*, 18: 21–44.

Nekola, J. C. 2003b. Large-scale terrestrial gastropod community composition patterns in the Great Lakes Region of North America. *Diversity and Distributions*, 9: 55–78.

Nekola, J.C. 2004. Terrestrial gastropod fauna of northeastern Wisconsin and the southern Upper Peninsula of Michigan. *American Malacological Bulletin*. 18:21-44

Nekola, J. C. 2005. Geographic variation in richness and shell size of eastern North American land snail communities. *Records of the Western Australian Museum*, Supplement no. 68, pp. 39–51.

Nekola, J. C. and M. Barthel. 2002. Morphometric analysis of Carychium exile and Carychium exiguum in the Great Lakes Region of North America. *Journal of Conchology*, 37(5): 515– 530.

Neuckel, W. 1985. Anal uptake of water in terrestrial pulmonate snails. *Journal of Comparative Physiology B: Biochemical, Systemic, and Environmental Physiology*, 156(2): 291–296.

Nigh, T.A. and W.A. Schroeder. 2002. *Atlas of Missouri ecoregions*. Missouri Department of Conservation, Jefferson City.

Örstan, A. 2006. Rearing terrestrial Gastropoda. Pp. 287–293 In: C. F. Sturm, T. A. Pearce, and A. Valdés. (Eds.) *The Mollusks: A Guide to Their Study, Collection, and Preservation*. American Malacological Society.

Pearce, T. A. and A. Örstan. 2006. Terrestrial Gastropoda. pp. 261–285, in C. F. Sturm, T. A. Pearce, and A. Valdés. (Eds.) *The Mollusks: A Guide to Their Study, Collection, and Preservation*. American Malacological Society, pp. 1–445.

Pearce, T. A., M. C. Fields and K. Kurita. 2007. Discriminating shells of *Gastrocopta pentodon* (Say, 1822) and *G. tappaniana* (C. B. Adams, 1842) (Gastropoda: Pulmonata) with an example from the Delmarva Peninsula, eastern USA, *Nautilus*, 121(2): 66–75.

Pilsbry, H. A. 1916. Mid-Pacific Land Snail Faunas. *Proceedings of the National Academy of Sciences*, 2: 429–433.

Pilsbry, H. A. 1940. *Land Mollusca of North America (North of Mexico)*. The Academy of Natural Sciences Philadelphia. Vol. I, Part 2, pp. 575–994.

Pilsbry, H. A. 1946. *Land Mollusca of North America (North of Mexico)*. The Academy of Natural Sciences Philadelphia. Vol. II, Part I, pp. 1–520.

Pilsbry, H. A. 1948. *Land Mollusca of North America (North of Mexico)*. The Academy of Natural Sciences Philadelphia. Vol. II, Part 2.

Platt, T. R. 1989. Gastropod intermediate hosts of *Parelaphostrongylus tenuis* (Nematoda: Metastrongyloidea) from northwestern Indiana. *Journal of Parasitology*, 75(4): 519–523.

Prior, D. J., Hume, M., Varoa, D. and Hess, S. D. 1983. Physiological and behavioral aspects of water balance and respiratory function in the terrestrial slug, *Limax maximus*. *Journal of Experimental Biology*, 104: 111–127.

Ramsden, C. T. 1913. Land shells carried by birds. *Nautilus*, 27(7): 71–72.

Roberts, L. and J. Janovy Jr. 2000. *Foundations of Parasitology, 6th edition*. McGraw-Hill. 670 pp.

Rossman, D. A. and P. A. Myer. 1990. Behavioral and morphological adaptation for snail extraction in the North American brown snake (genus *Storeria*). *Journal of Herpetology*, 24(4): 434–438.

Roth, B. 1987. Identities of two Californian land Mollusks described by Wesley Newcomb. *Malacological Review*, 20: 129–132.

Roth, B. 2003. *Cochlicopa* Férussac 1821 not *Cionella* Jeffreys 1829; Cionellidae Clessin 1879 not Cochlicopidae Pilsbry 1900 (Gastropoda: Pulmonata: Stylommatophora). *Veliger*, 46(2): 183–185.

Roth, B. and P. S. Sadeghian. 2003. Checklist of the Land Snails and Slugs of California. Santa Barbara Museum of Natural History, *Contributions in Science*, no. 3, pp. 1–81.

Rowley M. A., Loker E. S., Pagels J. F. and Montali R. J. 1987. Terrestrial gastropod hosts of *Parelaphostrongylus tenuis* at the National Zoological Park's Conservation and Research Center, Virginia. *Journal of Parasitology*, 73(6): 1084–9.

Sampson, F. A. 1913. A preliminary list of the Mollusca of Missouri (exclusive of the Unionidae). *Transactions of the Academy of Science of St. Louis*, 12(3): 67–108.

Smith, L. H. 1981. Quantified aspects of pallial fluid and its effect on the duration of locomotor activity in the terrestrial gastropod *Triodopsis albolabris*. *Physiological Zoology*, 54: 407–414.

Solem, G. A.1974. *The Shell Makers: Introducing Mollusks*. Wiley & Sons, New York, 289 pp.

Solem, G. A. 1986. A collector's tale. *Field Museum of Natural History Bulletin*, 57(6) 22–25.

Swallow, G. C. 1855. *Second Annual Report of the Geological Survey of Missouri*, James Lusk, Jefferson City, Missouri, p. 215.

Symondson, W. O. C. 2004. Coleoptera (Carabidae, Staphylinidae, Lampyridae, Drilidae and Silphidae) as predators of terrestrial gastropods. In: *Natural Enemies of Terrestrial Molluscs*. pp. 37–84. CABI Publishing, Oxford, UK. 644 pp.

Taylor, D. W. 1960. *Late Cenozoic Molluscan Faunas from the High Plains*. Geological Survey Professional Paper 337, Washington, U. S. Government Printing Office, pl. 1–4, pp 1–94.

Theler, J. L. 2000. Archaic escargot: A consideration of evidence for snails as a human food source at Modoc Rock Shelter, Illinois. In: Mounds, Modoc, and Mesoamerica: Papers in Honor of Melvin L. Fowler, edited by S.R. Ahler, pp. 39–55. *Illinois State Museum Scientific Papers*, vol. 28. Springfield.

Thom, R. H. and J. H. Wilson 1980. The natural divisions of Missouri. *Transactions of the Missouri Academy of Science*, 14: 9–23.

Turgeon, D. D., J. F. Quinn, Jr., A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P.M. Mikkelson, R. J. Neves, C. F. E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F. G. Thompson, M. Vecchione, and J. D. Williams. 1998. *Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks*, 2nd edition. American Fisheries Society, Special Publication 26, Bethesda, MD, 509 pp.

Vagvolgyi, J. 1968. Systematics and evolution of the genus Triodopsis (Mollusca: Pulmonata: Polygyridae). *Bulletin of the Museum of Comparative Zoology*, 136(7): 145–254.

van der Schalie, H. 1939. *Hendersonia occulta* (Say) in Michigan; its distribution, ecology, and geological significance. *Occasional papers of the Museum of Zoology No. 399, Univ. of Mich. Press*, Ann Arbor, MI. 9 pp.

van der Schalie, H. and L. L. Getz. 1961. Comparisons of adult and young Pomatiopsis cincinnatiensis (Lea) in respect to moisture requirements. *Transactions of the American Microscopical Society*, 80: 211–220.

Van Devender, A. S. 1979. A new Vertigo (Pulmonata: Pupillidae) from the Ozarkian uplift. *Nautilus*, 93: 2–3.

Webb, G. R. 1950. New and neglected Philomycids and the genus *Eumelus* Rafinesque (Mollusca, Gastropoda, Pulmonata). *Transactions of the American Microscopical Society*, 69(1): 54–63.

Webb, G. R. 1953. Anatomical studies on some Midwestern Succinidae and two new species. *Journal of the Tennessee Academy of Science*, 28(3): 213–220.

Wu, Shi-Kuei, Ronald D. Oesch and Mark E. Gordon, 1997. Missouri aquatic snails. *Missouri Department of Conservation, Natural History Series*, No. 5, 97 pp.