



*Land Snails*  
of the  
*Great Smoky Mountains*  
(Eastern Region)



## Make a Difference

For a moment, consider our earth and its life-giving gifts of air, water, and sustenance.

Our spiritual and integral relationship to the world surrounding our everyday lives is often taken for granted. Rivers have become gutters of spoil, mountaintops islands of demise, the forests and oceans a place we pillage. The decisions we as a species make every day, singly or collectively can have far reaching consequences. We must all think in terms of how our every action, from flushing our toilets to the foods we eat, affects our planet and the life force within it. Our world is not infinite but a place of boundaries. Clearly, our species has pushed many of these boundaries and beyond. At the very least, each of us can make a difference by changing one deed that instead honors these boundaries. Eat locally or organically grown food. Plant a garden. Create a compost for biodegradable refuse and use it to fertilize garden plants. Conserve water. Plant trees which help reduce greenhouse gases. Use compact florescent bulbs in your home and business. Buy cleaning agents, paints, and preservatives that are environmentally friendly. Recycle. Conserve gas by consolidating trips. Support “green” companies. Consider ways to incorporate alternative energy into your lifestyle. Look for opportunities in your relationships, both private and in business, to promote environmental awareness. And most importantly, make it a point to teach our children about the natural world, for they are the future.

~Dan & Judy 2006



# Land Snails of the Great Smoky Mountains (Eastern Region)

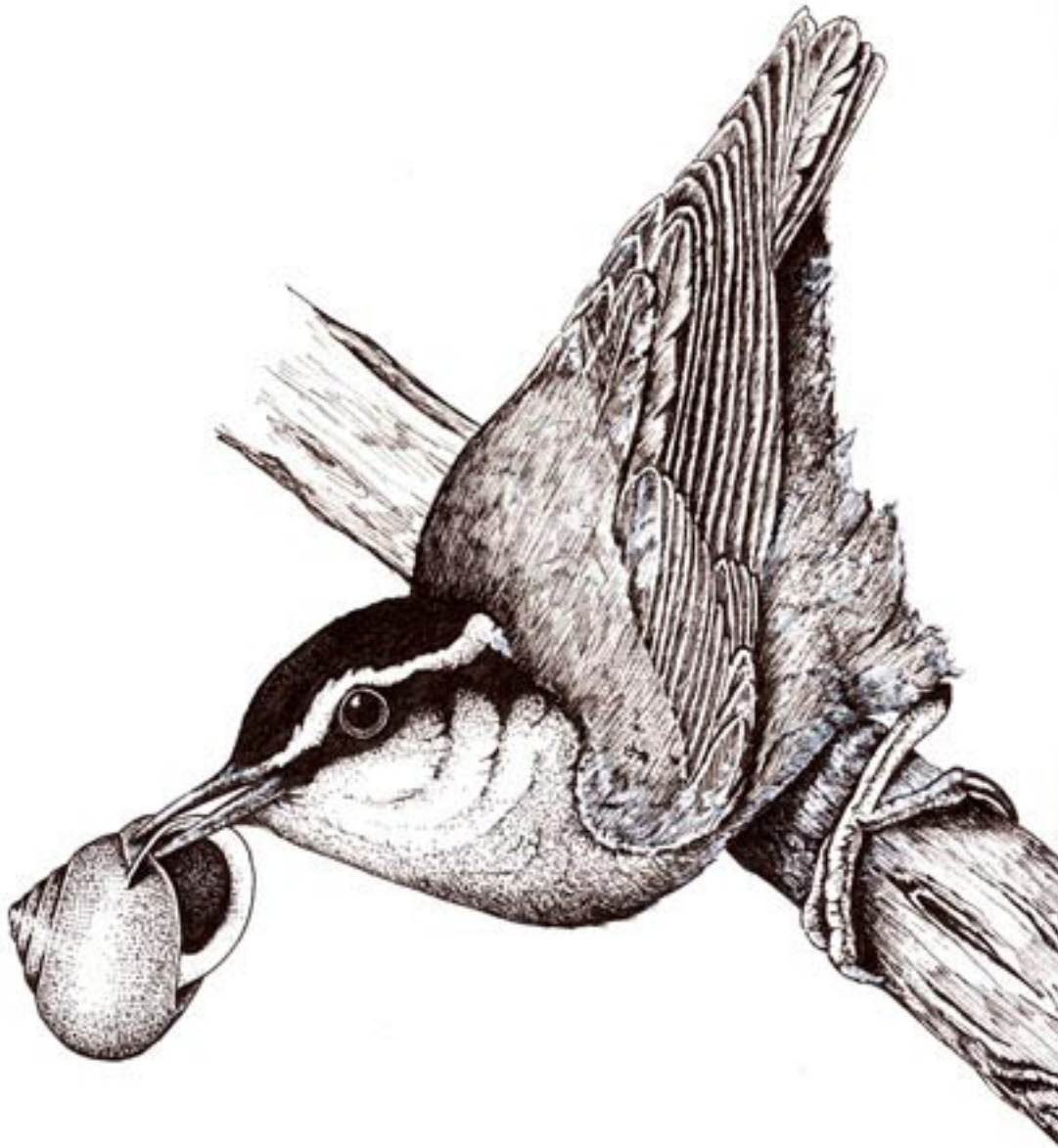
Dan Dourson  
Judy Dourson

*Illustrations and photos by Dan Dourson  
unless otherwise stated*

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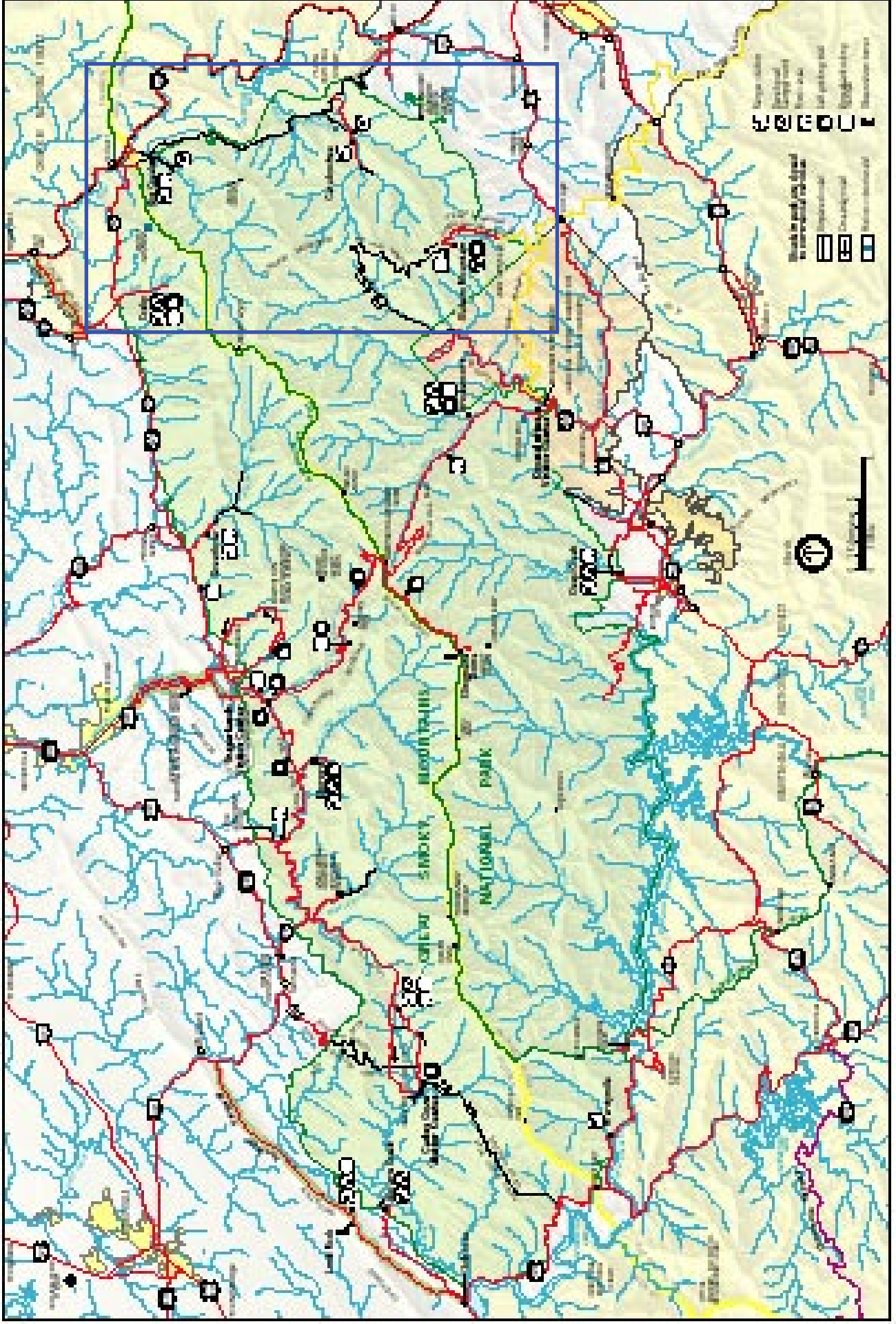
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## Map of Area

### *Land Snails of the Great Smoky Mountains (Eastern Region)*

Area covered by this book falls within the blue rectangle





## Introduction

Terrestrial gastropods or land snails are members of the Phylum MOLLUSCA, a large and diverse group with almost 100,000 described species worldwide. In eastern North America, 500 native land snails have been documented. Over 140 species occur in the Great Smoky Mountains National Park, some of which are found nowhere else. The majority of snails in the Smokies have shells that are rigid, primarily composed of calcium carbonate. One species, *Vitrinizonites latissimus*, has a flexible shell composed mainly of proteins. The least known terrestrial gastropods occurring in the park are the slugs. Contrary to popular belief, slugs are not snails that have crawled out of their shells. Instead, the shells of slugs are either undeveloped in the mantle or absent entirely.

Snail identification is often a study in subtlety; a world of intricate patterns and design where the difference between species may be fine, faint spiral lines or minute papillae. Hairs or bristles cover some shells while other shells have glass-like surfaces. The majority of shells are distinct with discernible variations even in species that are less than 2 mm in size. Occasionally, genital dissection or DNA analysis may be necessary to identify snails to a species level. The identification of slugs can often prove difficult due to variations in color patterns, sometimes within the same species.

***Land Snails of the Great Smoky Mountains National Park (Eastern Region)* is an annotated guide to the 80 species of terrestrial mollusca that have been documented thus far in this region of the park or that likely occur.** It also contains detailed information regarding soft anatomy, basic shell characteristics, snail predators, reproduction, feeding habits, and habitat likely to yield land snails.

Species accounts contain the following information: scientific name, common name, width or height, description, similar species, habitat, and status. Species of special interest including species of rare status or unusual range/habitat extensions are highlighted in blue. For most species described, there are two standard images: side and bottom which are generally the best diagnostic views of most shells. The top view is included for some species.

## Importance of Land Snails

In the past, the importance of land snails and their relationship to a variety of higher order organisms has largely been ignored. Live snails and their shells provide a food source and calcium supplement to a variety of animals. Many small mammals such as shrews and mice include land snails in their diet. Several species of salamanders including the terrestrial form of *Notopthalmus viridescens*, the red eft, are known to consume small snail species. Two North Carolina state records for land snails, *Vallonia excentrica* and *Cionella lubrica*, were recovered from examining fecal matter of the red eft. (Van Devender and Van Devender 2003). Wild turkey and grouse as well as a variety of song birds also consume snails. The calcium carbonate in snail shells is a critical supplement to female birds developing their eggs or during nesting when parents provide supplemental calcium to growing young (Hames 2002). Several European studies have equated declining bird populations with disappearing land snails as a result of acid rain.

## Impacts to Native Land Snails

Native land snail declines during the past century have been attributed to a variety of threats including the loss of indigenous habitats as a result of urban sprawl and other land changing activities, acid precipitation and the expansion of exotic gastropods such as Limacidae, Arionidae and Helicidae. Non native snails may also be carriers of potentially harmful diseases to our native wildlife.

In the Cades Cove area of the Great Smoky Mountain National Park, a surplus of deer has severely damaged the herbaceous ground cover up to around six feet in surrounding forests. Leaf and duff layers are present, but common wildflower species are not. In this area, live snails and shells are largely scarce, even around caves and outcrops of limestone where many species are typically found.

Mt. Airy Forest in Cincinnati, Ohio may be suffering a similar loss of snail fauna, though not as a result of an overpopulation of deer. Signs of exotic earthworm infestations are evident with leaf and duff layers largely absent in many of the fringe areas of the forest, leaving only exposed bare soil. The microbe and fungi cycles that are responsible for the break down of organic matter into essential elements such as nitrogen, phosphorous, and calcium are severely altered without the duff layers. Since land snails are dependent on calcium for shell production, this calcium depletion may adversely affect land snail populations within the affected forest community. Once these exotic earthworms are introduced, it takes a relatively short amount of time for them to wreak havoc on the whole layer of leaf litter. Within a matter of three to five years, they can consume a whole layer of organic matter affecting the organisms that reside there. Native macro invertebrates, salamanders, frogs, small mammals, and herbaceous plants are negatively impacted (Lee 1985). The authors have searched these duffless landscapes at Mt. Airy Forest for native land snails with very little success in locating either live individuals or their shells. Generally, the only snail found is *Cepaea nemoralis*, itself an exotic snail invader from central and western Europe.

Logs provide land snails protective cover from predation, moist habitats during droughts, food sources, and for many species, an area to lay eggs. Forest fires, another threat, kill large numbers of land snails that reside under the leaf litter. However, live snails often survive under rocks, moist depressions created from uprooted trees, and logs that provide a moist refuge from the intense heat and fire. These protected islands of unburned habitat are likely important for the maintenance of populations and recolonization of burned-over forest environments.

The long-term effects of these forest changes on land snail viability is unknown and in most areas unstudied. There are likely species of snails that can be used to determine the quality of forest habitat, much in the same way that freshwater mussels are used to determine the quality of a stream. For example, *Philomycus venustus*, *Xolotrema denotatum*, and *Vitrinizonites latissimus* are species largely found in quality habitat.

Land snails can be considered one of the many building blocks for the ecosystems in which they reside; providing not only a food source but accessibility to calcium, often a rare commodity in the southern Appalachian Mountains.



# Collecting Land Snails

## Selecting sites to survey

When surveying for land snails, there are specific habitats that should be targeted in order to comprehensively cover an area. These habitats include: under leaf litter, rocks, and logs; under exfoliating bark of standing and/or down dead trees; hollow trees like American beech and sycamore; damaged trees oozing sap; under and on top of caps of fungi; under moss mats and the flaps of rock tripe; base of black walnut trees; crotches of trees; any human constructed feature, including steep banks, retaining walls, cement structures, bridge abutments, spring houses, discarded bottles or other discarded refuse; cliffline features, caves and rock talus.

The natural behavior of land snails can be observed best during warm, rainy nights when snails are most active, midspring to early summer, when nighttime temperatures are 60 degrees or above.

## Materials List for Collecting in the Field:

- o Ziploc bags
- o Permanent marker
- o GPS unit
- o Field notebook
- o Hand lens
- o Quart-size drying bags



## Collecting Methods

### Macro Snails

Samples of larger (macro) specimens from 5mm and greater should be collected and placed in Ziploc bags with date, site number, GPS coordinates, and collector name written in permanent marker on the bag.

### Micro Snails

Samples of smaller (micro) specimens from 4mm or less are best collected from leaf/soil collections. Sites that yield increased numbers of snails include the base of black walnut and butternut trees, the base of large mature hardwood trees, tree crotches and leaf litter along the edges of seeps. Optimal sites that tend to yield the most land snails can be determined by collecting a handful of soil/leaf litter then scanning the litter with a hand lens for evidence of micro specimens. If any snails are observed, a quart-sized cotton drying bag is filled with the material from the site, labeled with the date, site number, collector's name and GPS coordinates. These leaf samples are taken back to the lab and dried for approximately two weeks. Dried samples should be sifted through a series of sieves ranging from 4.76 mm down to 500 micrometers. The subsequent debris that remains after this sifting process is then searched with the aid of an Optivisor or other magnification device. It will be necessary to use a zoom microscope to determine the species of these small snails. Many of them have microscopic ornamentation that can only be seen under high magnification.

## Collection of Live Specimens

Generally it is not necessary to collect live specimens due to the abundance of dead shells. If live snails are collected for the purpose of anatomy work, it is necessary to euthanize them in water for 24 hours so that they relax, then place them in a solution of at least 85% (or higher) ethyl alcohol.

*Most states and federal agencies like the US Forest Service and National Park Service require permits for collecting. Check with your local agencies prior to collecting, particularly on public lands.*

## Diet

Land snails are known to consume a wide variety of food. While predominantly considered herbivores, there are snails like *Haplotrema concavum*, as well as some *Ventridens* and *Mesomphix* species that hunt and eat other snails. Food sources can include tree sap, most species of fungi, lichens, and a variety of vegetation. Snails use a special organ, the radula, which acts as a rasp, to obtain food. Many species of land snails are known to glean much needed calcium from the empty shells of other land snails.



*Triodopsis* feeding on mushroom



*Anguispira jessica* feeding on the sap of sugar maple from holes created by the yellow-bellied sapsucker



*Stenotrema* gleaning calcium from empty shell



*Triodopsis* feeding on mold growing from wood rat guano



*Triodopsis* feeding on crustose lichen



## Reproduction



*Copulating Mesomphix inornatus*

Land snails are functional hermaphrodites, with each individual having two sets of sex organs; testes, sperm and penis; ovaries, eggs, an oviduct and a pouch or receptacle for holding in reserve the sperm of another individual. In rare cases, self-fertilization is possible but normally mating is between two individuals of the same species. Egg-laying follows in various locations including under logs and deep moist leaf litter.



**Snail eggs**

Another unusual, yet interesting aspect of snail reproduction occurs when species of the genus *Philomycus* eject calcareous “love darts” into their mates to stimulate copulation. Cupid does exist, if only in the world of land snails!



*Philomycus flexuolaris*

R. Tucker Abbott

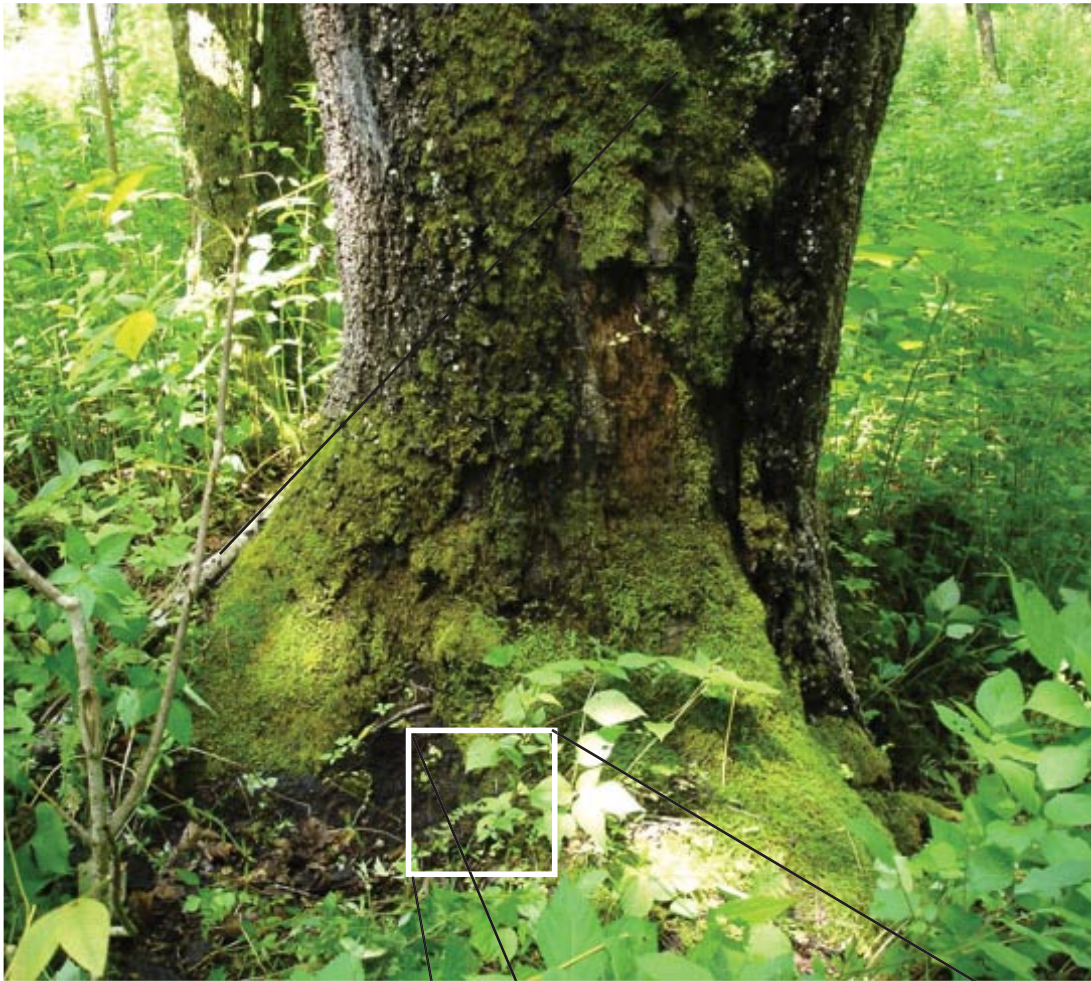


## Habitat



Habitats typically searched include hillsides, ravines, and around limestone outcrops under leaf litter. In addition, there are specific habitats that should be targeted. One such habitat is the leaf litter in tree crotches which can sometimes yield high species diversity. The area where several tree trunks are merged forms a kind of pocket for leaf litter and debris. Snails have been discovered in these crotches 8-10 ft. off the ground. Collections near streams should be made upslope from the stream edge while collections at seeps and springs should be made at their beginnings around the edges. Rock talus is another excellent place to search for snails due to its cool, moist environment. The area around birch trees, often associated with the cool, rock talus, is another target area. The leaves may provide another source of calcium for the snails.





The base of a variety of large diameter tree species can sometimes yield high numbers of land snails, especially the smaller varieties. A square meter of rich humus at the base of black walnut or butternut trees can often harbor more than 15 species. Other trees that occasionally yield substantial numbers include buckeye, basswood, and sugar maple. These trees may provide a calcium source for the snails.





## Land Snail Predators



A number of snail species have been collected from both gut contents and fecal matter from a variety of salamanders, including the spotted salamander, *Ambystoma maculatum* (left)



R. W. Van Devender

The head and thorax regions of *Schaphinotus* beetles are significantly smaller. This allows the beetle to enter the aperture of the snail to extract the live animal. (above)



*Haplotrema concavum* (right), dubbed the tiger of land snails, attacks and consumes a *Patera perigrapta* (left)

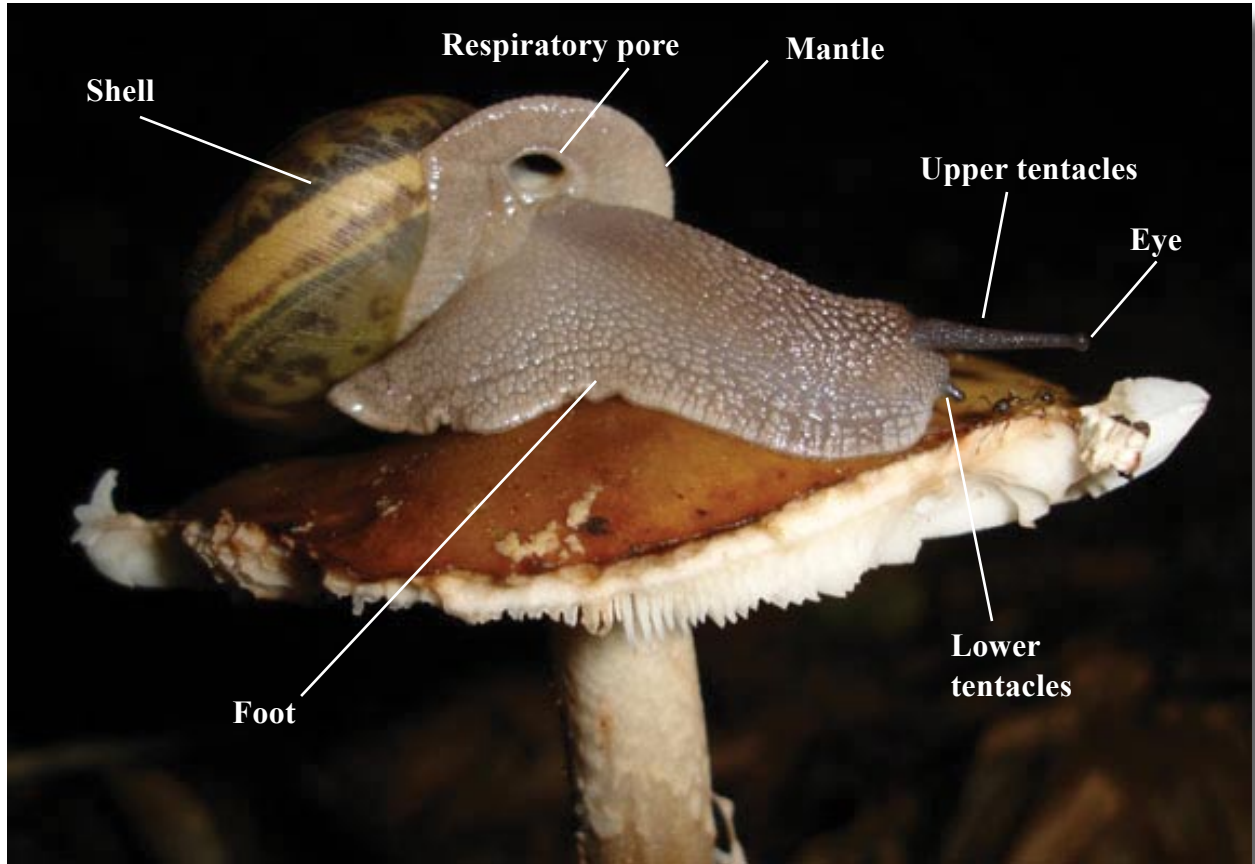


Small mammals such as mice and shrews are known to consume land snails (right). In order to extract the fleshy parts of the snail, these critters will chew through the tops of the shells (left)





## Basic Land Snail Anatomy and Shell Characteristics



Reflected lip

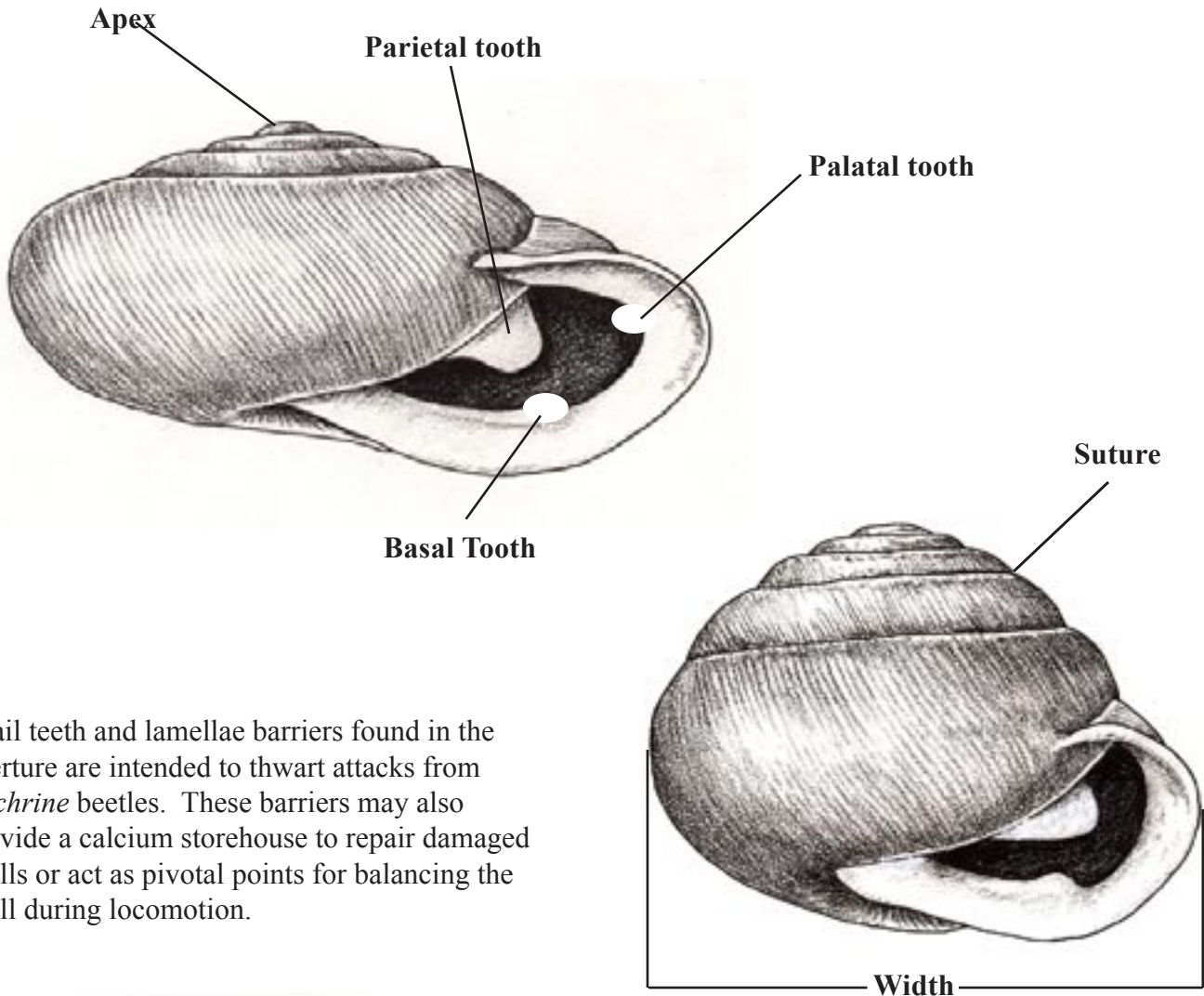


Simple lip

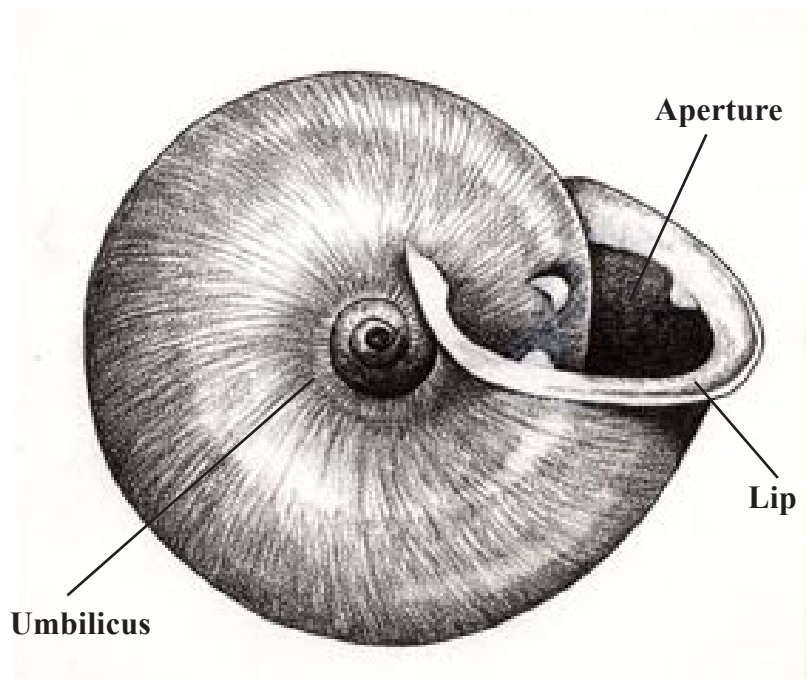
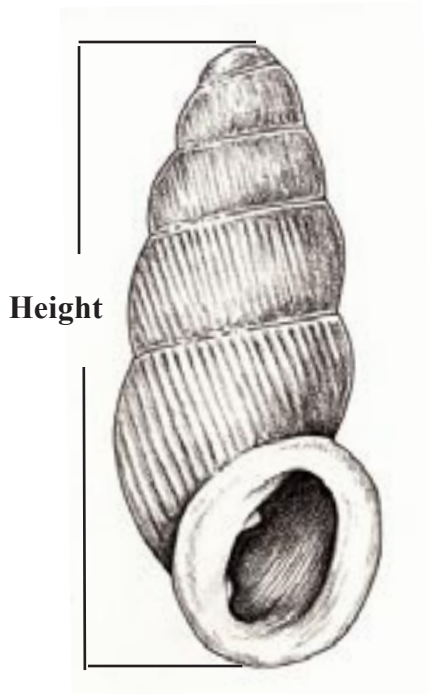


Counting whorls

## Shell Characteristics



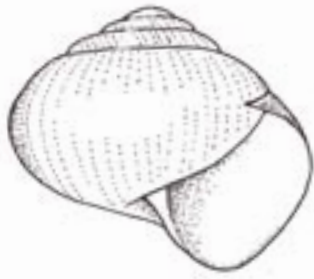
Snail teeth and lamellae barriers found in the aperture are intended to thwart attacks from *Cyathine* beetles. These barriers may also provide a calcium storehouse to repair damaged shells or act as pivotal points for balancing the shell during locomotion.



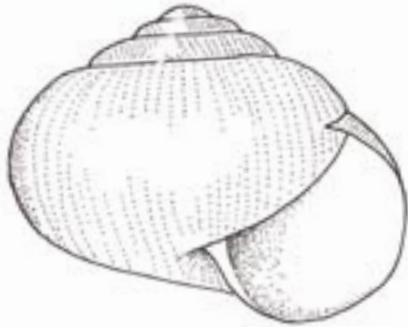
## Shell Growth

### *Mesodon*

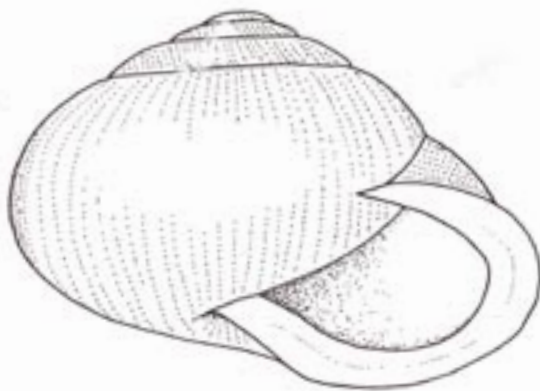
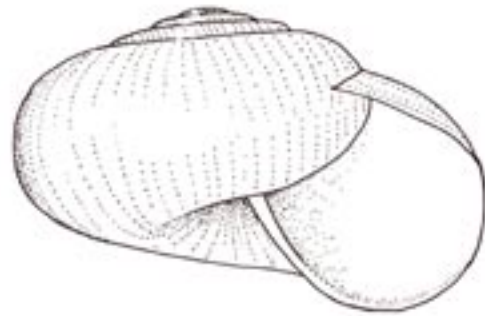
### *Mesomphix*



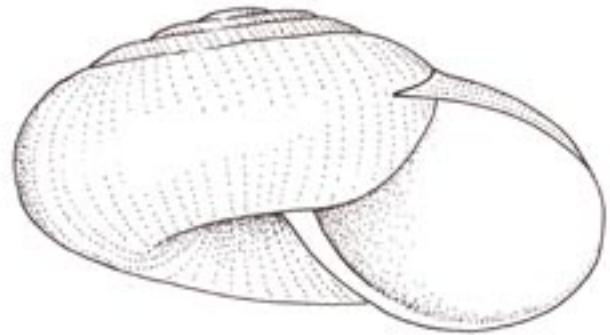
**Juvenile**



**Sub-adult**



**Adult**

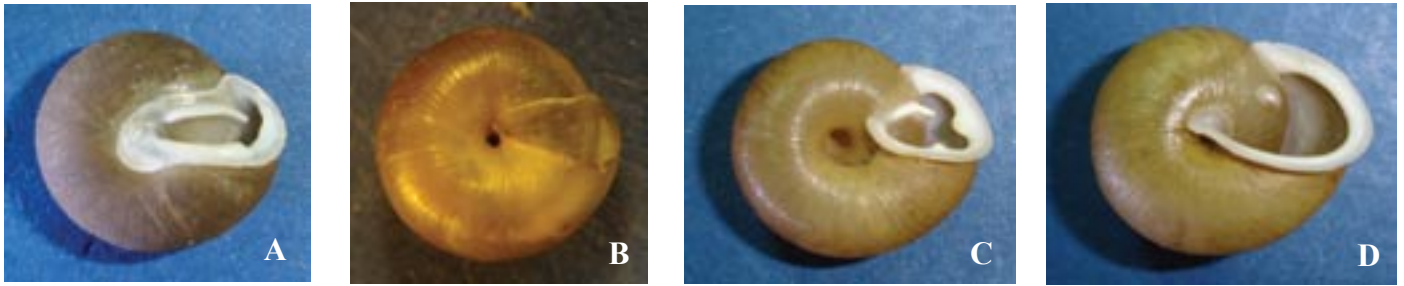


Immature shells of any species are difficult, if not impossible, to identify. Determining the maturity of a shell can often be accomplished by examining the aperture. As shells mature, the shape of the aperture changes. Note the aperture of both juvenile species. The bottom seems to droop as if it has an invisible weight attached. This begins to round out until it finally reaches a more horizontal oval shape at maturity.

Immature *Mesodon* species are easily confused with *Mesomphix* species. *Mesodon* and *Triodopsis* species do not form reflected lips until they reach maturity. Other species such as *Mesomphix*, *Anguispira*, and *Ventridens* do not possess reflected lips even at maturity.



## Types of Umbilicus



**Figure A**-Imperforate shell (with closed umbilicus); **Figure B**-Perforate shell (with very small umbilical opening); **Figure C**-Umbilicate shell (with noticeable umbilical opening); **Figure D**-Rimate shell (with umbilical opening partially closed by apertural lip)



**Ribs**



**Round periphery**

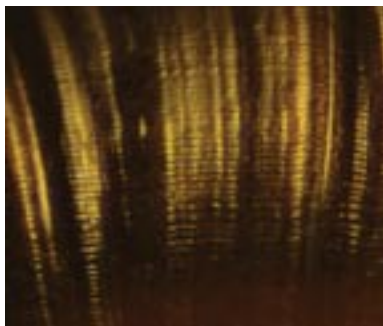


**Transverse striae**

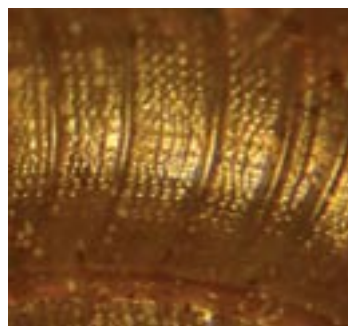


**Carinate periphery**

## Micro Surface Features



**Spiral striae**



**Papillae (Bumps)**



**Hairs**

# General Key to Identification of Land Snails for the Eastern Region of the Great Smoky Mountains National Park



*Information and measurements are for adult shells only.*

How to use this key:

This snail key was developed to be straightforward and easy to use. To begin the identification of a snail, follow the steps below. If you move through the key but are unable to positively identify the snail, go back and reconsider the shape of the shell. (Record all observations)

## **Shape**

Determine the general shape of the shell (see next page for further assistance in determining shell shape) Shapes of shells can sometimes vary considerably within the same species and even within the same population.

## **Diameter**

Determine the diameter (this will be the height in pupa shape shells). Note: Measurements represent a range of sizes from each group of shells. Sizes will sometimes vary outside the ranges given in species accounts.

## **Whorls**

Determine the number of whorls.

## **Umbilicus**

Look at the umbilicus and determine whether it is: imperforate, perforate, umbilicate, or rimate.

## **Teeth**

Make note of any presence or absence of teeth in the aperture , their size and spatial arrangement.

## **Spiral Striae**

To determine if spiral striae exist, examine shell surface under strong lens or scope.



## Shell Shape

For the purposes of this key, shells of the eastern region have been categorized in four basic shell shapes. While some shells fit easily into these categories, others may prove to be more difficult to discern. Shell shape will often vary within the same genus, and even in the same population. The images on this page show the basic shape as well as examples of variations within that basic category.



**Pupa Shape**



*Carychium*



*Gastrocopta*



*Cionella*



**Beehive Shape**



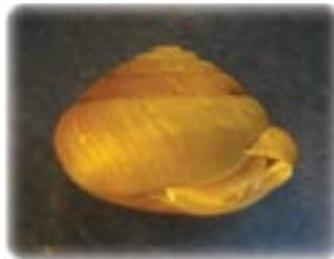
*Euconolus dentatus*



*Euconolus chersinus*



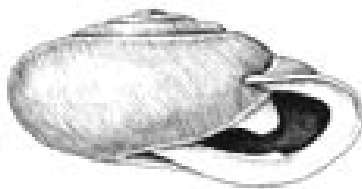
**Heliciform Shape**



*Stenotrema*



*Mesomphix*



**Depressed Heliciform**



*Mesomphix*



*Xolotrema*

## Snail Key

### Shells under 3.5 mm in height (pupa shape)



Page

Teeth absent in aperture.....	Columella simplex	21
Teeth present in aperture; shell under 2 mm..	Carychium clappi	19.
	Carychium exile	19
	Carychium nannodes	19
	Gastrocopta pentadon	20
	Vertigo gouldi	21
Teeth present in aperture; shell over 2mm.....	Gastrocopta contracta	20
	Gastrocopta corticaria	20

### Shells under 3.5 mm in diameter (beehive shape)



Teeth visible through bottom of shell.....	Euconulus dentatus	22
Teeth absent.....	Euconulus chersinus	22

### Shells under 3.5 mm in diameter (depressed heliciform)



Imperforate, fine spiral striae .....	Guppya sterkii	22
Perforate having 2 or 3 sets of 5 teeth.....	Paravitrea multidentata	33
Umbilicate no spiral striae, reflected lip.....	Vallonia excentrica	23
Umbilicate no spiral striae, simple lip.....	Helicodiscus X	24
Umbilicate, spiral striae present; shell under 2 mm.....	Hawaiiia minuscula	30
	Punctum blandianum	25
	Punctum minutissimum	25
	Punctum vitreum	25
	Striatura meridionalis	35
Umbilicate, spiral striae present; shell over 2 mm.....	Glyphyalinia cumberlandiana	29
	Helicodiscus notius	24
	Striatura ferrea	35

### Shells under 3.5 mm in diameter (heliciform)



Teeth visible through bottom of shell; distinct ribs.....	Strobilops aeneus	23
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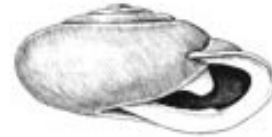
**Shells 3.5 mm to 12.5 mm in height (pupa shape)**



Page

Shell 5-6 mm, no teeth.....	<i>Cionella lubrica</i>	21
Shell 7-8 mm, no teeth.....	<i>Cionella morseana</i>	21

**Shells 3.5 mm-12.5 mm diameter (depressed heliciform)**



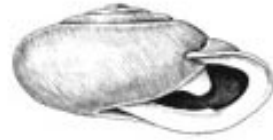
Perforate; teeth absent.....	<i>Glyphyalinia carolinensis</i>	28
	<i>Glyphyalinia indentata</i>	29
	<i>Glyphyalinia junaluskana</i>	29
	<i>Glyphyalinia sculptilis</i>	30
	<i>Paravitrea capsella</i>	32
	<i>Paravitrea clappi</i>	32
Perforate; teeth or lamellae present .....	<i>Paravitrea lamellidens</i>	33
	<i>Paravitrea varidens</i>	34
Umbilicate, teeth present.....	<i>Triodopsis hopetonensis</i>	46
Umbilicate; teeth absent.....	<i>Glyphyalinia wheatleyi</i>	30
	<i>Zonitoides arboreus</i>	38
	<i>Zonitoides elliotti</i>	38
Umbilicate; distinct ribs; carinate periphery.....	<i>Discus bryanti</i>	26
	round periphery.....	<i>Discus patulus</i>
Rimate; teeth present.....	<i>Euchemotrema fasciatum</i>	39
	<i>Euchemotrema fraternum</i>	39

**Shells 3.5 mm-12.5 mm in diameter (heliciform)**



Perforate; teeth present.....	<i>Gastrodonta interna</i>	28
	<i>Ventridens decussatus</i>	37
	<i>Ventridens gularis</i>	37
Imperforate (slitmouth).....	<i>Stenotrema altispira</i>	44
	<i>Stenotrema pilula</i>	45
	<i>Stenotrema magnifumosum</i>	44
	<i>Stenotrema stenotrema</i>	45
	<i>Stenotrema X</i>	45

**Shells 13 mm-42 mm (depressed heliciform)**



Page

Imperforate, with teeth.....	<i>Inflectarius rugeli</i>	40
	<i>Inflectarius subpalliatu</i>	41
	<i>Patera perigrapta</i>	44
	<i>Xolotrema denotatum</i>	47
Imperforate, no teeth.....	<i>Vitrinizonites latissimus</i>	38
Perforate, smooth surface.....	<i>Mesomphix andrewsae</i>	31
	<i>Mesomphix subplanus</i>	31
Umbilicate, no teeth.....	<i>Appalachina chilhoweensis</i>	39
	<i>Anguispira jessica</i>	26
	<i>Haplotrema concavum</i>	27
	<i>Haplotrema kendeighi</i>	27
Umbilicate, three teeth.....	<i>Triodopsis tridentata</i>	46
	<i>Triodopsis vulagata</i>	46

**Shells 13 mm to 42 mm (heliciform)**



Imperforate, teeth absent.....	<i>Mesodon normalis</i>	42
Imperforate, parietal tooth only.....	<i>Fumonelix jonesiana</i>	40
	<i>Fumonelix wheatleyi</i>	40
	<i>Mesodon altivagus</i>	42
	<i>Mesodon zaletus</i>	43
Imperforate, parietal & basal tooth present.....	<i>Patera clarki</i>	43
Perforate, teeth absent.....	<i>Ventridens acerra</i>	36
	<i>Ventridens arcellus</i>	36
Umbilicate, smooth surface.....	<i>Mesomphix cupreus</i>	31
Rimate, parietal tooth only.....	<i>Mesodon thyroidus</i>	43



## Species Accounts

Family CARYCHIDAE

### *Carychium clappi* Hubricht, 1959

**Common name:** Appalachian thorn

**Height:** 1.9-2.1 mm

**Description:** Shell with about 4½ whorls; transverse striae; parietal tooth present; shells are transparent in live individuals but become bleached and white with age

**Similar Species:** *Carychium exile* is smaller in size and has less distinct striae near the apex.

**Habitat:** Pockets of wet leaves in depressions around seeps and the base of black walnut trees

**Status:** Found throughout the Great Smoky Mountains (GSM)



### *Carychium exile* H. C. Lea, 1842

**Common name:** ice thorn

**Height:** 1.75 mm

**Description:** Shell with about 4½ whorls; transverse striae; parietal tooth present; shells are transparent in live individuals but become bleached and white with age

**Similar Species:** *Carychium clappi* averages a larger size and the transverse striae are more distinct near the apex.

**Habitat:** Pocket of wet leaves in depressions around seeps and the base of black walnut trees.

**Status:** Slightly less common than *C. clappi*. Found throughout the GSM

### *Carychium nannodes* Clapp, 1905

**Common name:** file thorn

**Height:** 1.3-1.5 mm

**Description:** Shell with about 4½-5 whorls; parietal tooth present; translucent shell surface is essentially smooth with extremely faint growth lines; sutures are deeply impressed; smallest of the *Carychium* species

**Similar Species:** *Carychium exile* and *Carychium clappi* are larger and have better developed transverse striae.

**Habitat:** Pockets of wet leaves in depressions around seeps and the base of black walnut trees

**Status:** Relatively common throughout the GSM



Family PUPILLIDAE

***Gastrocopta contracta*** (Say, 1822)

**Common name:** bottleneck snaggletooth

**Height:** 2.2-2.5 mm

**Description:** Shells with about 5½ whorls; transverse striae present; spire tapering; triangular aperture with well-developed teeth

**Similar Species:** Other species of *Gastrocopta*

**Habitat:** Found in a variety of habitats including the bases of black walnut, large white oaks, and poplar trees

**Status:** One of the most common *Gastrocopta* species found in the GSM



***Gastrocopta corticaria*** (Say, 1816)

**Common name:** bark snaggletooth

**Length:** 2.5 mm

**Description:** Shell with 5½ whorls; transverse striae weak; translucent; two teeth are visible in the aperture

**Similar Species:** *Carychium* species are smaller (about 1 mm) and more narrow in form.

**Habitat:** Base of black walnut trees

**Status:** Recently discovered (2004) in North Carolina

***Gastrocopta pentadon*** (Say, 1821)

**Common name:** comb snaggletooth

**Height:** 1.5-1.8 mm

**Description:** Shell with about 5 whorls; old shells white, fresh shells are glossy and translucent, spire tapering; numerous teeth present; thickened callous around lip

**Similar Species:** Other species of *Gastrocopta*

**Habitat:** Base of black walnut trees, tree crotches, around seeps

**Status:** Relatively common throughout the GSM



***Columella simplex*** (Gould, 1840)

**Common name:** None

**Width:** 1.8-2.1 mm

**Description:** Shell with 5½ whorls; perforate; shell is nearly smooth showing irregular and very low transverse striae under magnification; no teeth in aperture

**Similar Species:** None

**Habitat:** Bases of large hardwood trees like poplar, black walnut, butternut, and oak; found from valley floors up to 6200 ft..

**Status:** Relatively common in the GSM, some uncertainty exists with taxonomy



***Vertigo gouldi*** (A. Binney, 1843)

**Common name:** variable vertigo

**Width:** 1.5-2.1 mm

**Description:** Shell with 4½ -5½ whorls; transverse striae prominent; aperture with usually 5 teeth but occasionally only 4

**Similar Species:** *Vertigo bollesiana* is smaller with indistinct transverse striae; body whorl smooth

**Habitat:** Base of black walnut and other large diameter hardwood trees

**Status:** Most common *Vertigo* species in the GSM

Family CIONELLIDAE

***Cionella lubrica*** (left) (Muller, 1774) and ***Cionella morseana*** (right) (Doherty, 1878)

**Common name:** glossy pillar (*C. lubrica*) and Appalachian pillar (*C. morseana*)

**Height:** 5-6 mm (*C. lubrica*), 7-8 mm (*C. morseana*)

**Description:** Shells are glossy and translucent, elongate with unreflected but thickened lips, and lack any aperture teeth. The shell of *C. lubrica* differs from *C. morseana* by being wider, less cylindrical, having shorter spire whorls, and by the wider and thicker callous rim of the outer apertural lip. Formerly listed as *Cochlicopa lubrica* and *Cochlicopa morseana* respectively.

**Similar Species:** Each other

**Habitat:** Moist upland woods, rock talus, and occasionally at the base of black walnut trees

**Status:** *C. morseana* is relatively common throughout the park; *C. lubrica* is currently only known from the eastern side of the GSM around the Purchase Knob area





Family HELICARIONIDAE

***Euconulus chersinus*** (Say, 1821)

**Common name:** wild hive

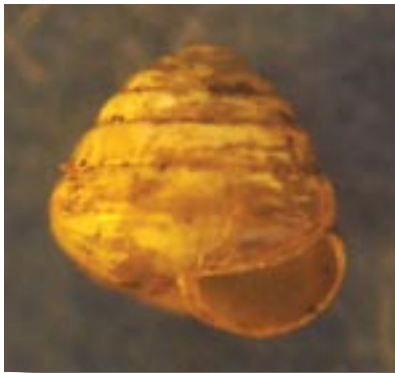
**Height:** 2.4-3.4 mm

**Description:** Shell with 6-8 whorls; perforate; shaped like a beehive, numerous whorls with a fine spiral sculpture.

**Similar Species:** *E. dentatus* has internal teeth.

**Habitat:** Grassy meadows, base of black walnut trees

**Status:** Scattered throughout the GSM



***Euconulus dentatus*** (Sterki, 1893)

**Common name:** toothed hive

**Height:** 2.4 mm

**Description:** Shell with 6½ whorls; perforate; shaped like a beehive; fine spiral sculpture; 1-2 teeth can be seen through the bottom of shells in good condition (**Fig. A**)

**Similar Species:** *E. chersinus* exhibits no teeth in any stage of growth.

**Habitat:** Grassy meadows, base of black walnut trees

**Status:** Only recently discovered (2005) in the GSM



***Guppya sterki*** (Dall, 1888)

**Common name:** none

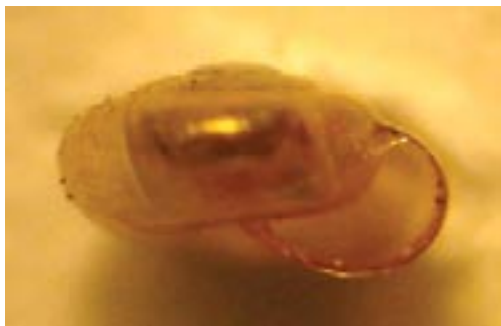
**Width:** 1.2-1.3 mm

**Description:** Shell with 3½-4 whorls; imperforate; live and fresh dead shells are translucent; weak growth wrinkles and extremely fine spiral striation starting at the apex of the shell that can only be seen under strong magnification

**Similar Species:** *Helicodiscus X* is umbilicate and does not exhibit any spiral ornamentation.

**Habitat:** Variety of habitats including base of walnut trees, in wet leaves along seeps, and other moist conditions

**Status:** Common throughout the GSM



Family STROBILOPSIDAE

***Strobilops aeneus*** Pilsbry 1926

**Common name:** bronze pinecone

**Height:** 2.4-2.8 mm

**Description:** Shell with about 5½ whorls; umbilicate; lip reflected; distinct ribs present and are best observed under magnification; carinate periphery; parietal tooth well-developed and elongated

**Similar Species:** None

**Habitat:** Found in colonies under exfoliating bark of hardwood logs in advanced stages of decay

**Status:** Relatively common in the GSM



Family VALLONIIDAE

***Vallonia excentrica*** Sterki 1893

**Common name:** Iroquois vallonia

**Width:** 1.8-2.3 mm

**Description:** Shell with 3-3½ whorls; moderately umbilicate glossy, thin shell; the whorls rapidly increase and are joined by a fairly deep suture, strongly reflected white lip

**Similar Species:** None

**Habitat:** Base of apple and black walnut trees

**Status:** Rare in the GSM, only known from the Purchase Knob area



### *Helicodiscus X*

**Common name:** none

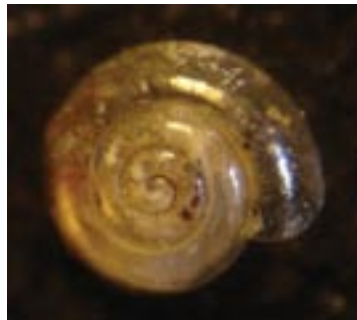
**Width:** 1.5 mm

**Description:** A minute *Helicodiscus* with 4 whorls; weak, irregularly spaced growth lines that can only be seen under high magnification; widely umbilicate (about 1/4 of the shell diameter), no trace of spiral ornamentation; fresh shells are translucent, becoming white with age

**Similar Species:** Shells of *Helicodiscus X* refer to both *H. singleyanus* and *H. inermis*. In terms of general shape, *Helicodiscus X* is most like *H. singleyanus* but is smaller and has a more glossy surface. It differs from *H. inermis* by being smaller with notably stronger growth lines, and has an ovate-lunate aperture whereas *H. inermis* has a round aperture. The surface of *Helicodiscus X* does not exhibit the punctate sculpture of *H. inermis*. *Hawaiiia miniscula* is larger and exhibits more strongly developed transverse striae and weakly developed spiral striae.

**Habitat:** Bases of black walnut, apple, butternut, red oak, and American beech trees

**Status:** Has been found in scattered locations across the North Carolina side of the GSM; its status at this time is undetermined and warrants further investigation including its overall range and DNA work



### *Helicodiscus notius* Hubricht, 1962

**Common name:** tight coil

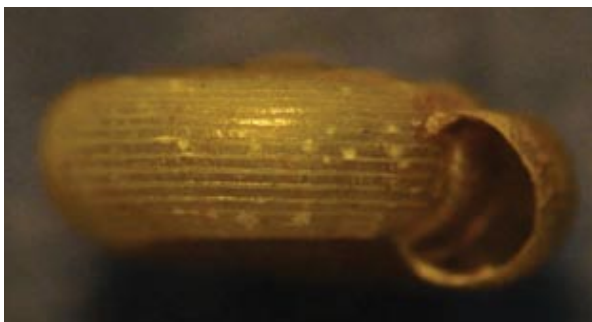
**Width:** 3.6 mm

**Description:** Shell with 5-5½ whorls; widely umbilicate showing all the whorls; distinctly raised spiral striae; spiral striae on the embryonic whorl (apex) are strongly developed; paired teeth can be seen through bottom of shell

**Similar Species:** *H. parallelus* is a little smaller, with one less whorl and the spiral striae on the embryonic whorl are faint or absent altogether.

**Habitat:** Base of black walnut trees, rock talus slopes

**Status:** Relatively uncommon in the GSM





***Punctum blandianum*** Pilsbry, 1900

**Common name:** brown spot

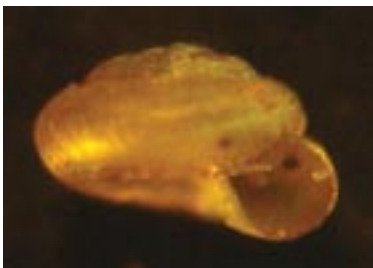
**Width:** 1.1-1.3 mm

**Description:** Shell with about 4 whorls; widely umbilicate (widest of the *Punctum species*); spirally striae and possesses transverse ribs closely spaced but can only be seen with strong magnification

**Similar Species:** The umbilicus of *P. minutissimum* and *P. vitreum* is smaller. *P. vitreum* has wider ribs.

**Habitat:** Between mats of wet leaves, especially around small seeps

**Status:** Uncommon, scattered throughout the GSM



***Punctum minutissimum*** (I. Lea, 1841)

**Common name:** small spot

**Width:** 1.1-1.3 mm

**Description:** Shell with about 3½ -4½ whorls; initial 1½ whorls are smooth; with the rest being sculptured with closely spaced ribs and spiral striae; umbilicate

**Similar Species:** *P. blandianum* has a shell that is more depressed with a more open umbilicus. *P. vitreum* has notably wider ribs.

**Habitat:** Between mats of wet leaves, especially around small seeps, base of black walnut trees

**Status:** Most common *Punctum* species in the GSM

***Punctum vitreum*** H. B. Baker, 1930

**Common name:** glass spot

**Width:** 1.2-1.4 mm

**Description:** Shell with about 4-4½ whorls; umbilicate; transverse ribs and spiral striae; ribs are spaced most widely of the *Punctum* species

**Similar Species:** *P. minutissimum* is similar in size but has more narrowly spaced ribs. *P. blandianum* has a wider umbilicus.

**Habitat:** Between mats of wet leaves, especially around small seeps, base of black walnut trees

**Status:** Uncommon in the GSM, a recent record (2005) for the state of North Carolina



***Anguispira jessica*** Kutchka, 1938

**Common name:** mountain tigersnail

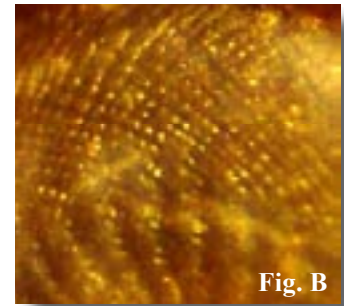
**Width:** 15-20 mm

**Description:** Shells with 5½ whorls; umbilicate; color bands or blotches always present; embryonic whorl covered with criss-cross markings (**Fig. B**), remaining whorls covered with strong rib-striae; periphery is weakly carinate.

**Similar Species:** *Anguispira alternata* is larger, usually found at lower elevations and criss-cross markings are much less distinct or absent altogether.

**Habitat:** An arboreal snail which has been documented in the canopies of tulip trees, *Liriodendron tulipifera*, over 70 feet from the ground (Keller 2001). Near the ground, it is found in small colonies on rotting hardwood in advanced stages of decay

**Status:** Most common *Anguispira* species found in the GSM



***Discus bryanti*** (Harper, 1881)

**Common name:** sawtooth disc

**Width:** 6.5 mm-7.5 mm

**Description:** Shells with 5-5½ whorls; widely umbilicate; distinct ribs present; strong carinate periphery.

**Similar Species:** *Discus patulus* is similar but lacks the carinate periphery and has a notably smaller umbilicus.

**Habitat:** Usually associated with rotting hardwood logs in advanced stages of decay

**Status:** A species of Special Concern in North Carolina, appears to be restricted to the eastern region of the GSM





***Discus patulus*** (DeShayes, 1830)

**Common name:** domed disc

**Width:** 7-8 mm

**Description:** Shells with about 5½ whorls; widely umbilicate; distinct ribs present

**Similar Species:** *Discus bryanti* has a distinct carinate periphery and larger umbilicus.

**Habitat:** A colony species found on rotting hardwood logs in advanced stages of decay

**Status:** Common throughout the GSM

Family HAPLOTREMATIDAE

***Haplotrema concavum*** (Say, 1821)

**Common name:** gray-foot lancetooth

**Width:** 16-22 mm

**Description:** Shell with about 4-5 whorls; widely umbilicate shell, compressed, foot of live animal is a dull yellowish gray

**Similar Species:** *Haplotrema kendeighi* is found at higher elevations and the foot of the live animal is a bright blue. Shells of *H. kendeighi* and *H. concavum* are imperceptible.

**Habitat:** Habitat generalist found in a variety of forested habitats

**Status:** Common throughout the GSM



***Haplotrema kendeighi*** Webb, 1951

**Common name:** blue-foot lancetooth

**Width:** 16-22.4 mm

**Description:** Shell with about 4½-5½ whorls; widely umbilicate; shell surface somewhat smooth and glossy; shell depressed; foot of live animal is bright blue

**Similar Species:** *Haplotrema concavum* foot is a dull yellowish gray. Shells of *H. kendeighi* and *H. concavum* are imperceptible (Hubricht 1956).

**Habitat:** A species of higher elevation mixed hardwood forest

**Status:** Listed as Special Concern in the state of North Carolina. The rarity of this species remains somewhat unknown. Both *H. kendeighi* and *H. concavum* can be found together.



Family ZONITIDAE

***Gastrodonta interna*** (Say, 1822)

**Common name:** brown bellytooth

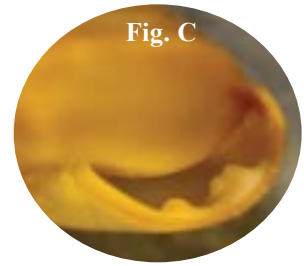
**Width:** 6.5-7.5 mm

**Description:** Shell with 8-9 whorls; perforate; shell thick for its small size, conspicuous ribs on upper surface, no spiral striae, two teeth can be viewed in the aperture (**Fig. C**).

**Similar Species:** None

**Habitat:** Found in mixed hardwood forests around rotting wood in advanced stages of decay

**Status:** Common throughout the GSM



***Glyphyalinia caroliniensis*** (Cockerell, 1890)

**Common name:** spiral mountain glyph

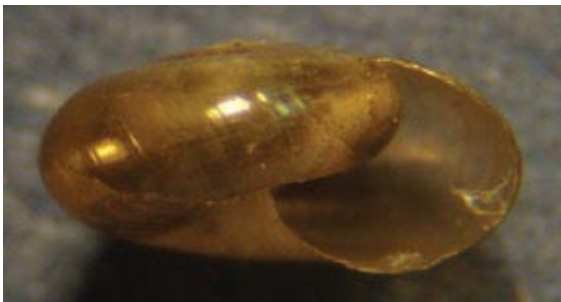
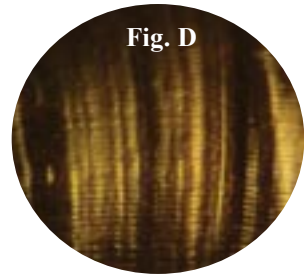
**Width:** 8-12 mm

**Description:** Shell with 5-5½ whorls; perforate; indented transverse striae are widely and almost equally spaced; depressed whorls; sculptured with distinct, fine, spiral striae (**Fig. D**)

**Similar Species:** *Glyphyalinia indentata* is smaller and the spiral striae are much less defined.

**Habitat:** In and around logs, rocks, and other forest detritis

**Status:** Common in the GSM





***Glyphyalinia cumberlandiana*** (Clapp, 1919)

**Common name:** hill glyph

**Width:** 2.5-3 mm

**Description:** Shell with 4 whorls that rapidly increase; shell thin and extremely fragile: widely umbilicate, displaying all the whorls; lightly sculptured across the whorls with closely set indented transverse striae; spire flattened; lip very slightly reflected

**Similar Species:** *Glyphyalinia wheatleyi* is larger in size and has a slightly thicker shell.

**Habitat:** Rocky places, among forest debris of mixed hardwood

**Status:** Relatively uncommon in the GSM



***Glyphyalinia indentata*** (Authors)

**Common name:** carved glyph

**Width:** 4.7-5.7 mm

**Description:** Shell with 4-4½ whorls; shell depressed with widely spaced indented transverse striae; perforate to rimate; aperture rather large; faintly sculptured with fine spiral striae

**Similar Species:** *Glyphyalinia caroliniensis* is more strongly sculptured with spiral striae.

**Habitat:** Rocky places, among forest debris of mixed hardwood

**Status:** Common in the GSM

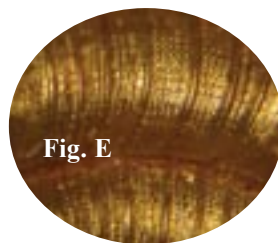


Fig. E

***Glyphyalinia junaluskana*** (Clench and Banks, 1932)

**Common name:** dark glyph

**Width:** 6.7-10 mm

**Description:** Shell with 6 whorls; perforate; closely spaced and regular indented striae; distinct spiral beading, especially on last whorl (Fig E)

**Similar Species:** *Glyphyalinia sculptilis* lacks the distinct beading

**Habitat:** Around logs, forest debris, and mixed hardwood sites

**Status:** A species of Special Concern in North Carolina



***Glyphyalinia sculptilis*** (Bland, 1858)

**Common name:** suborb glyph

**Width:** 7-12.5 mm

**Description:** Shell with 7 whorls; shell depressed; scarcely perforate; closely spaced and regular indented striae

**Similar Species:** *Glyphyalinia junaluskana* possesses distinct beading.

**Habitat:** Around logs, forest debris, and mixed hardwood sites

**Status:** Common in the GSM



***Glyphyalinia wheatleyi*** (Bland, 1883)

**Common name:** bright glyph

**Width:** 3½ -5 mm

**Description:** Shell with 5-5½ whorls; widely umbilicate; irregularly spaced, indented striae; shell depressed and thin; faint spiral striae present

**Similar Species:** *Glyphyalinia cumberlandiana* is about half the size.

**Habitat:** Under stones and woody debris in mixed hardwood

**Status:** Common throughout the GSM

***Hawaiiia minuscula*** (A. Binney, 1840)

**Common name:** minute gem

**Width:** 1.6 mm

**Description:** Shell with 3½-4½ whorls; umbilicate; aperture is round with the height and width almost equal; transverse striae are visible under strong magnification, although the spiral striations are faint, they are a constant character.

**Similar Species:** *Helicodiscus X* is smaller and exhibits no spiral ornamentation.

**Habitat:** While Hubricht (1985) lists this snail as a species of disturbed areas, in the Great Smoky Mountains, it is a species of rich woods, the base of black walnut and butternut trees.

**Status:** Uncommon in the GSM





***Mesomphix andrewsae*** (Pilsbry, 1895)

**Common name:** mountain button

**Width:** 16.3-21 mm

**Description:** Shell with 4½ -5 whorls; perforate; compressed shell; glossy, almost glass-like luster; sculptured with weak, low, inconspicuous growth wrinkles

**Similar Species:** *M. subplanus* is larger and has more tightly coiled whorls.

**Habitat:** Habitat generalist, found in a variety of upland, mixed hardwood forests

**Status:** Common in the GSM



***Mesomphix cupreus*** (Rafinesque, 1831)

**Common name:** copper button

**Width:** 22-28.4 mm

**Description:** Shell with 4½ -5 whorls; umbilicate; glossy; no spiral striation; one of the largest of the *Mesomphix* species in the Smokies

**Similar Species:** *M. capnodes* is larger and has spiral striae with a slightly larger umbilicus.

**Habitat:** Habitat generalist, found in a variety of upland, mixed hardwood forests; frequently found in ravines close to small streams

**Status:** Relatively common in the GSM

***Mesomphix subplanus*** (A. Binney, 1842)

**Common name:** flat button

**Width:** 16.3-23 mm

**Description:** Shell with 5½-6 tightly coiled whorls that are sharply marked with growth wrinkles; rimate; no spiral ornamentation

**Similar Species:** *M. andrewsae* is smaller, less tightly coiled, and glossier.

**Habitat:** Higher elevations of rock talus and other forest debris in mixed hardwood

**Status:** Relatively common in the GSM



***Paravitrea capsella*** (Gould, 1851)

**Common name:** dimple supercoil

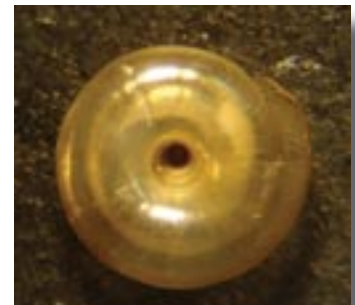
**Width** 4.8-6.mm

**Description:** Shell with 6½ -7½ whorls; perforate; aperture is roundly narrow; no teeth at any stage of growth

**Similar Species:** *Paravitrea varidens* is larger with one more whorl and has a more rectangular aperture.

**Habitat:** A variety of habitats in mixed hardwood

**Status:** Relatively common in the GSM



***Paravitrea clappi*** (Pilsbry, 1898)

**Common name:** Mirey Ridge supercoil

**Width:** 5.8 mm

**Description:** Shell with 6½ -7½ whorls; perforate; glossy, thin, semi-transparent shell; lip is sharp; aperture is rectangular in shape; no teeth at any stage of growth

**Similar Species:** *Paravitrea lamellidens* and *Paravitrea multidenta* are smaller and possess lamella and or teeth in the aperture.

**Habitat:** Moist leaf litter, rock talus usually above 5000 feet in the northern hardwood forest; a fossorial species of deep leaf litter

**Status:** Rare, a species of Special Concern in North Carolina



***Paravitrea lamellidens*** (Pilsbry, 1898)

**Common name:** lamellate supercoil

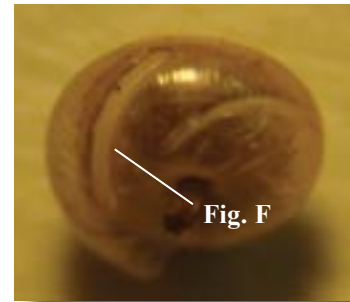
**Width:** 3.5-3.8 mm

**Description:** Shell with 6½ whorls; perforate; transverse striae closely spaced; 1 to 3 radial lamellae instead of rows of teeth (**Fig F**)

**Similar Species:** *P. multidentata* is similar in size and form, but has a larger umbilicus and rows of usually four to five teeth in the last whorl instead of lamellae.

**Habitat:** Found in a variety of mixed hardwood habitats; especially among rock talus; a species that burrows deep into the leaf litter

**Status:** Uncommon, a species of Special Concern in North Carolina



***Paravitrea multidentata*** (A. Binney, 1840)

**Common name:** dentate supercoil

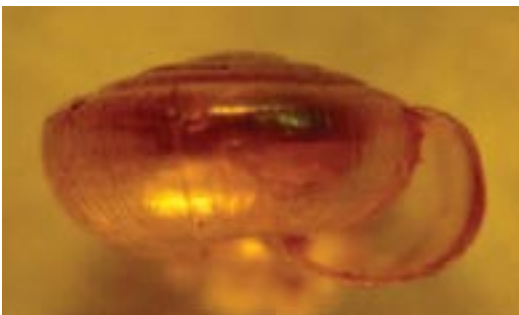
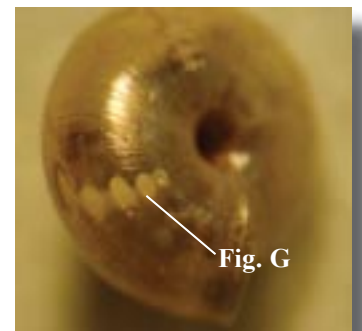
**Width:** 2.5-3 mm

**Description:** Shell with 6 whorls; perforate, glossy; growth lines are faint but regularly spaced; two to four rows of usually 4-5 white teeth (**Fig. G**) may be seen through the base of the shell

**Similar species:** *P. lamellidens* has lamellae instead of teeth and has a smaller umbilicus. *P. umbilicaris* has distinct spiral sculpture.

**Habitat:** Common around base of black walnut trees; alongside small seeps and springs

**Status:** One of the more common *Paravitrea* species in the GSM





***Paravitrea varidens*** Hubricht, 1978

**Common name:** roan supercoil

**Width:** 7.6 mm

**Description:** Shell with 8½ whorls; perforate to umbilicate; shell is thin, shining and sculptured with numerous irregularly spaced, impressed transverse striae; adults are toothless; young shells exhibit two or three radial rows of 3-5 rather large teeth

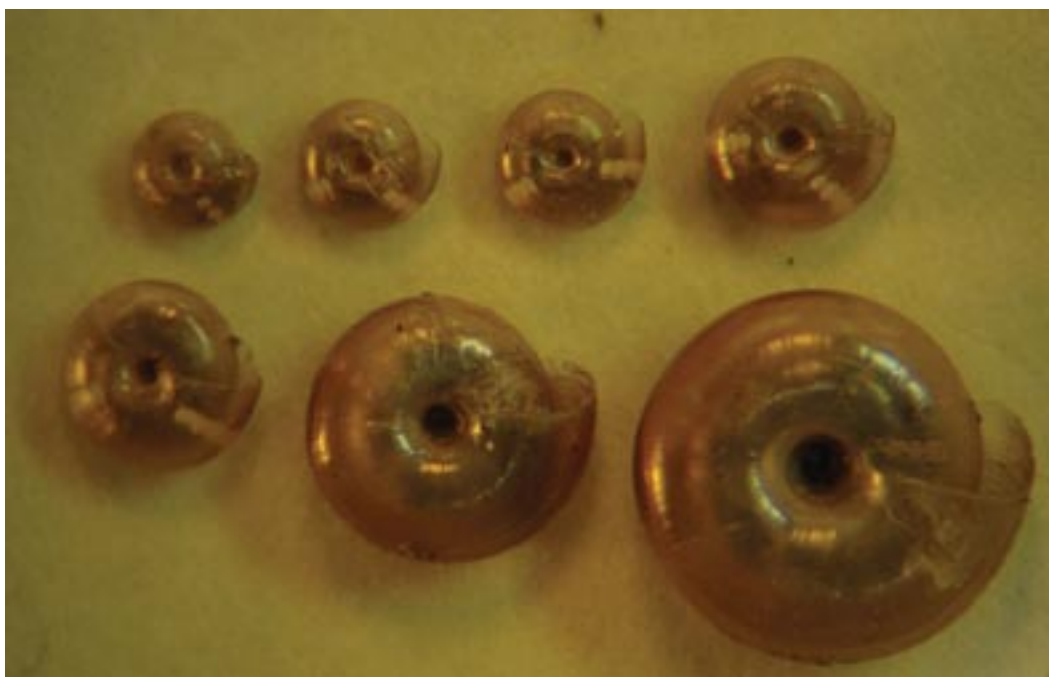
**Similar Species:** *P. multidentata* is much smaller and exhibits teeth in all stages of growth including adult shells.

**Habitat:** Mixed hardwood, rock talus, small seeps, crotches of trees; usually at higher elevations

**Status:** Recently found (2006) in the GSM around the Purchase Knob area



The genus *Paravitrea* is a difficult group of land snails to distinguish without a series of shells at various stages of growth. Some juveniles of *Paravitrea* species can exhibit teeth that disappear as adults. The images below represent a series of *Paravitrea varidens*. Notice that the first five juvenile shells (from left to right) exhibit distinct radial rows of teeth. The sixth and seventh shells are reaching maturity. In the sixth shell, the teeth are barely visible. However in the seventh shell, the largest, the teeth have been completely absorbed.



***Striatura ferrea*** Morse, 1864

**Common name:** black striate

**Width:** 2.5-3.4 mm

**Description:** Shell with 3½-4 whorls; widely umbilicate; dull sheen; shell with distinct regularly spaced transverse striae; under high magnification shell also exhibits distinct spiral striae

**Similar Species:** *S. meridionalis* is notably smaller and has a larger umbilicus.

**Habitat:** Found in seeps and springs living among the layers of wet leaves

**Status:** Relatively common in the GSM



***Striatura meridionalis*** (Pilsbry & Ferriss, 1902)

**Common name:** median striate

**Width:** 1.7-1.8 mm

**Description:** Shell with 3-3½ whorls; widely umbilicate; one of the smallest snails in the GSM; shell with distinct regularly spaced transverse striae; under high magnification, shells also exhibit distinct spiral striae

**Similar Species:** *S. ferrea* is notably larger and has a smaller umbilicus.

**Habitat:** Found in seeps and springs living among the layers of wet leaves, common around the base of black walnut trees

**Status:** Common in the GSM





***Ventridens acerra*** (Lewis, 1870)

**Common name:** glossy dome

**Width:** 12.6-18.4 mm

**Description:** Shell with 7-8 whorls; perforate; shell glossy and dome-shaped; transverse striae are weak; no teeth at any stage of growth

**Similar Species:** *V. arcellus* is smaller with a slightly larger umbilicus.

**Habitat:** Habitat generalist found in a variety of mixed hardwood under leaf litter, around rocks and logs at lower elevations below 4000 feet

**Status:** Common throughout the GSM



***Ventridens arcellus*** Hubricht, 1976

**Common name:** golden dome

**Width:** 12.9-13.6 mm

**Description:** Shell with 6-7½ whorls; perforate, shell glossy and exhibits no teeth at any stage of growth

**Similar species:** *V. acerra* is larger in diameter, more compressed, generally found below 4000 feet.

**Habitat:** Higher elevation of mixed hardwood forest under leaf litter, logs, and rock talus

**Status:** Relatively common at high elevations in the GSM





***Ventridens decussatus*** (Walker & Pilsbry, 1902)

**Common name:** crossed dome

**Width:** 7.8-8.2 mm

**Description:** Shell with 8 whorls; perforate; strongly transverse striae on top and much less on bottom with traces of spiral striae near the periphery; exhibits two teeth inside aperture in all stages of growth (**Fig. H**); umbilicus is wider in juvenile shells and becomes more narrow in adult shells; juvenile shells are strongly carinate (**Fig. G**) becoming bluntly angular with age

**Similar Species:** *V. gularis* is about the same size and shape but has a rimate umbilicus and does not exhibit the strong transverse striae.

**Habitat:** Habitat generalist, found among the leaf litter in mixed hardwood forests

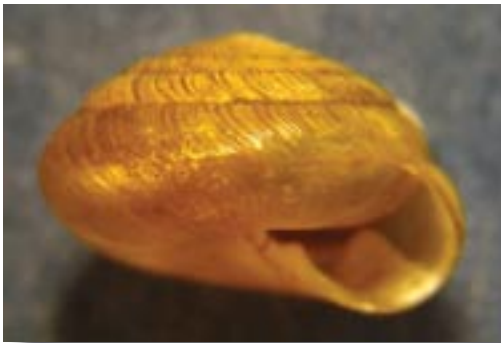
**Status:** Most common in the eastern portions of the GSM



Fig. G



Fig. H



***Ventridens gularis*** (Say, 1822)

**Common name:** throaty dome

**Width:** 7.5-8 mm

**Description:** Shell with 7½ -8 whorls; rimate to perforate; shell glossy; transverse striae present on top but indistinct on the bottom; teeth are present in all stages of growth (**Fig. I**)

**Similar Species:** *V. decussatus* has a more open umbilicus and has strongly transverse striae.

**Habitat:** Habitat generalist found among the leaf litter in mixed hardwood forests

**Status:** Common throughout the GSM

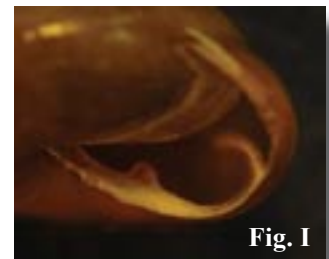


Fig. I



***Vitrinizonites latissimus*** (J. Lewis, 1875)

**Common name:** glassy grapeskin

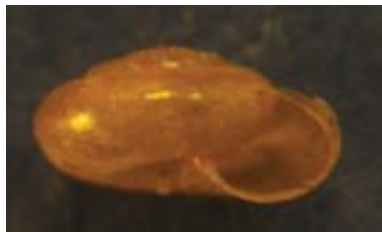
**Width:** 16.2-19.5 mm

**Description:** Shell with 2½-3 whorls; imperforate; a thin, extremely fragile, protein-based shell; one of the most distinctive snails in the GSM

**Similar Species:** None

**Habitat:** Found usually from 3000 feet to the summits in a mixture of northern hardwood and spruce/fir forests

**Status:** Common throughout the GSM



***Zonitoides arboreus*** (Say, 1816)

**Common name:** quick gloss

**Width:** 5-6 mm

**Description:** Shell with 4½ -5 whorls; openly umbilicate; shell thin, glossy and quite fragile; exhibits extremely faint spiral striae that can only be seen under high magnification

**Similar Species:** *Zonitoides elliotti* is larger with a moderately reflected lip; *Z. patuloides* is about the same size as *Z. arboreus* with a slightly larger umbilicus and has distinct rib striae covering entire shell.

**Habitat:** An arboreal snail often found under exfoliating bark of dead trees but also associated with rotting hardwood logs in advanced stages of decay

**Status:** Common throughout the GSM

***Zonitoides elliotti*** (Redfield, 1856)

**Common name:** green dome

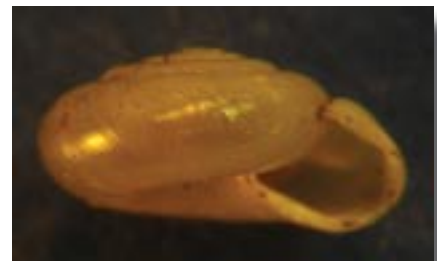
**Width:** 7.5 mm-8.4 mm

**Description:** Shell with 5-6 whorls; umbilicate; transverse striae are present; lip notably reflected; base of shell very glossy;

**Similar Species:** *Zonitoides arboreus* is smaller with a simple non-reflected lip

**Habitat:** Usually associated with hardwood logs in advanced stages of decay in a variety of mixed forest types including pine

**Status:** Common throughout the GSM



Family POLYGYRIDAE

*Appalachina chilhoweensis* (Lewis, 1870)

**Common name:** queen crater

**Width:** 26.5-42 mm

**Description:** Shell with 6-6 ½ whorls; umbilicate; shell is thin and somewhat fragile for its large size; largest land snail in the GSM, formerly listed as *Mesodon chilhoweensis*

**Similar Species:** None

**Habitat:** A variety of habitats including rich coves, dry ridgetops up to about 5400 ft.

**Status:** A species of Special Concern in North Carolina



*Euchemotrema fasciatum* Pilsbry & Archer, 1948

**Common name:** mountain pillsnail

**Width:** 9.4-11 mm

**Description:** Shell with 5-6 whorls; rimate; bluntly angular periphery; light tawny color band sometimes difficult to detect; formerly listed as *Stenotrema fraternum montanum*

**Similar Species:** *Euchemotrema fraternum* is smaller with a higher shell profile and does not exhibit a color band.

**Habitat:** Usually found around the base of hardwood trees and occasionally in between the deep bark furrows of trees

**Status:** Relatively common throughout the GSM

*Euchemotrema fraternum* (Say, 1824)

**Common name:** upland pillsnail

**Width:** 7.8-11.4 mm

**Description:** Shell with 5-6 whorls; imperforate to rimate; rounded periphery

**Similar Species:** *Euchemotrema fasciatum* is larger, more compressed and exhibits a color band

**Habitat:** Found under logs, rocks, and other forest debris in mixed hardwood

**Status:** Presently known only from the east side of the Smokies in the Big Creek drainage





***Fumonelix jonesiana*** (Archer, 1938)

**Common name:** big-toothed covert

**Width:** 12.8-13.5 mm

**Description:** Shell with 5-5½ whorls; imperforate; large parietal tooth; weak rib or transverse striae

**Similar Species:** *Fumonelix wheatleyi* is larger in diameter, has a smaller parietal tooth, and more pronounced transverse striae.

**Habitat:** Usually found from 4000 feet to the summits

**Status:** Endemic to the GSM, *F. jonesiana* is listed as threatened for the state of North Carolina



***Fumonelix wheatleyi*** (Bland, 1860)

**Common name:** cinnamon covert

**Width:** 13.2-18 mm

**Description:** Shell with about 5½ whorls; imperforate; sculptured with strongly transverse striae which is a consistent character, no spiral striae present; young specimens may exhibit short, fine hairs; small parietal tooth usually present; formerly listed as *Mesodon wheatleyi*.

**Similar Species:** *Fumonelix jonesiana* has a parietal tooth that is notably larger. *F. clingmanicus* is smaller, with a thinner shell. A parietal tooth may or may not be present.

**Habitat:** Variety of habitats from the valleys to the mountaintops

**Status:** Common throughout the GSM

***Inflectarius rugeli*** (Shuttleworth, 1852)

**Common name:** deep-toothed shagreen

**Width:** 7.8-16.4 mm

**Description:** Shell with about 5½ whorls; imperforate; fine hairs are present in young shells; three teeth present in aperture; the palatal tooth deeply recessed into the aperture; formerly listed as *Mesodon rugeli*.

**Similar Species:** *Inflectarius inflectus* is similar in size and shape but differs in the location of the palatal tooth which is not as deeply recessed as in *I. rugeli*.

**Habitat:** Habitat generalist found under leaf litter, logs, and rocks

**Status:** Common in the GSM



*Inflectarius subpalliatu/verus* (Pilsbry, 1893) Hubricht 1954

**Common name:** velvet covert

**Width:** 12.1-14.6 mm

**Description:** Shell with about 5-5½ whorls; imperforate; depressed, periphery rounded; well-developed parietal tooth that is long and slightly curved; basal tooth present but weakly defined; formerly listed as *Mesodon subpalliatu/verus*

**Similar Species:** Leslie Hubricht (1954) described a new species, *Mesodon verus*, from Mt. Sterling Creek, one mile north of Mt. Sterling Gap, Haywood County, North Carolina. Hubricht noted several differences between *M. subpalliatu*, its closest relative, but later synonymized *M. verus* back to *M. subpalliatu* in 1974. At present time (using current nomenclature), *I. verus* is not considered a valid species. However, having compared numerous specimens of *I. subpalliatu* from Roan Mountain, NC with specimens from the Smokies, it is my opinion that Hubricht's original assessment in 1954 was correct. Distinct and constant differences are present between the two shells. *Inflectarius verus* is smaller in diameter, possesses a larger parietal tooth that is more blade-like and curved, as well as a difference in the position of the parietal tooth (see photo below). K. C. Emberton (1991) reported specimens with distinctive penial morphology from the type locality of *I. verus* and provisionally identified them as that taxon. In the most recent publication on taxonomy, Mollusks 2<sup>nd</sup> edition (1998), classification is listed as uncertain. Additional investigation of soft tissue or DNA work will be necessary to make a final determination.

**Habitat:** A habitat generalist found in elevations up to 3500 feet in mixed hardwood forests. However, there appears to be a preference toward rock talus slopes

**Status:** Currently, *I. subpalliatu* is a species of Special Concern in North Carolina. The species in question appears to be restricted to the eastern regions of the GSM. If, in fact, *I. verus* is a valid species; it may represent another endemic to the Great Smoky Mountains.



*I. verus* (GSM)

*I. subpalliatu* (Roan Mt.)



**Specimens from GSM**



*I. verus* (GSM)

*I. subpalliatu* (Roan Mt.)

***Mesodon altivagus*** (Pilsbry, 1900)

**Common name:** wandering globe

**Width:** 23.4-27.5 mm

**Description:** Shell with about 5½-6 whorls; imperforate; shell heliciform and thin, sometimes exhibiting a light band around the periphery; spiral striae present; parietal tooth small when present

**Similar Species:** *Mesodon normalis* is usually larger with a thicker shell and has no parietal tooth. *Mesodon altivagus* is generally found above 4500 feet while *M. normalis* is a species of lower elevations.

**Habitat:** Habitat generalist of higher elevation forest including northern hardwood and spruce/fir

**Status:** Endemic to the Great Smoky Mountains, but currently not listed. *Mesodon altivagus*, once synonymized with *Mesodon andrewsae*, was elevated to species status by Emberton in 1991 on the basis of penial characters.



Fig. K

***Mesodon normalis*** (Pilsbry, 1900)

**Common name:** grand globe

**Width:** 21-38 mm

**Description:** Shell with about 5½ -6 whorls; imperforate; shell heliciform; no teeth; spiral striae present. Live animal is illustrated in (Fig. J). In (Fig. K), snail is in a state of estivation, note cellophane-like cover over aperture

**Similar Species:** Above 4000 feet, *Mesodon altivagus* replaces *M. normalis*; *Mesodon zaletus* is smaller, has a parietal tooth and more solid shell.

**Habitat:** Habitat generalist found in a variety of forest types

**Status:** Common throughout the GSM; it is the most observed and conspicuous snail within the boundaries of the park.



Fig. J





***Mesodon thyroidus*** (Say, 1816)

**Common name:** white-lip globe

**Width:** 15-31 mm

**Description:** Shell with about 5-5½ whorls; rimate; dull, thin shell; sculptured with fine transverse striae; minute, engraved spiral striae; parietal tooth usually present

**Similar Species:** *M. zaletus* is imperforate; *M. normalis* is imperforate and has no parietal tooth.

**Habitat:** Usually more common around disturbed areas like old fields and homesteads; less common in rich woods

**Status:** Scattered throughout the GSM



***Mesodon zaletus*** (A. Binney, 1837)

**Common name:** toothed globe

**Width:** 19-31 mm

**Description:** Shell with about 5½ -6 whorls, solid; imperforate with fine transverse striae, with microscopic spiral striae, parietal tooth usually present

**Similar Species:** *M. thyroidus* is rimate; *M. normalis* is larger, more fragile and does not possess a parietal tooth.

**Habitat:** Rich cove hardwood

**Status:** Relatively common throughout the GSM



***Patera clarki*** (I. Lea, 1858)

**Common name:** dwarf-proud globe

**Width:** 13-18.2 mm

**Description:** Shell with about 5½ -6 whorls; imperforate; shell heliciform; imperforate; strongly transverse striae with weak spiral striae, exhibits both parietal and basal teeth

**Similar Species:** *Mesodon elevatus* is larger

**Habitat:** Habitat generalist found in a variety of forest types

**Status:** Common in the GSM; a species of Special Concern in North Carolina

***Patera perigrapta*** (Pilsbry, 1894)

**Common name:** engraved bladetooth

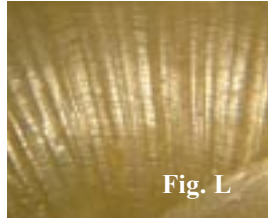
**Width:** 15.8-23.4 mm

**Description:** Shell with about 5½ -6 whorls; imperforate; sculptured with conspicuous engraved spiral striae (**Fig. L**); blade-like parietal tooth; basal tooth present but weakly defined

**Similar Species:** *Patera appressus* has spirally arranged papillae.

**Habitat:** It is generally associated with rotting hardwood in advanced stages of decay, hollow trees like the American beech and sycamore

**Status:** Common throughout the GSM



***Stenotrema altispira*** (Pilsbry, 1894)

**Common name:** highland slitmouth

**Width:** 8.4-11.2 mm

**Description:** Shell with about 5½-6½ whorls; imperforate; shell is covered with minute hairs ; possesses a distinct interdenticular sinus

**Similar Species:** *Stenotrema depilatum* is similar in sculpture and size but does not exhibit hairs on any part of the shell.

**Habitat:** Habitat generalist, found in a variety of upper elevation, mixed hardwood

**Status:** Relatively common throughout the GSM

***Stenotrema magnifumosum*** (Pilsbry, 1920)

**Common name:** Appalachian slitmouth

**Width:** 6-9 mm

**Description:** Shell with about 5-5½ whorls, imperforate, usually without hairs, periphery bluntly angular; interdenticular sinus is deep much like *S. stenotrema*

**Similar Species:** Other species of *Stenotrema*; *S. altispira* is larger and is covered in fine hairs.

**Habitat:** Under logs and other forest debris in mixed hardwood forests from 1600 to 4500 feet

**Status:** Common throughout the GSM





***Stenotrema pilula*** (Pilsbry, 1900)

**Common name:** pygmy slitmouth

**Width:** 5.7-6 mm

**Description:** Shell with about 5 whorls; imperforate; sculptured with minute hairs that are longer at the periphery; a distinct interdenticular sinus; this pill-like snail is the smallest *Stenotrema* species in the GSM

**Similar Species:** *Stenotrema hirsutum* is notably larger.

**Habitat:** Found among logs, rock, and other forest debris on rather dry, wooded hillsides

**Status:** Relatively common throughout the GSM



***Stenotrema stenotrema*** Pfeiffer, 1819)

**Common name:** inland slitmouth

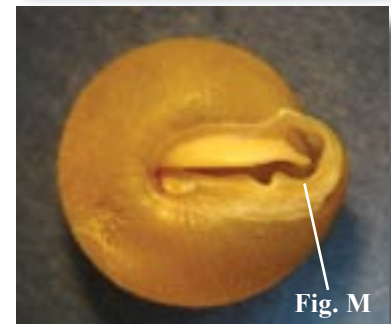
**Width:** 7.8-12.8 mm

**Description:** Shell with 5-6 whorls; imperforate; sculptured with numerous hairs and a rounded periphery and a distinct interdenticular sinus (**Fig. M**); the largest *Stenotrema* species found in the GSM

**Similar Species:** *Stenotrema X*, an undescribed species, is similar but differs in its more subangular periphery and being smaller in diameter. The basal lip notch of *Stenotrema X* is smaller than *S. stenotrema*. *S. stenotrema* has a distinct interdenticular sinus (**Fig. M**), whereas in *Stenotrema X*, it is wanting or absent altogether (**Fig. N**).

**Habitat:** Found in a variety of mixed hardwood habitats below 2500 feet.

**Status:** One of the most common *Stenotrema* species in the GSM



***Stenotrema X***

**Common name:** None

**Width:** 8-9 mm

**Description:** Shell with 5-6 whorls; imperforate; subangular periphery; basal lip notch small with an indistinct interdenticular sinus (**Fig. N**); numerous hairs in fresh specimens

**Similar Species:** *Stenotrema stenotrema*, is larger, has a more rounded periphery, notably deeper basal notch, and a distinct interdenticular sinus.

**Habitat:** Found across the GSM at lower elevation in mixed hardwood forest

**Status:** Currently an undescribed species that warrants soft body anatomy and DNA study to determine species status. *Stenotrema X* is often found together with *Stenotrema stenotrema*, where it is readily separated by its smaller size.





***Triodopsis hopetonensis*** (Shuttleworth, 1852)

**Common name:** magnolia threetooth

**Width:** 9.2-13 mm

**Description:** Shell with about 4½-5½ whorls; umbilicate; aperture contains a parietal tooth, palatal tooth, and basal tooth; when viewing the shell from the bottom, the parietal tooth points above the palatal tooth

**Similar Species:** *T. tridentata* is larger and the parietal tooth points below the palatal tooth.

**Habitat:** Found in disturbed areas, often transported to different sites on building supplies, especially treated lumber

**Status:** Uncommon in the GSM



***Triodopsis tridentata*** (Say, 1816)

**Common name:** northern threetooth

**Width:** 11.7-25.3 mm

**Description:** Shell with about 5-6 whorls; umbilicate; shell depressed heliciform with transverse striae, minute papillae around the umbilicus; when looking at a bottom view of the shell, the parietal tooth points below the palatal tooth

**Similar Species:** *T. vulgata* is not as compressed and the parietal tooth points above the palatal tooth.

**Habitat:** Habitat generalist, found in a variety of mixed hardwood forests

**Status:** Most common *Triodopsis* species in the GSM

***Triodopsis vulgata*** (Pilsbry, 1940)

**Common name:** dished threetooth

**Width:** 13.5-19.5 mm

**Description:** Shell with about 6½ whorls; shell solid; umbilicate; depressed heliciform with strong transverse striae; teeth are pronounced, parietal tooth points above palatal tooth

**Similar Species:** *Triodopsis tridentata* is slightly more depressed and teeth are much smaller; parietal tooth points below the palatal tooth.

**Habitat:** Habitat generalist, found in a variety of lower elevation mixed hardwood forests

**Status:** Relatively common throughout the GSM





***Xolotrema denotatum*** (Ferussac, 1821)

**Common name:** velvet wedge

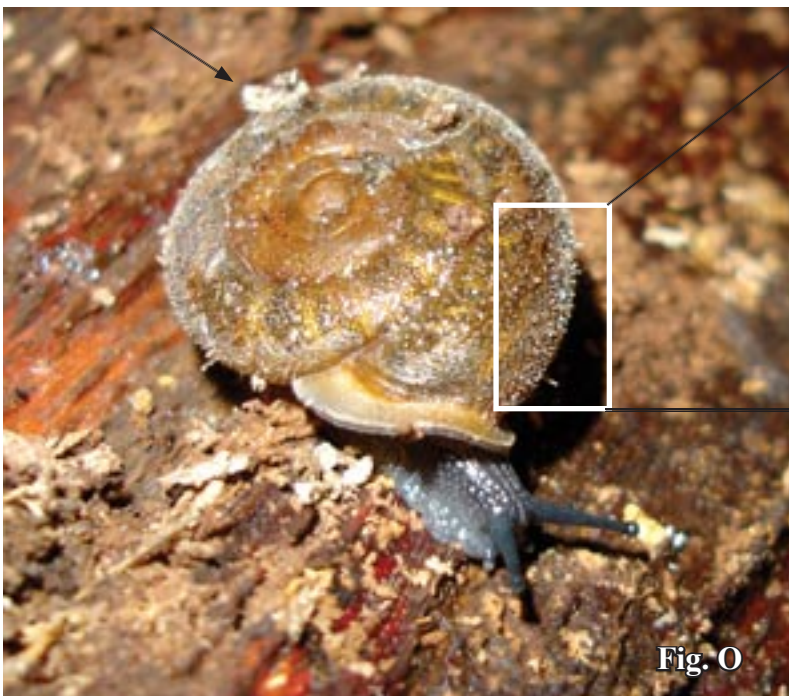
**Width:** 19-25 mm

**Description:** Shell with about 5½ whorls; imperforate; periostracum is dark; boldly reflected lip with well-defined parietal tooth and palatal tooth sits high on the outer lip and a somewhat less defined basal tooth; shell covered with short, stiff hairs (**Fig O**); formerly listed as *Triodopsis denotata*

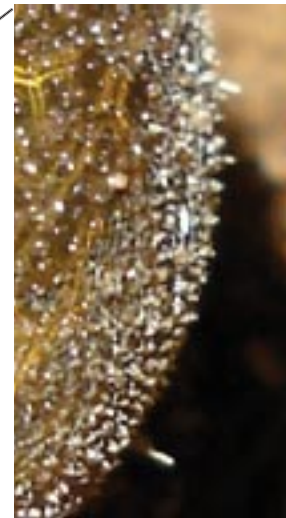
**Similar Species:** None

**Habitat:** A species of rich, mesic woods; usually found in association with rotting hardwood in advanced stages of decay

**Status:** Uncommon in the GSM



**Fig. O**



The short stiff hairs seen in (**Fig O**) grab forest debris in order to make the shell more cryptic to possible predators. On the top left of the photo is a bit of lichen that illustrates this point.

## Slugs of the Great Smoky Mountains (Eastern Region)

### *Pallifera hemphilli* (W. G. Binney, 1885)

**Common name:** black mantleslug

**Length:** While crawling 20-25 mm

**Description:** Uniformly black and narrow in form

**Similar Species:** *Pallifera dorsalis* is about the same size but is ashy-blue or grey, *P. secreta* is about the same size as *P. hemphilli* but has scattered small, round black spots on the forward half of the mantle.

**Habitat:** From about 2500 feet to the summits, but appears to be most common in spruce fir



### *Pallifera dorsalis*

**Common name:** pale mantleslug (A. Binney, 1842)

**Length:** While crawling 6.5-15 mm

**Description:** A small species of slug; mantle not covering head region; ashy-blue or gray; sole of foot whitish

**Similar Species:** *Pallifera hemphilli* is black.

**Habitat:** Cooler environments around seeps and springs; often found between wet mats of leaves, under exfoliating bark of logs in advanced stages of decay

**Status:** Relatively common in the GSM





***Philomycus carolinianus*** (Bosc, 1802)

**Common name:** Carolina mantleslug

**Length:** While crawling 50-100 mm

**Description:** Mantle covers the entire back, sides and head regions; with one or two rows of black or brown spots running down center of mantle

**Similar Species:** *Philomycus flexuolaris* has three longitudinal stripes.

**Habitat:** Usually found under exfoliating bark of hardwood logs in advanced stages of decay in lower elevation mixed hardwood forests

**Status:** Relatively common in the GSM



***Philomycus flexuolaris*** (Rafinesque, 1820))

**Common name:** winding mantleslug

**Length:** While crawling 50 to 75 mm

**Description:** Mantle covers the entire back, sides and head regions; usually three longitudinal stripes that can be broken into spots both dorsal and lateral; best observed when the slugs are fully extended and crawling

**Similar Species:** *Philomycus carolinianus* usually has two longitudinal rows of black or brown spots running down the center of the mantle. *Philomycus venustus* has two dorsal bands (which can to be continuous or interrupted), a narrow lateral band on each side (which can also be continuous or interrupted) and connected to the dorsal bands by a series of oblique stripes.

**Habitat:** Usually found in association with rotting hardwood in advanced stages of decay, especially under exfoliating bark, a species of higher elevation, mesic woods

**Status:** Common in rich woods



***Philomycus togatus*** (Gould, 1841)

**Common name:** toga mantleslug

**Length:** While crawling 50-100 mm

**Description:** Mantle covers the entire back, sides and head region, color pattern consisting of a broad dorsal band and a narrower lateral band on each side, scattered irregular small spots between bands

**Similar Species:** Other *Philomycus* species

**Habitat:** A common species in the Piedmont region, usually in upland oak woods

**Status:** Rare, only recently documented (2005) in the GSM



***Philomycus venustus*** (Hubricht, 1953)

**Common name:** brown-spotted mantleslug

**Length:** While crawling 50 to 100 mm

**Description:** Mantle covers the entire back side and head region; color pattern varying from individuals; having a dorsal band, a narrow lateral band on each side connected to the dorsal band by a series of oblique stripes; oblique stripes are sometimes broken into a series of spots (Hubricht 1953)

**Similar Species:** *Philomycus flexuolaris* does not exhibit a series of oblique stripes.

**Habitat:** Found with *P. flexuolaris* but tends to be more terrestrial, only occasionally being found on trees (Hubricht 1953)

**Status:** Relatively common in the GSM





## Introduced Species

***Arion fasciatus*** (Nilsson, 1823) Introduced from Europe

**Common name:** dusky arion

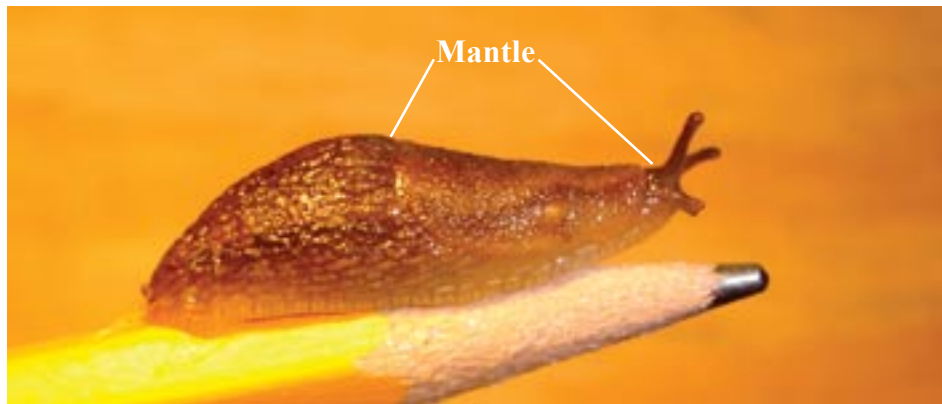
**Length:** While crawling 50-60 mm

**Description:** Saddle-like mantle covers only the anterior part of the body; foot is pale yellow; body color is a grayish-yellow to dark reddish brown; mucus clear

**Similar Species:** The native slugs of the GSM have a mantle that covers most of the body.

**Habitat:** Found usually around disturbed areas of the GSM, such as old homesteads and camping sites along the horse trails

**Status:** Uncommon in the GSM



***Limax maximus*** (Linnaeus, 1758) Introduced from Europe

**Common name:** giant garden slug

**Length:** While crawling 80-120 mm

**Description:** A large slug with a saddle-like mantle that covers only the anterior part of the body; mantle and body covered with black spots

**Similar Species:** None

**Habitat:** A species of disturbed habitats around buildings, old homesteads; known from the Cades Cove area

**Status:** Uncommon in the GSM



**Species of land snails that may occur in the eastern regions of the Great Smoky Mountains but have not yet been documented.**

**CARYCHIIDAE**

*Carychium mexicanum*  
*Carychium exiguum*  
*Carychium X (undescribed)*

*Mesodon elevatus*  
*Mesodon clausus*  
*Neohelix albolabris*  
*Triodopsis fallax*

**DISCIDAE**

*Anguispira alternata*  
*Anguispira mordax*  
*Discus nigrimontanus*

**POMATIOPSIDAE**

*Pomatiopsis lapidaria*

**HELICARIONIDAE**

*Euconulus fulvus*  
*Euconulus trochulus*

**PUPILLIDAE**

*Gastrocopta armifera*  
*Gastrocopta procera*  
*Vertigo oscariana*  
*Vertigo tridentata*  
*Vertigo parvula*  
*Vertigo bollesiana*

**HELICODISCIDAE**

*Helicodiscus fimbriatus*  
*Helicodiscus bonamicus*  
*Helicodiscus parallelus*  
*Helicodiscus singleyanus*  
*Helicodiscus inermis*

**SUCCINEIDAE**

*Succinea ovalis*

**PHILOMYCIDAE (Slugs)**

*Philomycus virginicus*  
*Megapallifera mutabilis*  
*Pallifera secreta*  
*Pallifera fosteri*

**ZONITIDAE**

*Glyphyalinia pentadelphia*  
*Glyphyalinia rhoadsi*  
*Glyphyalinia solida*  
*Glyphyalinia praecox*  
*Mesomphix inornatus*  
*Mesomphix rugeli*  
*Mesomphix latior*  
*Mesomphix perlaevis*  
*Mesomphix vulgatus*  
*Paravitrea bellona*  
*Paravitrea umbilicaris*  
*Ventridens theoloides*  
*Ventridens lawae*  
*Ventridens lasmodon*  
*Ventridens intertextus*  
*Zonitoides patuloides*  
*Striatura exigua*

**POLYGYRIDAE**

*Polygyra plicata*  
*Stenotrema hirsutum*  
*Stenotrema depilatum*  
*Inflectarius inflectus*  
*Patera appressus*  
*Mesodon ferrissi*  
*Fumonelix orestes*  
*Fumonelix clingmanicus*  
*Fumonelix christyi*

# Terminology

**Angular periphery**-shell having an angular rather than a round contour (also referred to as carinate)

**Apex**- the tip of the shell where the embryonic whorl begins

**Aperture**- opening or mouth of the snail shell

**Basal tooth**- refers to the tooth on the basal (lower) lip

**Columella**- the internal column that the whorls revolve around

**Compressed shell**- a shell that is heliciform in shape

**Depressed heliciform**- shell with flattened spiral

**Embryonic whorl**-the first of a series of whorls

**Heliciform shape**-shell that has an elevated spire or globose form

**Hermaphrodite**-possessing both male and female reproductive organs

**Imperforate**- a completely closed umbilicus

**Lamella**-raised calcium deposits on the interior of the shell that often can only be seen through the bottom of the shell in live animals. or fresh dead shells

**Lip**- the edge of the aperture; also called the peristome

**Mantle**- the organ that is responsible for building the shell

**Palatal tooth**- refers to the tooth located on the outer lip

**Papillae**- small calcium deposits that appear as minute bumps on the surface of the shell

**Parietal tooth**-refers to the tooth located on inner wall of the aperture or body of the snail shell

**Perforate**- a minute opening in the umbilicus

**Periphery**- the part of the whorl farthest from the central axis

**Radula**- A ribbon-like organ with many fine teeth used in rasping food

**Ribs**- prominent protrusions on the shell surface

**Rimate**- the lip of the aperture slightly covers the umbilicus

**Rounded periphery**- An evenly curved periphery; not angular or carinate

**Striae**-surface features that are either indented or raised in the shell surface

**Spiral striae**- surface features that are indented or raised on the shell surface running parallel with the whorls

**Spire**-all the whorls above the aperture

**Suture**- the line where one whorl of the shell is in contact with another

**Transverse striae**- surface features indented or raised in the shell surface running perpendicular with the whorls

**Umbilicate**- an opening in the center of the axis of the shell bottom that is rather wide

**Umbilicus**- an opening in the center of the axis of the shell bottom

**Whorl**- one complete turn of a gastropod shell

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## References

- Burch, J. B. 1962. How to know the eastern land snails. Wm. C. Brown Company Publishers, Dubuque, IA.
- Burch, J. B. and J. Younglum, 1988. Land snails of the University of Michigan Biological Station Area. Walkerana Vol. 3 No. 9
- Grimm, F. W. 1995. Terrestrial Mollusca from Assessment of Species Diversity in the Mixedwood Plains Ecozone. Smithsonian Magazine, Aug. 2000.
- Hames, R., K. V. Rosenberg, J. D. Lowe, S.E Barker, and A. A. Dhondt. 2002. Adverse effects of acid rain on the distribution of the wood thrush *Hylocichla mustelina* in North America. Proceedings of the National Academy of Sciences. 99 No. 16
- Hubricht, L 1953. Three new species of *Philomycidae*. The Nautilus 66:78-80
- Hubricht, L. 1954. A new species of *Mesodon* from the Great Smoky Mountains National Park. The Nautilus 68:65-66
- Hubricht, L. 1956. Land snails of Shenandoah National Park. The Nautilus 70:1-15
- Hubricht, L. 1985. The distribution of the native land mollusks of the eastern United States. Fieldiana Pub. 1359
- Keller, H. W., Snell, K. L. 2002. Feeding activities of slugs on Myxomycetes and macrofungi. Mycologia 94: 757-760
- Lee, K.E. 1985. Earthworms: their ecology and relationships with soils and land use. Academic Press, NY.
- Pilsbry, H. A. 1940. Land Mollusca of North America (north of Mexico). I Part II. The Academy of Natural Sciences of Philadelphia. Philadelphia, PA.
- Pilsbry, H. A. 1946. Land Mollusca of North America (north of Mexico). II Part I. The Academy of Natural Sciences of Philadelphia. Philadelphia, PA.
- Pilsbry, H. A. 1948. Land Mollusca of North America (north of Mexico). II Part II, The Academy of Natural Sciences of Philadelphia. Philadelphia, PA.
- Van Devender, A. S., and R. W. Van Devender. 2003. Surveying the land snails of the southern Appalachians. Program and Abstracts American Malacological Society:61
- Taft, C. 1961. The shell-bearing land snails of Ohio. Ohio Biological Survey. 1 No. 3.
- 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, 2<sup>nd</sup> edition. American Fisheries Society, Special Publication 26, Bethesda, MD.