Conservation Biology Research Grants Program
Natural Heritage & Nongame Research Program
Division of Ecological Services
© Minnesota Department of Natural Resources

Images of Minute Minnesota Land Snails

Matt Barthel
January 2000

This disk contains diagnostic images representative of minute land snail taxa from Minnesota. The snails imaged are from throughout the Great Lakes region of North America. The snails were selected from the collections maintained at the University of Wisconsin-Green Bay (UWGB). The shells imaged were assigned to species (or subspecies) based on the UWGB collection and the Hubricht collection at the Field Museum of Natural History.

The snails imaged typically are smaller than 3.5mm in height and width. The images were obtained using a Hitachi S-2460N Scanning Electron Microscope (SEM). The snails were imaged in N-SEM mode at a vacuum of 10 Pa and acceleration voltage of 22kv, and using a Robinson Backscatter Detector with Gamma correction.

The images were scanned and stored in TIFF format. The images can be transferred to other image formats using most standard image modifying programs. The images are stored as both 75 and 600dpi (dots per inch). The 75dpi images load quickly because they are typically smaller than 100k (kilobytes). The 600dpi images are typically larger than 1.5M (megabytes) and are better for modifying resolution and size.

For quick viewing the images in the 75dpi folder should be used. For detailed viewing the images in the 600dpi folder should be used.

Individual images of the snails can be located using the FILE INFO file inside the KEY folder. This file is provided in several program formats. Information regarding the snails imaged is found in the DATA file inside the KEY folder. This file includes; names of the snails imaged, folders and files the images are in, and information on the localities were the snails were collected.

Acknowledgments

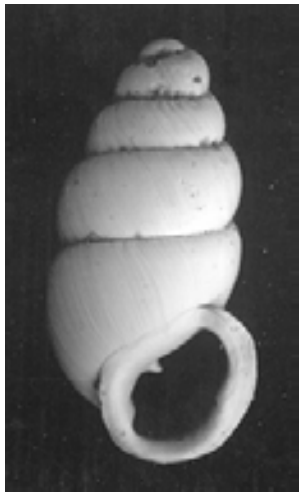
The creation of these images would not have been possible without the hundreds of hours of work by students Candice Kasprzak, Pete Massart, Chela Moore, Eric North, and Tamara Smith who helped assist in field collection and lab processing of samples containing the shells. Students enrolled in the land snail practicum also assisted in lab processing. Jeff Nekola provided expertise in land snail taxonomy and access to the University of Wisconsin-Green Bay snail collection. Bob Wise of the University of Wisconsin Oshkosh provided SEM guidance and use of the Electron Microscope Lab. Support for this project was received from the Minnesota Nongame Wildlife Tax Checkoff through the Minnesota Department of Natural Resources, Division of Fish and Wildlife, Natural Heritage and Nongame Research Program.

For information on the images and snails imaged contact.
Matt Barthel or Jeff Nekola at:
Department of Natural and Applied Sciences
University of Wisconsin-Green Bay
2420 Nicolet Drive
Green Bay Wisconsin 54311
E-mail: bartmg22@uwgb.edu
nekolaj@uwgb.edu

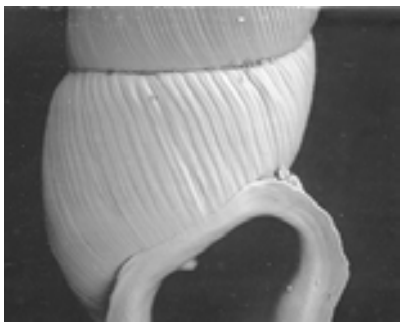
IMAGES

Carychiu

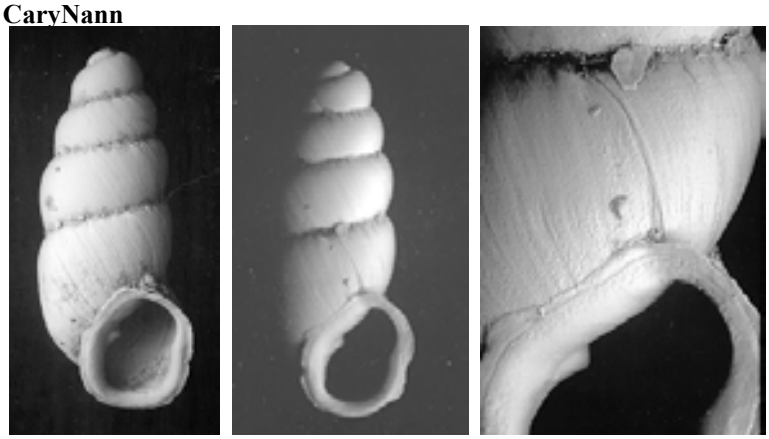
CaryExig



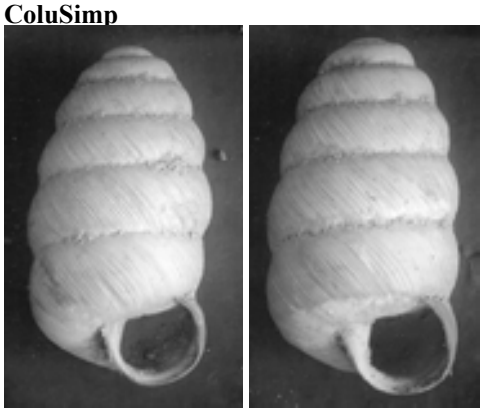
CaryExil



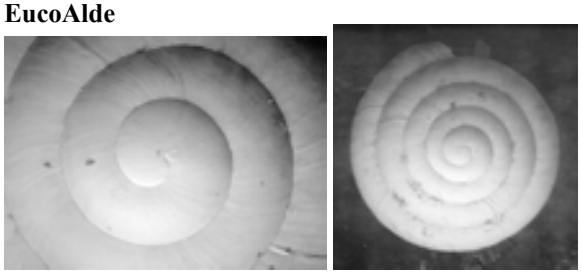
CaryNann

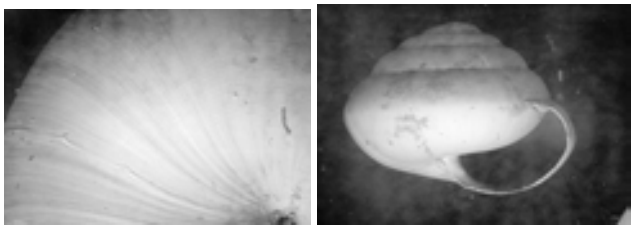


ColuSimp

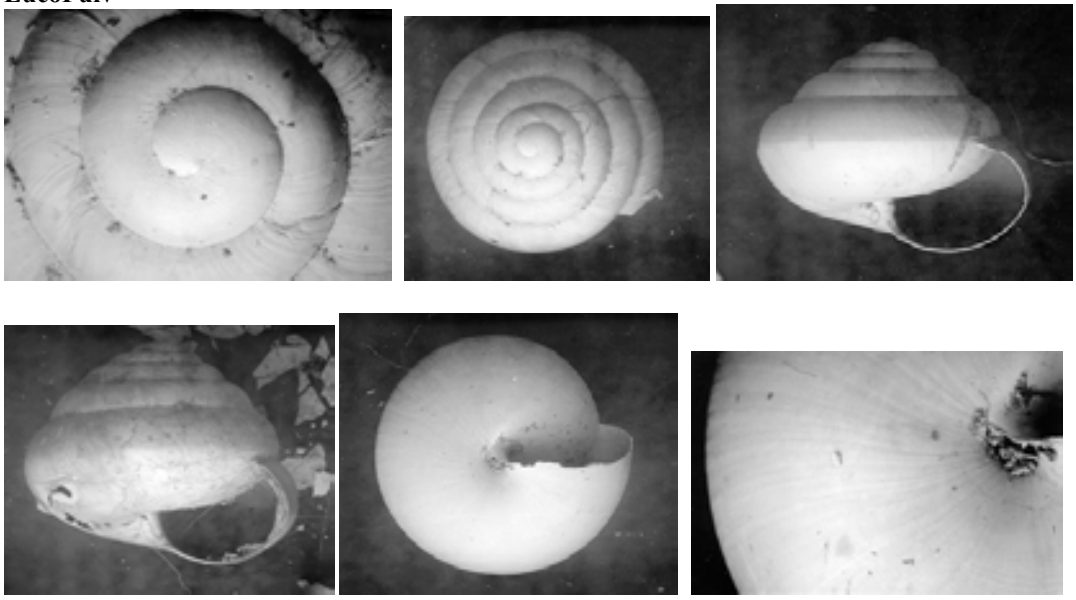


EucoAlde

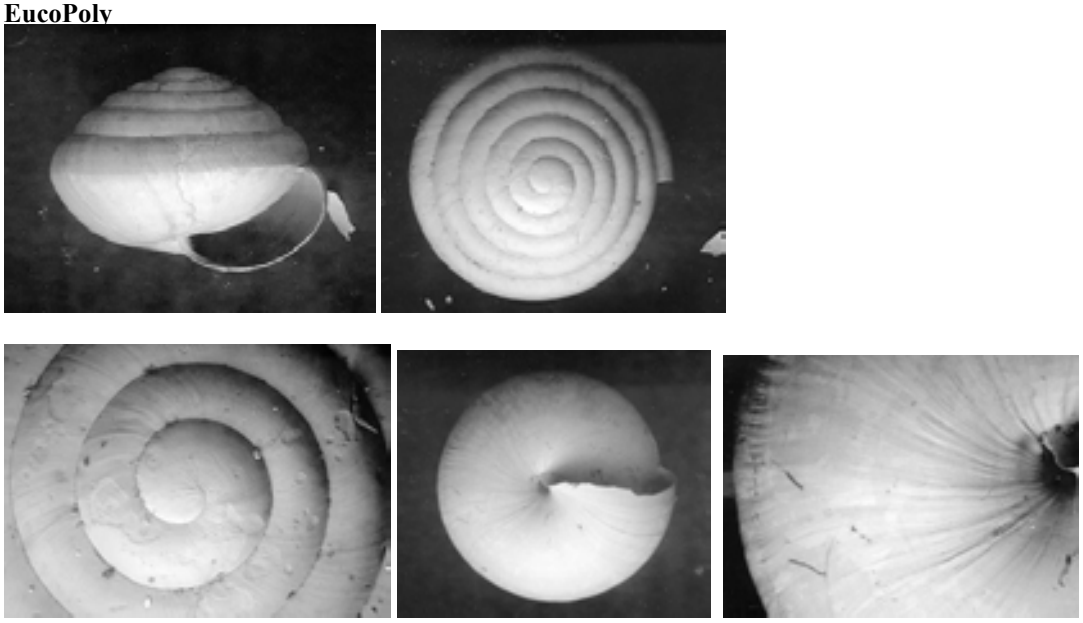




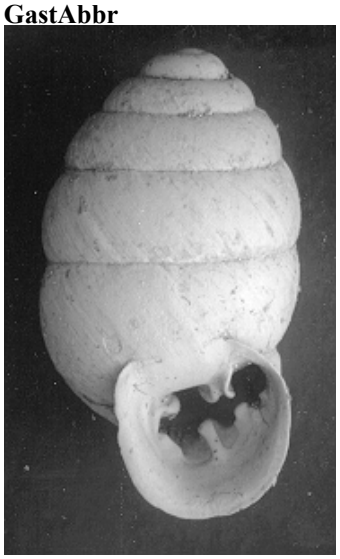
EucoFulv



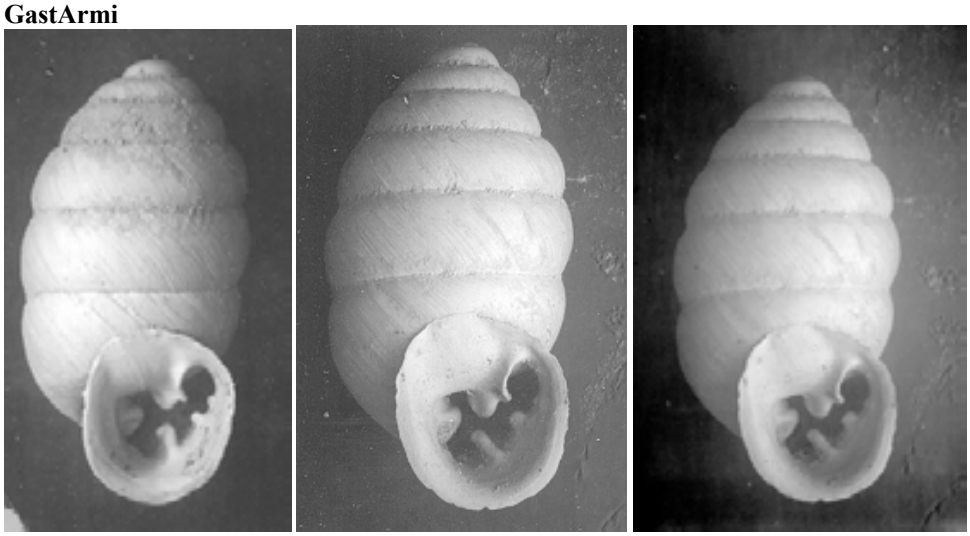
EucoPoly



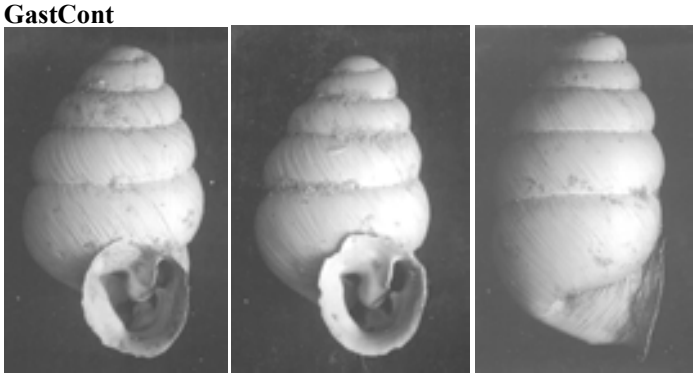
GastAbbr



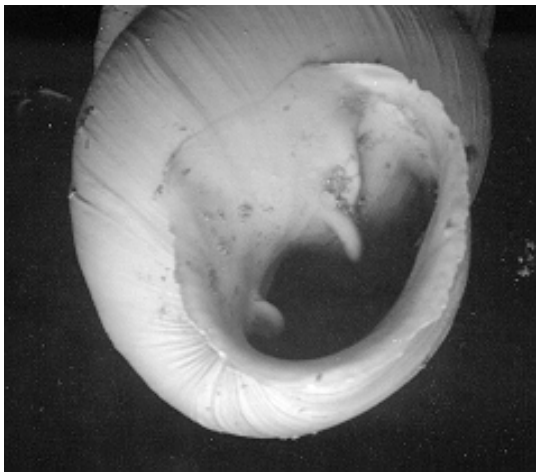
GastArmi



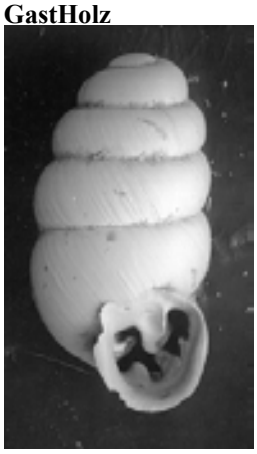
GastCont



GastCort

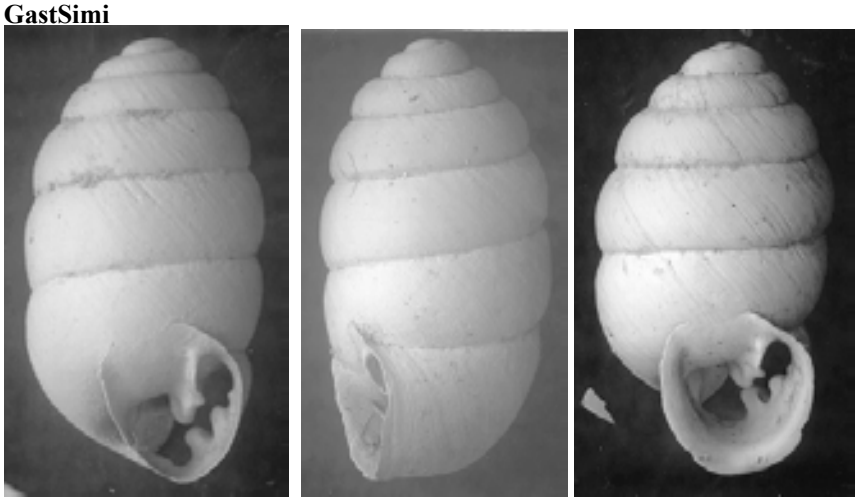



GastHolz

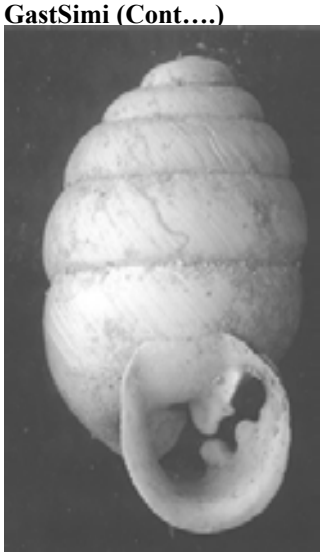



GastPent


GastSimi

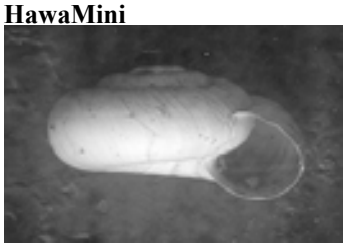


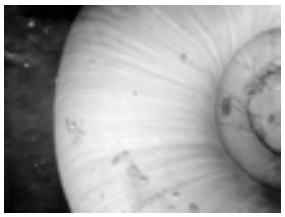
GastSimi (Cont….)



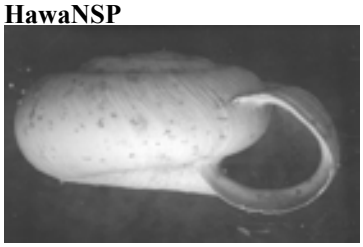
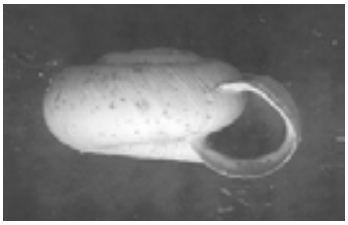
GastTapp

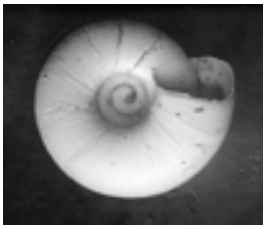
HawaMini



HawaNSP

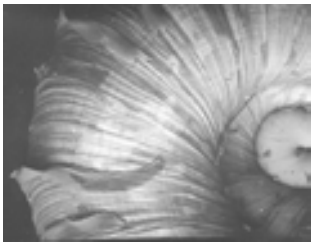





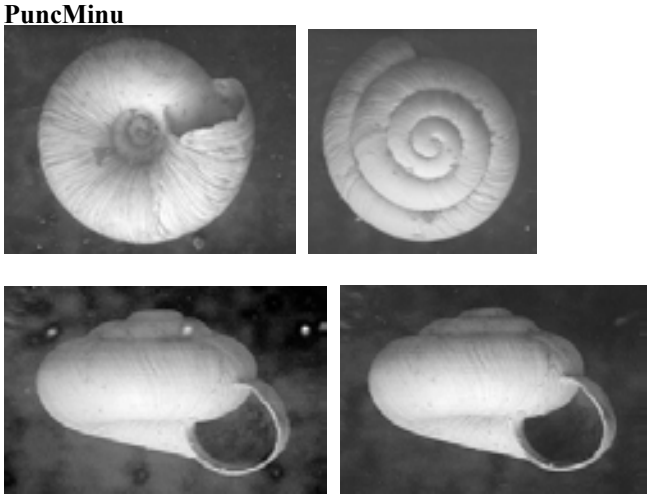

PlanAste



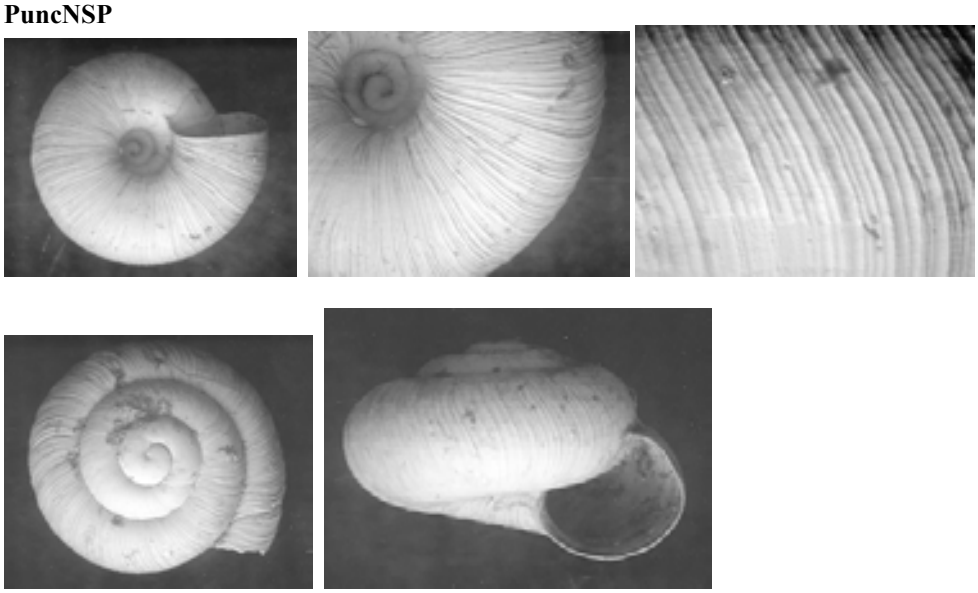




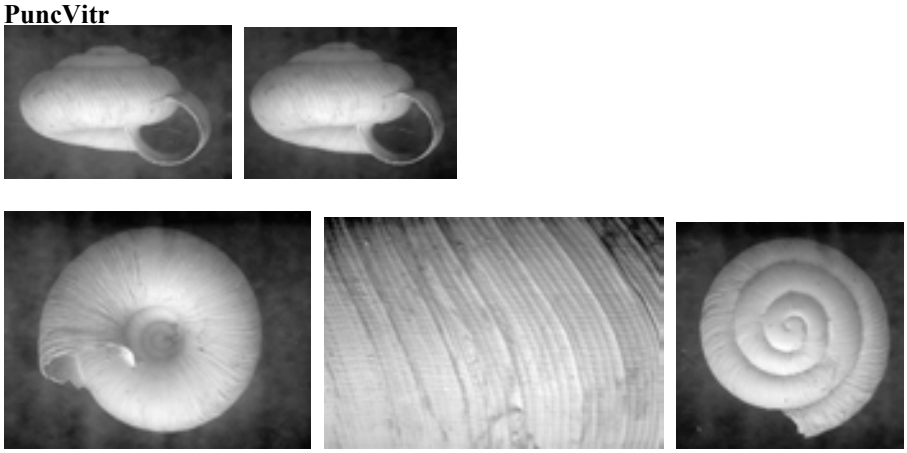
PuncMinu



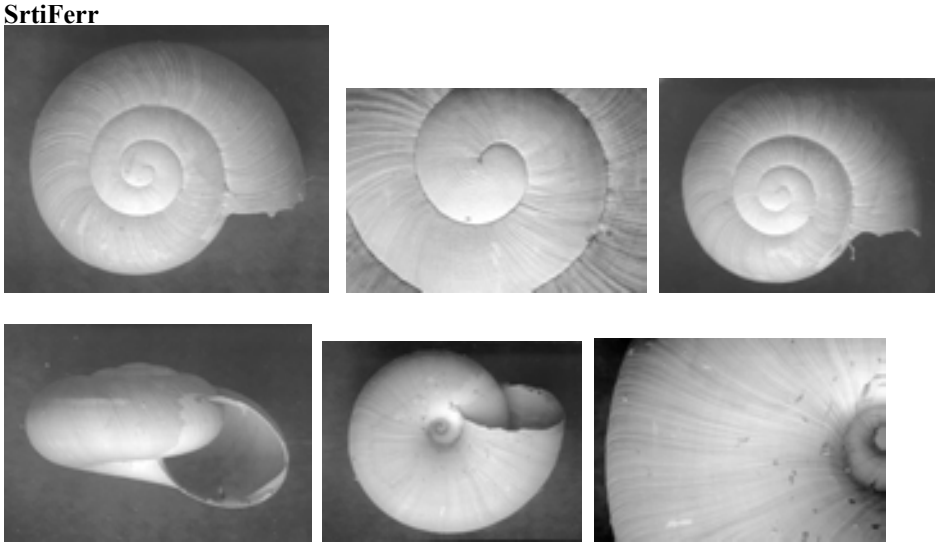
PuncNSP



PuncVitr

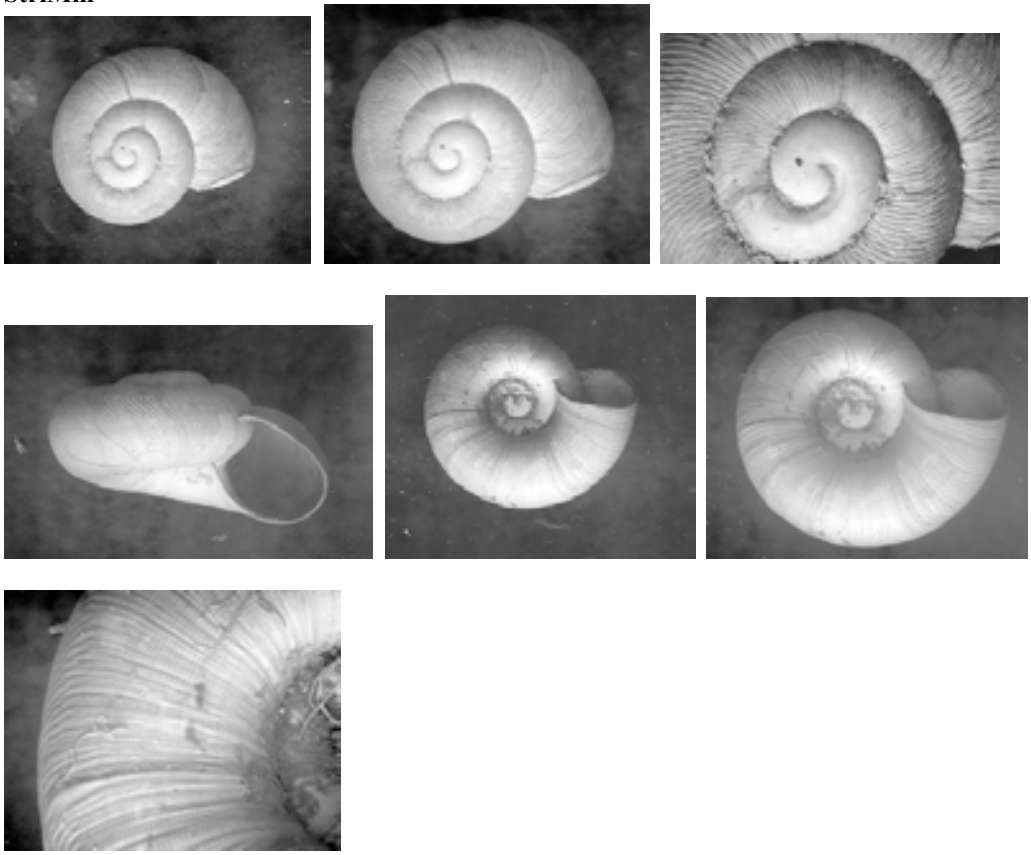


SrtiFerr

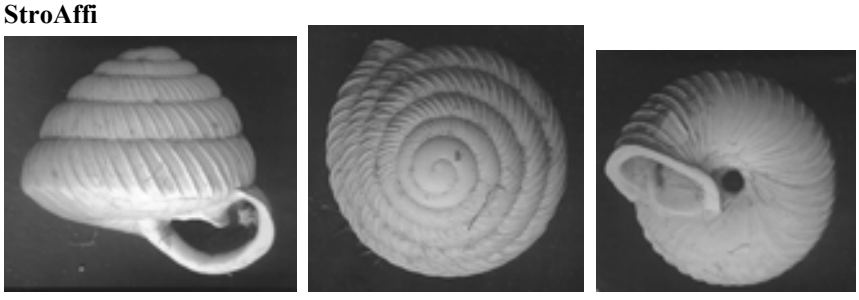


StriExig

StriMili

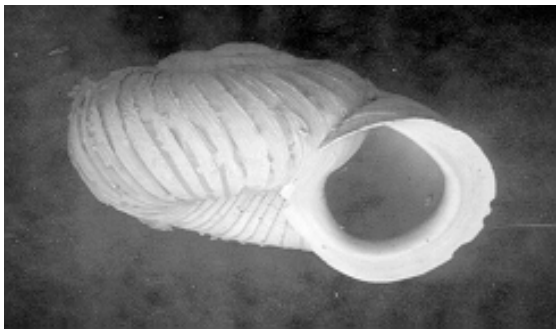


StroAffi

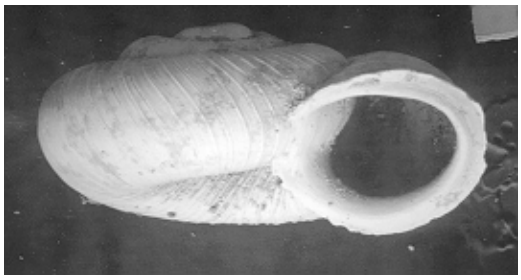
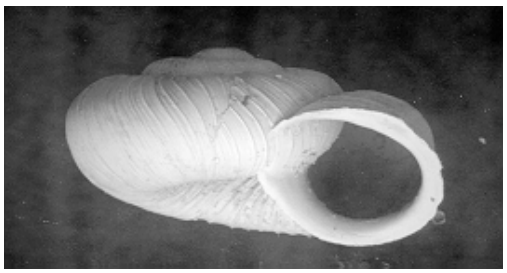


StroLaby

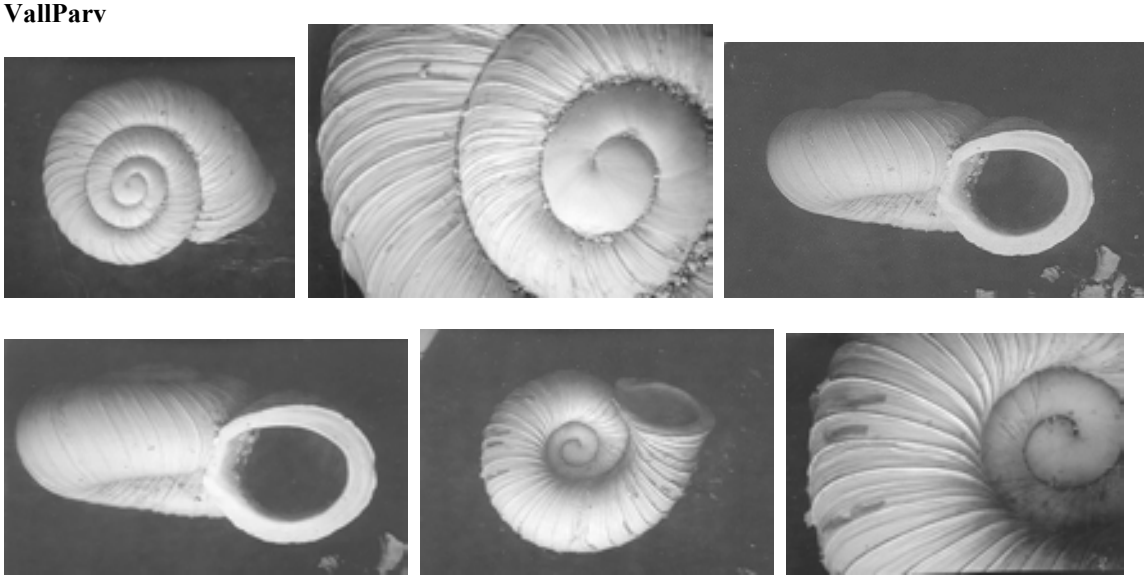
ValCost

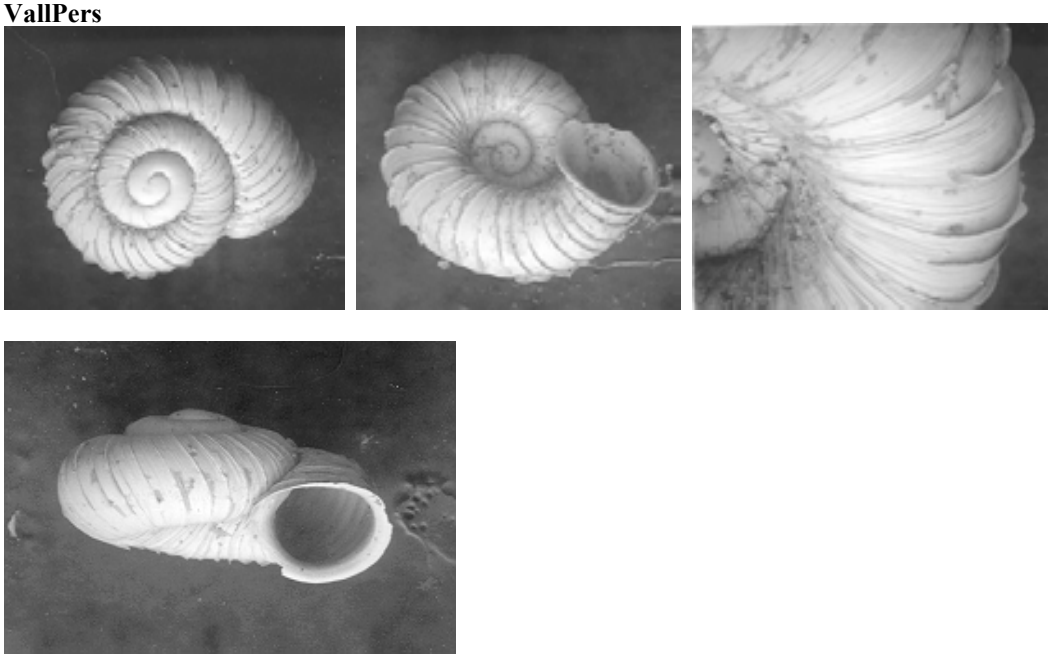

ValGrac

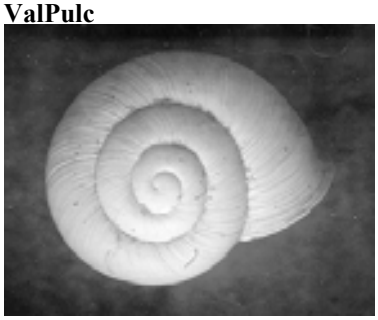
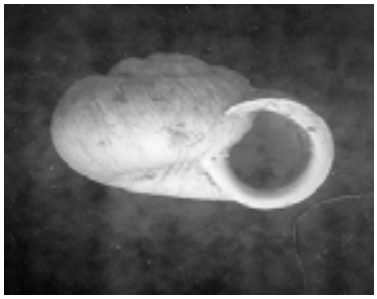
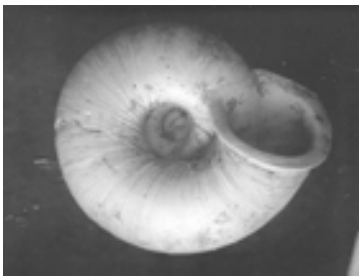
VallParv



VallPers



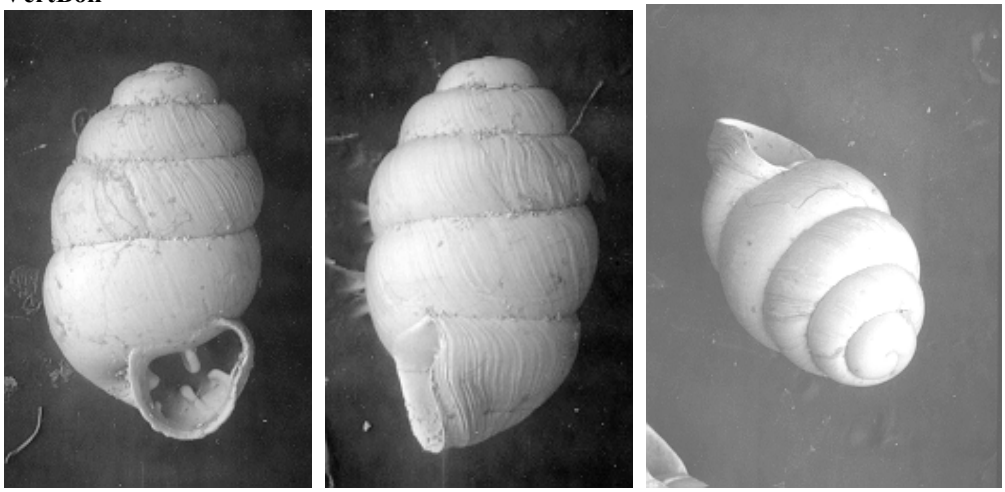
ValPulc

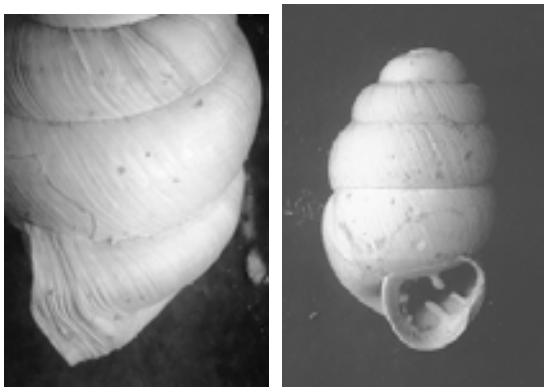





VertArth

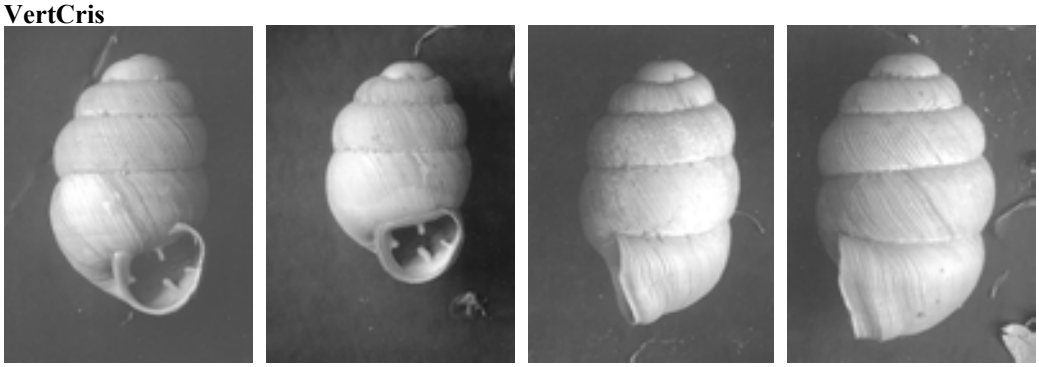


VertBoll

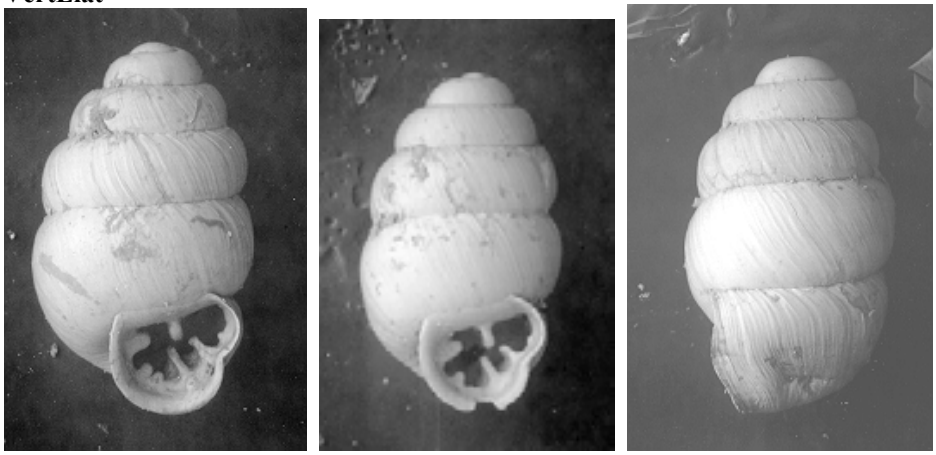




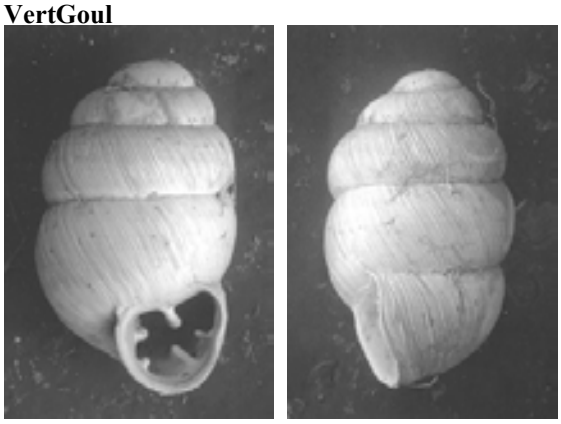
VertCris



VertElat

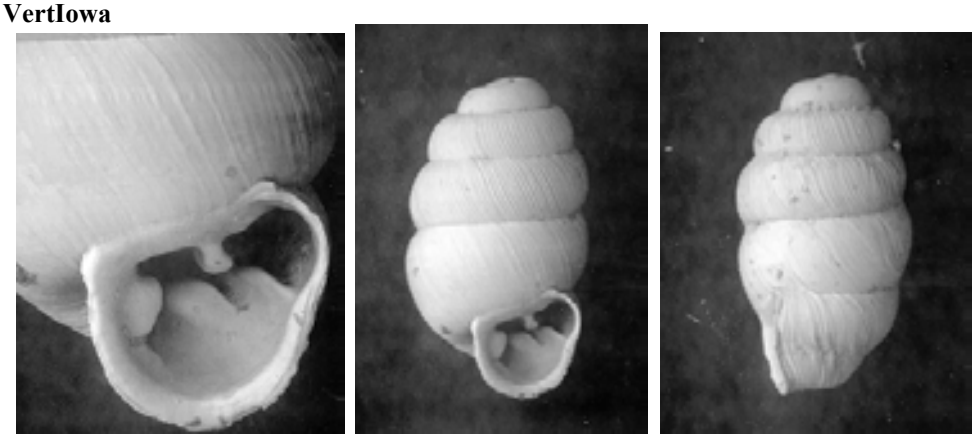


VertGoul

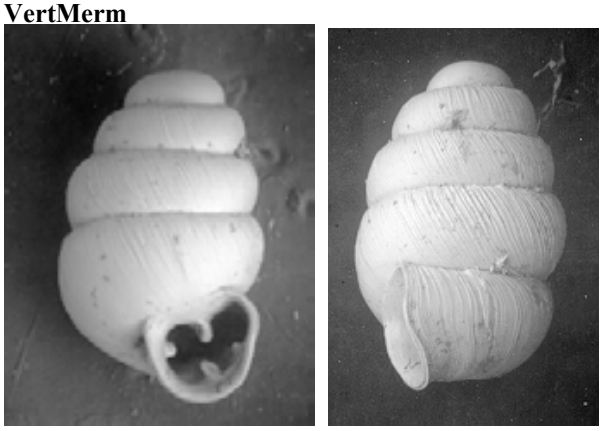


VertHubr

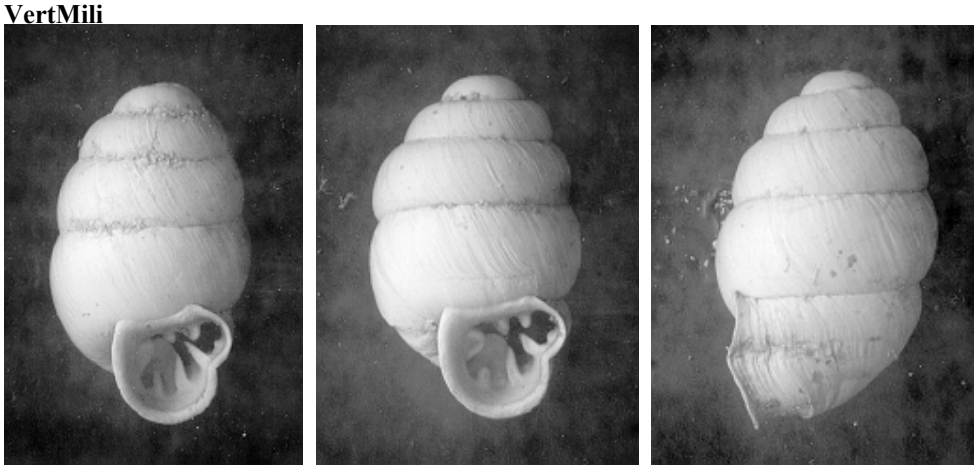
VertIowa



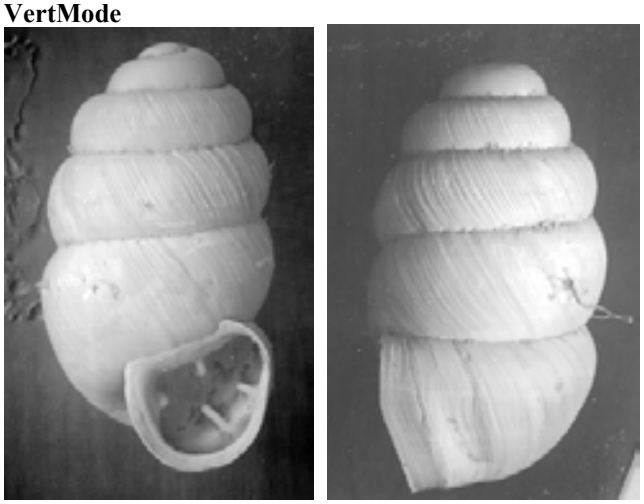
VertMerm



VertMili

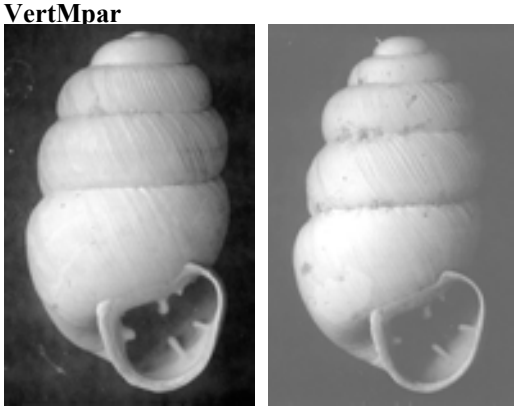


VertMode



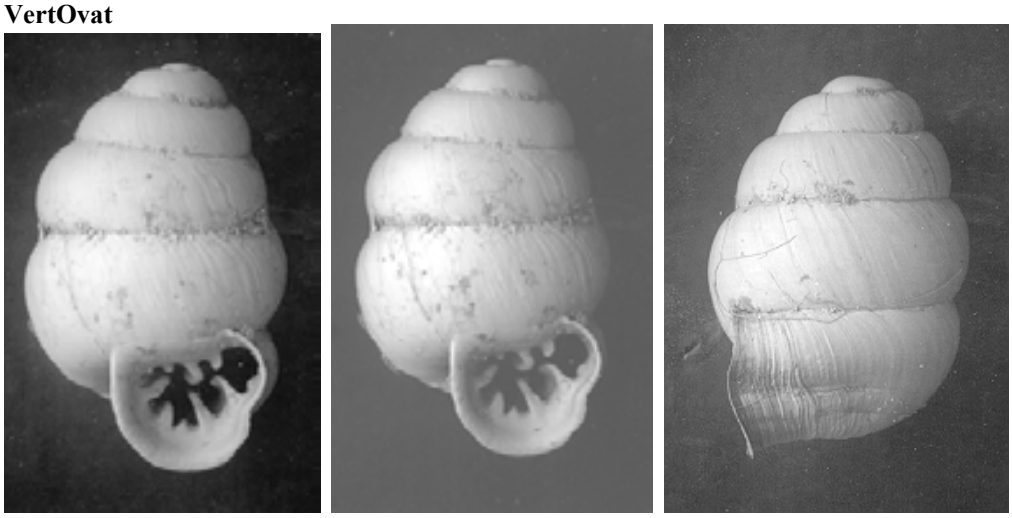
VertMors

VertMpar

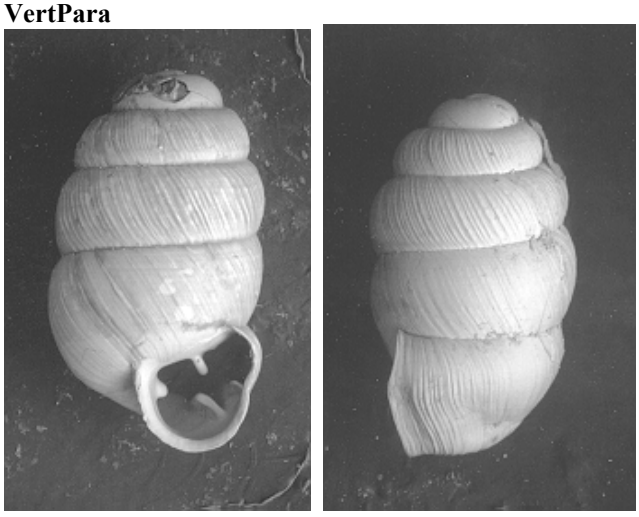


VertNyla

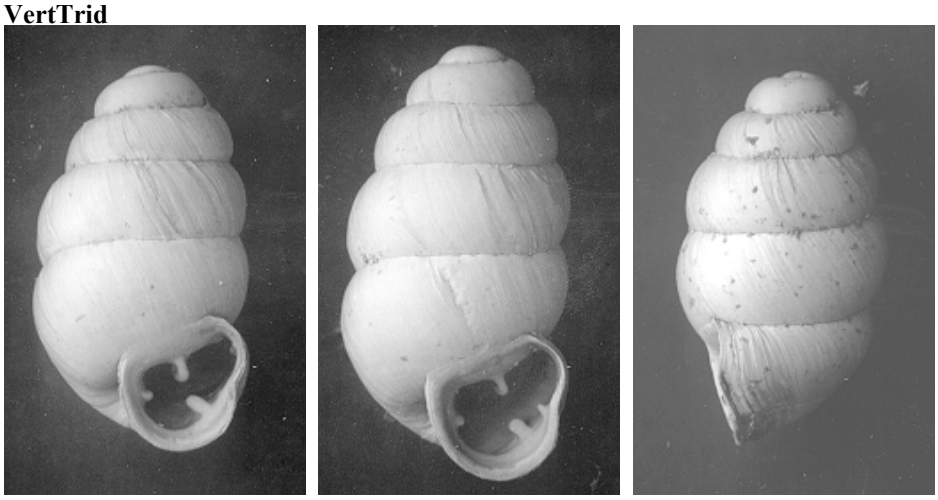
VertOvat



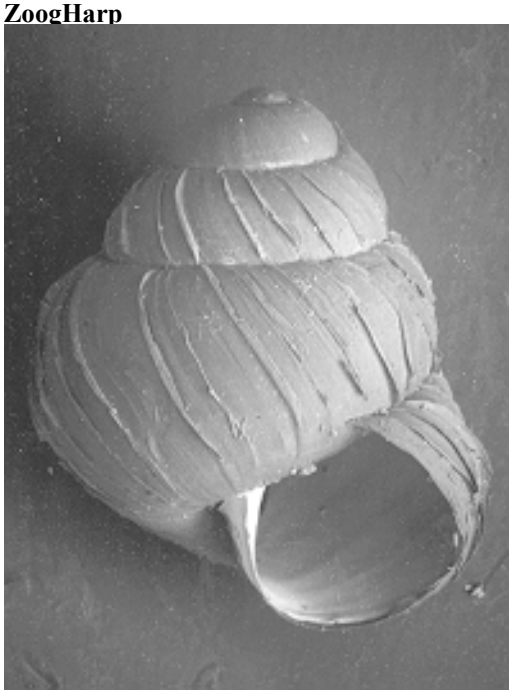
VertPara



VertTrid



ZoogHarp



Key to the terrestrial gastropod genera of Wisconsin and nearby states
Adult Shells -- Version 1.2

1 Individuals without external shell ..... Slugs
Individuals with external shell 2
2 Shell as wide or wider than tall 3
Shell taller than wide 57
3 Shell approximately as wide (.8-1.2x) as tall 4
Shell obviously wider (>1.2x) than tall 8
4 Shell umbilicate ..... *Strobilops*
Shell imperforate to rimate 5
5 Shell >10mm diameter 6
Shell <10mm diameter 7
6 Shell imperforate, peristome white, expanded ..... *Neohelix* group
Shell narrowly umbilicate or rimate, peristome thin ..... *Ventridens*
7 Peristome thickened, shell surface dull, suture absent, shell >3 mm diameter ..... *Hendersonia*
Peristome thin, shell surface satiny to glossy, suture deep, shell <3mm diameter ..... *Euconulus*
8 Shell diameter >6mm 9
Shell diameter <6mm 33
9 Shell with open umbilicus 10
Shell performate, imperforate or rimate 21
10 Peristome expanded, white 11
Peristome thin 15
11 Shell diameter >15mm 12
Shell diameter <15mm 13
12 Parietal and basal lamella present ..... *Mesodon clausus* group
Parietal and basdal lamella absent ..... *Allogonia*
13 Peristome continuous, 'y' or 'u' shaped on parietal surface ..... *Polygyra*
Peristome not continuous 14
14 Basal and palatial lamellae present, umbilicus >2 mm diameter ..... *Triodopsis tridentata* group
Basal and palatial lamellae absent, umbilicus <2 mm diameter ..... *Stenotrema*
15 Top of shell flat, shell white, smooth, umbilicus >5mm wide ..... *Haplotrema*
Top of shell raised, shell yellow to brown, umbilicus <5mm wide 16
16 Shell with spiral or transverse color markings, >10mm wide 17
Shell of single color 18
17 Umbilicus, on average, <=1/5 shell diameter ..... *Oreohelix*
Umbilicus, on average, >1/5 shell diameter ..... *Anguispira*
18 Shell >15mm diameter ..... *Mesomphix*
Shell <15mm diameter 19
19 Umbilicus <1mm diameter ..... *Ventridens*
Umbilicus >1mm diameter 20
20 Umbilicus .>1/3 shell diameter; shell surface dull, strongly ribbed ..... *Discus*
Umbilicus < shell diameter; shell surface shiny with indistinct ribs ..... *Zonitoides*
21 Peristome thin 22
Peristome expanded, white 25
22 Lamellae present on aperture base 23
Lamellae absent within aperture 24
23 Shell surface smooth ..... *Ventridens*
Shell surface with thick, regularly-spaced ridges ..... *Gastrodonta*
24 Whorl size increasing by at least 50% each revolution ..... *Mesomphix*
Whorl size increasing slowly in size, tighly coiled ..... *Ventridens*

25 Shell rimate to umbilicate 26
Shell imperforate 29
26 Strong parietal lamella present 24
Parietal lamella, if present, weak ..... *Mesodon clausus* group
27 Basal and outer aperatural surface without lamellae, peristome not continuous above parietial lamellae ..... *Stenotrema*
Lamellae present on outer and basal aperatural surface 28
28 Shell <10mm diameter, umbilicus <1mm diameter ..... *Polygyra*
Shell >10mm diameter, umbilicus >2mm diameter ..... *Triodopsis tridentata* group
29 Palatial lamellae absent 30
Palatial lamellae present 32
30 Shell <13mm diameter, long parietal lamella extending most of aperture length ..... *Stenotrema*
Shell >15mm diameter, parietal lamella (if present) much shorter than aperture 31
31 Shell at least twice as wide as tall ..... *Triodopsis denotata* group
Shell less than twice as wide as tall ..... *Neohelix* group
32 Basal lamella a long ridge ..... *Triodopsis denotata* group
Basal lamella short, peg-like ..... *Mesodon rugeli* group
33 Shell imperforate 34
Shell perforate to umbilicate 36
34 Aperture wider than rest of shell, shell glassy, transparent ..... *Vitrina*
Aperture less wide than rest of shell, shell transluscent to opaque 35
35 Shell <2mm diameter ..... *Guppya*
Shell >2mm diameter ..... *Glyphyalinia*
36 Umbilicus < diameter of shell 37
Umbilicus > diameter of shell 46
37 Peristome expanded, white ..... *Polygyra*
Peristome thin 38
38 Aperture strongly crescent-shaped, its width remaining approximately the same throughout 39
Aperture oval, its width being much greater in the middle 40
39 Top of shell with thick ribs; lamellae present in aperture ..... *Gastrodonta*
Top of shell with only low, indented ribs; lamellae absent in aperture ..... *Paravitrea*
40 Adult shells with 4-6 whorls which increase less than twice in width per revolution 41
Adult shells with <4 whorls which increase twice or more in width per revolution 43
41 Upper shell surface with dull luster and thick ribs ..... *Discus*
Upper shell surface shiny and with weak ribs 42
42 Last 1/5 of body whorl whitened from thickened shell; lamellae present in aperture ..... *Ventridens*
Body whorl neither thickened nor whitened; lamellae absent ..... *Zonitoides*
43 Shell surface with regular, widely spaced, indented ribs ..... *Glyphyalinia*
Shell surface with irregular, closely spaced ribs 44
44 Shell surface without faint spiral lines ..... *Nesovitrea*
Shell surface with faint spiral lines 45
45 Shell 2 -3 mm diameter; milky-white; ribs elevated ..... *Striatura*
Shell 4 -5 mm diameter; rusty-brown; ribs indented ..... *Glyphyalinia*
46 Adult shell diameter >3mm 47
Adult shell diameter <3mm 50
47 Peristome white, expanded ..... *Polygyra*
Peristome thin 48
48 Shell with prominent, raised spiral lines ..... *Helicodiscus*
Shell without prominent, raised spiral lines 49
49 Ribs small, approximately 10 per mm; shell color light yellow-brown ..... *Zonitoides*
Ribs large, approximately 5 per mm; shell color deep rusty-brown ..... *Discus*

50 Peristome flared and usually thickened ..... *Vallonia*
Peristome unflared and always unthickened 51
51 Spiral lines present on protoconch surface 52
Spiral lines not present on protoconch surface 53
52 Whorls increasing rapidly in width ..... *Striatura*
Whorls increasing slowly in width ..... *Helicodiscus*
53 Ribs with distinct, sharp edges 54
Ribs (if present) with indistinct, rounded edges 56
54 Ribs not continuous, with regular pieces removed so that ribs look like a string of beads under high magnification; whorls increasing rapidly in width ..... *Striatura*
Ribs continuous, whorls increasing slowing in width 55
55 Major ribs +-0.2mm tall, shell almost flat on top ..... *Planogyra*
Major ribs (if any) <0.2mm tall, shell clearly peaked on top ..... *Punctum*
56 Shell with rounded spire; base of whorls rounded; ribs present on shell surface ..... *Hawaiia*
Shell with flat spire; base of whorls flattened; shell surface smooth ..... *Helicodiscus*
57 Lax spiral with no more than 3 whorls in mature shell 58
Tighter spiral with 4+ whorls in mature shell 60
58 Aperture taking up of shell ..... *Catinella*
Aperture taking up more than of shell 59
59 Shell and aperture broadly ovate ..... *Succinea*
Shell and aperture narrowly ovate to elongate ..... *Oxyloma*
60 Adult shell >4mm tall 61
Adult shell <4mm tall 65
61 Shell with glassy luster, transparent to transluscent, yellow to brown color ..... *Cochlicopa*
Shell with silky to dull luster, opaque 62
62 Peristome thickened or flared, white 63
Peristome unthickened and unflared 64
63 Lamellae present in aperture ..... *Gastrocopta*
Lamellae absent in aperture ..... *Pupoides*
64 Shell <9mm tall, dark olive-brown color ..... *Pomatiopsis*
Shell >15mm tall, light gray-brown to white color ..... *Rabdotus*
65 Shell 1 -1 times taller than wide, with prominent 0.2mm elevated ribs ..... *Zoogenites*
Shell >1 times taller than wide, ribs (if present) much less than 0.2mm tall 66
66 Shell 2 times taller than wide, shell white with expanded peristome ..... *Carychium*
Shell 1 -2 times taller than wide 67
67 0-2 lamellae present in aperture 68
3+ lamellae present in apreature 70
68 Shell white ..... *Gastrocopta*
Shell brown 69
69 Shell >3mm tall ..... *Pupilla*
Shell <3mm tall .....*Columella*
70 Shell brown, sinulus usually strong ..... *Vertigo*
Shell white to clear, sinulus absent ..... *Gastrocopta*

Species keys (arranged alphabetically by genus)

Allogonia: *A. profunda*

Anguispira:

1 Protoconch surface smooth; ribs weak, irregular; spiral color bands present ..... *A. kochi*
Protoconch with distinct cross-hatching; ribs strong, regular; color bands (if present) transverse 2
2 Shell height > shell diameter; 3+ ribs per mm on body whorl ..... *A. alternata*
Shell height < shell diameter; 2 or fewer ribs per mm on body whorl ..... *A. strongylodes*

Carychium:

1 Shell surface distinctly striate 2
Shell surface weakly striate to smooth 4
2 Shell >1.8 mm tall 3
Shell <=1.8 mm tall ..... *C. exile*
3 Striae strong with sharp edges, peristome unthickened ..... *C. clappi*
Striae weaker with rounded edges, peristome moderately thickened ..... *C. exile canadense*
4 Shell surface completely smooth; persitome thin, reflexed ..... *C. nannodes*
Shell surface weakly striate; peristome thickened 5
5 Shell diameter increasing with each whorl, basal whorl averaging < mm wide ..... *C. riparium*
Shell diameter constant over last 2-3 whorls, basal whorl > mm wide ..... *C. exiguum*

Catinella:

1 Shell >1.9 times as tall as broad, color light red-tan, resticted to fens ..... *C. exile*
Shell <1.8 times as tall as broad, color grey-green to tan, habitats various 2
2 Shell averaging >7mm tall, growth lines indistinct; tan-brown color; moist, open habitats .. *C. avara*
Shells averaging <7mm tall, growth lines relatively distinct, gray-green color 3
3 Living shells covered with detritus; woodland habitat ..... *C. wandae*
Living shells clean; algific slope or cliff habitat ..... *C. gelida*

*Note: Species differentiation in this genus is problematic, as is true for all Succineads. In particular, little or no reliable shell differences were noted between *C. gelida* and *C. wandae*. If these two taxa are distinct, it is possible that they may be easily separable only by their different habitat preferences.

Cochlicopa:

1 Mature shells >2.8 mm wide ..... *C. nitens*
Mature shells < 2.8 mm wide 2
2 Mature shells >2.3 mm wide, broadly ovate shape ..... *C. lubrica*
Mature shells < 2.3 mm wide, elliptical shape 3
3 Mature shells <6 mm tall ..... *C. lubricella*
Mature shells >6 mm tall ..... *C. morseana*

Columella:

Shell <2 mm tall, tapering, 5 -6 whorls ..... *C. simplex*
Shell >2 mm tall, cylindrical (bottom 3-4 whorls of same diameter), 6-7 whorls ..... *C. alticola*

Discus:

1 Lamella present on columellar side of aperture ..... *D. patulus*
Lamella absent 2
2 Ribs indistinct or lacking on shell base 3
Ribs distinct on shell base 4

3 5 -6 whorls on adult individuals, umbilicus >1/3 shell diameter ..... *D. macclintockii*
3 -4 whorls on adult individuals, umbilicus 1/3 shell diameter or less ..... *D. shimeki*
4 Margin of last whorl bluntly angular ..... *D. catskillensis*
Margin of last whorl rounded ..... *D. cronkhitei*

Euconulus:
1 Whorls gradually increasing in size, with last 3 constituting <2/3 of total shell diameter as seen from top; ribs and spiral lines indistinct to almost absent on initial whorls 2
Whorls increasing rapidly in size, with last 3 constituting >2/3 of total shell diameter as seen from top; distinct ribs and spiral lines present on initial whorls 5
2 Lamellae present on shell base ..... *E. dentatus*
Lamellae absent 3
3 Outside margin of last whorl rounded; shell shape (as seen from side) rounded; ribs and spiral lines almost absent from inital whorls ..... *E. polygyratus*
Outside margin of last whorl angled; shell shape (as seen from side) pyramidal; indistinct ribs and spiral lines present on inital whorls 4
4 Shell wider than tall ..... *E. chersinus*
Shell taller than wide ..... *E. trochulus*
5 Shell luster shiny; dark brown-copper colored; mature shell <2.8 mm diameter; spiral lines on base as or more distinct than transverse lines ..... *E. alderi*
Shell luster silky; tan to light-brown color; mature shell >2.8 mm diameter; spiral lines on base less distinct than transverse lines ..... *E. fulvus*

Gastrocopta:
1 Shell >3 mm tall 2
Shell <3 mm tall 4
2 Columellar lamella much wider than tall and without a strong forward projection, thus apperaring sheet-like; lower palatial lamella inserted more deeply into aperture than upper, 1/3 or more as wide as long ..... *G. similis*
Columellar lamella as tall or taller than wide and with a forward-projecting lobe; lower palatial lamella inserted at same depth as upper, less than 1/3 as wide as long 3
3 Shell >4 mm tall; basal lamella small or absent; columellar lamella with a distinct vertical lobe, thus appearing more or less pyramidal ..... *G. armifera*
Shell <4 mm tall; basal lamella well developed; columellar lamella without a distinct vertical lobe, thus appearing more or less cylindrical ..... *G. abbreviata*
4 Basal and palatial lamellae absent ..... *G. corticaria*
Basal and palatial lamellae present 5
5 Shell less than as wide as tall; diameter constant after 3rd whorl 6
Shell more than as wide as tall; increasing in diameter with each whorl 9
6 Shell height >2 mm 7
Shell height <2 mm 8
7 Parietal lamella simple .....*G. cristata*
Parietal lamella with two lobes ..... *G. procera*
8 Peristome margin flared ..... *G. holzingeri*
Peristome margin unflared ..... *G. venusta*
9 Shell >2 mm tall; peristome flared ..... *G. contracta*
Shell <2 mm tall; peristome thickened but not flared 10
10 Shell height slightly less than twice its diameter; lower palatial lamella large, deeply entering shell; to 1.8 mm tall ..... *G. pentedon*
Shell height approximately 1.3 times its width; lower palatial lamella small, not deeply entering into shell; to 2.2 mm tall ..... *G. tappaniana*

Gastrodonta: *G. interna*

Glyphyalinia:

1 Shell openly umbilicate 2
Shell imperforate to very narrowly rimate..... 3

2 Shell with evenly-spaced impressed ribs, color clear-white, spiral striations absent on protoconch ..... *G. rhoadsi*
Shell with more irregular impressed ribs, color honey-yellow, spiral striations present on protoconch ..... *G. wheatleyi*

3 Large tongue-like projection completely covering umbilicus ..... *G. solida*
Umbilicus only partially covered by small, tongue-like projection ..... *G. indentata*

Guppya: *G. sterkii*

Haplotrema: *H. concavum*

Hawaiia:

1 Callus present in aperture ..... *Hawaiia* n.sp.
Shell aperture unthickened 2

2 Umbilicus round, the inner margin of the body whorl intersects less than 1/3 of way across penultimate whorl ..... *H. miniscula*
Umbilicus oval, the inner margin of the body whorl insects at 1/3 or more of way across penultimte whorl ..... *H. alachuana*

*Note: *H. miniscula* and *H. alachuana* appear very similar, with apparent introgression between both forms being common in some populations. These 'species' may actually represent different developmental stages of the same taxon.

Helicodiscus:

1 Surface smooth or with microscopic spiral lines 2
Surface with large, raised spiral lines 4

2 Lamellae present in aperture ..... *H. roundyi*
Lamellae absent 3

3 Umbilicus deep (usually extending beyond of shell height) and wide (-1/3 of shell diameter) as seen in mature individuals ..... *H. singleyanus*
Umbilicus shallow (rarely extending beyond of shell height) and narrow (1/3- of shell diameter) as seen in mature individuals ..... *H. inermis*

4 Callus present in aperture, but lamellae absent ..... *Helicodiscus* n.sp.
Lamellae present, callus in aperture reduced or absent 5

5 Body whorl width (on bottom) <1 mm wide; umbilicus very wide (>2/3 shell diameter) and shallow (< shell height) ..... *H. shimeki*
Body whorl width (on bottom) >=1 mm; umbilicus less wide (<2/3 shell diameter) and deeper (approximately shell height) 6

6 Umbilicus increasing little in width over last 3 whorls, creating a steep sided (> 45° in relation to major shell axis) umbilicus wall; columellar wall of aperture straight and perpendicular to base of penultimate whorl .....*H. parallelus*
Umbilicus increasing gradually in width over last 3 whorls, creating an umbilicus wall at approximately a 45° angle to major shell axis; columellar wall of aperture rounded, departing base of penultimate whorl at a 60°-45° angle ..... *H. notius notius*

Note: *H. inermis* and *H. singleyanus* appear very close, and may represent different forms of the same species. Likewise, *H. parallelus* and *H. notius* appear to be almost indistinguishable in many

cases. *H. notius* may actually represent an intermediate form between *H. parallelus* and *H. shimeki*.

Hendersonia: *H. occulta*

Mesodon clausus group:

1 Umbilicus >3 mm wide, mostly open, peristome weakly expanded..... *M. sayanus*
Umbilicus <3 mm wide, almost covered, peristome strongly expanded 2
2 Shell diameter >18 mm ..... *M. thyroides*
Shell diameter <=18 mm ..... *M. clausus clausus*

Mesodon rugeli group:

Parietal lamellae >= 2 mm tall; palatial lamellae immersed, 1.5 mm wide..... *M. rugeli*
Parietal lamellae <1 mm tall; palatial lamellae marginal, 1 mm wide ..... *M. inflectus*

Mesomphix:

1 Umbilicus <1/10 shell width 2
Umbilicus >=1/10 shell width 4
2 Whorl and protoconch surface nearly smooth; glassy luster ..... *M. inornatus*
Whorl and protoconch striate; dull luster 3
3 Body whorl absent or with only indistinct spiral lines ..... *M. vulgatus*
Body whorl with distinct spiral lines ..... *M. globosus*
4 Umbilicus open, 1/5-1/6 shell diameter ..... *M. cupreus*
Umbillicus rimate, 1/7-1/10 shell diameter ..... *M. friabilis*

Neohelix group:

1 Shell with distinct spiral color bands ..... *Triodopsis multilineata*
Shell of uniform color 2
2 Diameter >20mm 3
Diameter <20mm 6
3 Parietal lamellae >1/3 aperture length, shell almost as tall as wide ..... *Mesodon elevatus*
Parietal lamellae <1/3 aperture length or absent, shell clearly wider than tall 4
4 Parietal lamella present; final 3 whorls constituting <80% of shell diameter ..... *Mesodon zaletus*
Parietal lamella absent; final 3 whorls constituting 80% or more of shell diameter 5
5 Pronounced thickening on peristome base near columella ..... *Triodopsis alleni*
Peristome thickness essentially constant throughout ..... *Triodopsis albolabris*
6 Basal margin of aperture straight ..... *Mesodon pennsylvanicus*
Basal margin of aperture concave ..... *Mesodon mitchellianus*

Nesovitrea:

Shell brown, >4 mm diameter at 4 whorls ..... *N. electrina*
Shell whitish, <4mm diameter at 4 whorls ..... *N. binneyana*

Oreohelix: *O. strigosa cooperi*

Oxyloma:

1 Penultimate whorl (as seen from bottom) low convex, with maximum width <= the maximum aperture width; aperture approaching maximum width in upper of shell ..... *O. salleana*
Penultimate whorl (as seen from bottom) more highly convex, with maximum width 2/3-3/4 of the maximum aperture width; aperture approaching maximum width at of shell height 2

2 Shell width > of shell height; shell apex angle >75° (e.g. 3 shells lined up like pie wedges with apices touching makes more than of a circle) ..... *O. peoriensis*
Shell width <= of shell height; shell apex angle approximately 60° (e.g. 3 shells lined up like pie wedges with apices touching makes of a circle or less) ..... *O. retusa*

*Note: this genus, along with all Succineads, is taxonomically complex, with taxa being perhaps unseparable based on shell characteristics. *O. peoriensis* looks very much like a small *Succinea*, and individuals may also key out in that genus. In the *Succinea* key, it will key out as *S. indiana*, with whom it will differ based upon it wetland rather than xeric upland habitat, and its smooth, clear shell (rather than roughened, translucent shells in *S. indiana*)

Paravitrea:
1 Mature shells <3 mm diameter; body whorl (on top side of shell) < mm wide; lamellae present on base ..... *P. multidentata*
Mature shells >3 mm diameter; body whorl (on top side of shell) > mm wide; lamellae absent on base 2
2 Shell top rounded; body whorl (on top side of shell) approximately twice the diameter of the penultimate; sculpture of numerous indistinct and shallow inset ribs ..... *P. significans*
Shell top shallowly pyramidal; body whorl (op top side of shell) approximately 1 times the diameter of the penultimate; sculpture of scattered deeply impressed ribs ..... *P. capsella*

Planogyra: *P. astericus*

Polygyra:
1 Umbilicus < shell diameter, rimate; hairs on shell surface ..... *P. leporina*
Umbilicus >1/3 shell diameter, shells without hairs 2
2 Margin of shell angular ..... *P. fatigata*
Margin of shell rounded 3
3 Upper palatial lamella deeply immersed; parietal lamella with straight-sided, angular channel down middle and a tri-lobed terminus ..... *P. plicata*
Upper palatial lamella only moderately immersed; parietal lamella with rounded, concave channel down middle and with square terminus ..... *P. dorfeulliana*

Pomatiopsis:
Shell approximately twice as tall as wide ..... *P. lapidaria*
Shell approximately 1.3 times as tall as wide ..... *P. cincinnatiensis*

Punctum:
1 Lamellae present on base of aperture ..... *P. smithi*
Lamellae absent 2
2 Shell sculpture very weak to absent ..... *P. parvulum*
Shell sculpture evident 3
3 Umbilicus >1/3 shell diameter ..... *P. blandianum*
Umbilicus <=1/3 shell diameter 4
4 Shell >1.2 mm diameter and > mm tall; color deep rust-brown ..... *Punctum* n.sp.
Shell <=1 mm diameter and <= mm tall; color tan to gray 5
5 All ribs of essentially equal size, spearated by 1-3 minor riblets ..... *P. minutissimum*
Some ribs more prominent than others, separated by 5+ minor riblets ..... *P. vitreum*

Pupilla: *P. muscorum muscorum*

Pupoides: *P. albilabris*

Rabdotus: *R. dealbatus dealbatus*

Stenotrema:

1 Lower margin of peristome complete (subgen. *Euchemotrema*) 2
Lower margin of peristome with notch removed (subgen. *Stenotrema*) 5
2 Shell margin angular ..... *S. hubrichti*
Shell margin rounded 3
3 Body and penultimate whorls >1 mm wide as measured from top of shell ..... *S. fraternum*
Body and penultimate whorls <=1 mm wide as measured from top of shell 4
4 Shell umbilicate; <8 mm diameter ..... *S. leai leai*
Shell imperforate; >=9 mm diameter ..... *S. leai aliciae*
5 Right end of parietal lamella entering aperture; aperture less wide than basal peristome lip .....*S. stenotrema*
Right end of parietal lamella barely entering aperture, aperture as wide as basal peristome lip 6
6 Aperture wider than basal peristome margin; shell >= 8 mm diameter; interior lamella at the junction of the columella and aperture extending >1 mm beyond basal peristome margin; approximately 4 shell hairs per mm ..... *S. barbatum*
Aperture same width as basal peristome margin; shell approximately 6 mm diameter; interior lamella at the junction of the columella and aperture extending <1 mm beyond basal peristome margin; 5-6 shell hairs per mm ..... *S. hirsutum*

Striatura:

1 Shell diameter <2mm 2
Shell diameter >2mm 3
2 Sprial lines prominent on protoconch, inter-rib distance greater than rib width ..... *S. meridionalis*
No sprial lines on protoconch, inter-rib distance same as rib diameter ..... *S. milium*
3 Prominent, widely spaced ribs present, umbilicus 1/3 shell diameter, whorls increasing slowly in diameter ..... *S. exiguum*
Ribs and spiral lines weak, umbilicus 1/5 shell diameter or less, whorls increasing rapidly in diameter ..... *S. ferrea*

Strobilops:

1 Margin angular, shell pyramidal, 3-4 basal folds ..... *S. aenea*
Margin rounded, shell beehive-shaped, 5+ basal folds 2
2 Basal folds of equal size, arranged in smooth arc ..... *S. affinis*
Basal fold size unequal with second from umbilius much longer than first, folds arranged in an irregular arc ..... *S. labyrinthica*

Succinea:

1 Shell apex angle >60° 2
Shell apex angle <60° 4
2 Mature shell length >15 mm; shell thin and usually translucent ..... S. *ovalis* group, including *S. ovalis, S*. n.sp. Minnesota A and *S*. n.sp. Minnesota B, plus the Wiscsonsin cliff-dwelling taxon called '*S. bakeri*' by Terry Frest
Mature shell length <15 mm 3
3 Shell surface irregular; shell thick and almost opaque ..... *S. indiana* group
Shell surface smooth; shell thin and transparent ..... *Oxyloma peoriensis*
4 Mature shell length >15 mm ..... *S. chittenangoensis*
Mature shell length <15 mm 5

5 Deep suture at apex; shell smooth; Pleistocene fossil ..... *S. bakeri*
Shallow suture at apex; shell with prominent growth ridges; extant taxon ..... *S. forsheyi*

*Note: A notoriously difficult group, which has been extensively split into a number of taxa based upon anatomical differences. However, the shells are all convergent, and given the plascticity of many of the genetalic traits considered taxonomically important, it is unclear how many of these proposed taxa are valid. This state of taxonomic affairs is reminiscent of the confusion which surrounds the plant genus *Rubus* in North America. In his Flora of the Northeastern US and Canada, Henry Gleason states:

> "Species in the ordinary sense of the term scarcely exist in the section *Eubatus*..... There have been produced in the American Brambles a large number, possibly as many as 10,000, of small populations of microspecies, differing from each other very slightly, although the culmination of minute differences leads to extremes which are quite unlike. .... In order to keep the number of taxonomic groups within bounds and make them recognizable to the student, it has been necessary to use only a limited number of combinations of characters, thereby segregating thirteen native American groups which can be regarded as collective species. These are intended for convenience only."

This summary applies almost identically to the genus *Succinea*. Thus, like Gleason did with *Rubus*, I have opted to designate in only 4 extant collective species-groups within *Succinea* to make this group more easy to deal with by ecological researchers.

Triodopsis denotata group:

1 Small palatial lamella present, pappilae with stiff hairs ..... *Triodopsis denotata*
Shells without papillose hairs 2
2 Shell margin acute ..... *Triodopsis obstricta*
Shell margin rounded 3
3 Body whorl with small, distinct, papillae; shell twice as wide as tall ..... *Mesodon laevior*
Body whorl with papillae very indistinct or absent; shell 1 times as wide as tall ..... *Triodopsis fosteri*

Triodopsis tridentata group:

1 Umbilicus deep, >= shell diameter; parietal wall of peristome strongly 'C' shaped when viewed on edge ..... *T. vulgata*
Umbilicus not as deep; < shell diameter; parietal wall of peristome straight or only slightly bowed when viewed on edge 2
2 Parietal lamella pointed at or above palatial ..... *T. discoidea*
Parietal lamella pointed below palatial ..... *T. tridentata*

Vallonia:

1 Peristome weakly thickened in mature shells 2
Peristome strongly white-thickened in mature shells 3
2 Diameter >2 mm ..... *V. cyclophorella*
Diameter <=2mm ..... *V. perspectiva*
3 Shell surface smooth, shiny, major ribs absent 4
Shell surface dull, major ribs present 5
4 Shell white; ribs low but distinct; diameter of minor axis in mature shells >1 mm; body whorl diameter remaining relatively constant at aperture so that last portion of whorl remains approximately parallel to penultimate ..... *V. pulchella*
Shell yellow-tan; ribs indistinct or lacking, making shell appear smooth; diameter of minor axis in mature shells <=1 mm; body whorl diameter increasing rapidly at aperture so that last portion of whorl diverges from penultimate ..... *V. excentrica*
5 Diameter of mature shells <=2mm ..... *V. parvula*
Diameter of mature shells >2mm 6

6 Diameter of mature shells <2 mm, 23-35 ribs on body whorl, ribs > 0.1 mm tall ..... *V. costata*
Diameter >2 mm, 45-50 ribs on body whorl, ribs <0.1 mm tall 7
7 Peristome prominently thickened; shell often less than twice as wide as tall; umbilicus approximately circular ..... *V. gracilicosta gracilicosta*
Peristome less strongly thickened; shell often more than twice as wide as tall; umbilicus strongly ovate ..... *V. gracilicosta albula*

Ventridens:
1 Umbilicus rimate, less than 1/10 shell diameter; shell diameter >6 mm 2
Umbilicus open, more than 1/10 shell diameter; shell diameter <6 mm 4
2 Basal lamellae present ..... *V. gularis*
Basal lamellae absent 3
3 Strong spiral striate on last whorl; shell surface dull below ..... *V. intertextus*
Spiral striae on last whorl indistinct, limited to base of whorl; shell surface glossy below ..... *V. ligera*
4 Palatial lamellae present ..... *V. virginicus*
Palatial lamellae absent .....*V. suppressus*

Vertigo:
1 Shell surface smooth or only weakly striate 2
Shell surface distinctly striate 11
2 6 or more lamellae present in aperture 3
5 or less lamellae present in aperture 6
3 Angular lamella absent ..... *V. pygmaea*
Angular lamella present 4
4 Shell <1.75mm tall; lower palatial lamella long, curved, deeply entering shell ..... *V. milium*
Shell >2mm tall; lower palatial lamella short, straight, not entering shell 5
5 Shell <2 mm tall, broadly ovate; 4-5 whorls in adult shells ..... *V. ovata*
Shell >2 mm tall, elliptical; 6-7 whorls in adult shells ..... *V. morsei*
6 Surface weakly, but regularly, striate 7
Surface either without striae, or with indistinct and irregular striae 8
7 Lamellae 5; deep depression present over palatial lamellae; shell height <1.8 mm ..... *V. bollesiana*
Lamellae 4 or less; no depression over palatial lamella; shell height >2 mm ..... *V. alpestris oughtoni*
8 Upper palatial lamella, if present, much smaller than lower ..... *V. tridentata*
Upper palatial lamella always present and approximately equal in size to lower 9
9 Shell with dull luster; very prominent, light-colored crest present ..... *V. pygmaea*
Shell with shiny luster; crest (if present) weak and of same color as rest of shell 10
10 Aperture with strong callus and sinulus; moderately strong crest present; shell rusty-orange, translucent to opaque, so that inside of shell (particularly the columella) is not easily observed; shell surface weakly striate; aperture approximately of shell height ..... *V. elatior*
Aperture with absent or very weak callus and sinulus; crest weak; shell light brown to tan and almost completely transparent, so that inside of shell (particularly the columella) is easily observed; striae very weak to absent; aperture approximately 1/3 of shell height ... *V. ventricosa*
11 Lower palatial lamella beginning on aperture margin and is parallel with upper palatial so that only its end is visible when viewed from front 12
Lower palatial lamella at least partially inserted into shell and not parallel to upper palatial so that at least some of its long axis apparent when viewed from front 17
12 Parietal lamella pointed at lower palatial lamella, so that parietal, palatial, and columellar lamellae form a cross 13
Parietal lamella pointed at upper palatial lamella. so that parietal, palatial, and columellar lamellae do not form a cross 15
13 Shell >2 mm tall, striae on shell surface not sharp; strong crest present ..... *V. modesta*
Shell <2 mm tall, striae distinct 14

14 Strong crest present on outside of shell in back of aperture; shell with numerous fine, uniform striations; shell color yellowish ..... *V. cristata*
Crest absent in back of aperture; shell striations irregular in size and location; shell color deep cinnamon-red ..... *V. mermacensis*
15 Angular lamella present ..... *V. hannai*
Angular lamaella absent 16
16 Striae indistinct, with shell often appearing smooth under low magnification; shell conical, <1 mm tall; deep depression over palatial lamellae ..... *V. bollesiana*
Striae distinct, with shell not appearing smooth under low magification; shell elliptical, often >1 mm tall; depression palatial lamellae weak or absent ..... *V. gouldi*
17 Callus present ..... *V. arthuri*
Callus absent 18
18 Upper and lower palatial lamellae of similar size 19
Lower palatial lamella much longer than upper 21
19 Palatial lamellae short; lower not deeply inserted into aperture; depression over upper palatial weak ..... *V. paradoxa*
Palatial lamellae long; lower moderately to deeply inserted into aperture; depression over upper palatial strong 20
20 Lower palatial lamella extending deeply past aperture; strong angular lamella; columellar lamella larger than parietal ..... *V. nylanderi*
Lower palatial lamella not deeply entering shell; angular lamella weak or absent; parietal lamella larger than columellar ..... *V. hubrichti hubrichti*
21 Basal lamella present; lower palatial extending deeply into aperture ..... *V. hubrichti variabilis*
Basal lamella absent; lower palatial not extending deeply into aperture 22
22 Sinulus weak; depression over palatial lamellae weak; columellar lamella in aperture placed less than way down column ..... *V. brierensis*
Sinulus strong; depression over palatial lamellae strong; columellar lamella in aperture placed way down column ..... *V. iowaensis*

Vitrina: *V. limpida*

Zonitoides:
1 Umbilicus covering over of shell diameter; upper surface dull, ribbed ..... *Z. limatulus*
Umbilicus covering less than 1/5 of shell diameter, upper surface shiny, ribless 2
2 Shell luster satiny from microscopic spiral lines; aperture elliptical; shell yellowish ..... *Z. arboreus*
Shell luster glassy, microscopic spiral lines absent; aperture round; shell rusty-brown ..... *Z. nitidus*

Zoogenites: *Z. harpa*