

## THE TERRESTRIAL MOLLUSKS OF TURKEY RUN STATE PARK, INDIANA\*

ALVIN R. CAHN and JACK T. KEMP

*University of Illinois, Urbana.*

Turkey Run State Park, lying in Parke County, Indiana, is one of the beauty spots of that state. Covering some 460 acres, it affords a most unusual variety of topographic features for so restricted an area. The park is bisected by Sugar Creek, a stream normally mild and docile but given to periodic floods, at which times it becomes a driving river. Tributary to the creek are a number of smaller streams which have cut their way through sandstone formations of varying hardness, to form ravines replete with waterfalls and other features of scenic beauty. These ravines transect an area of steep hills, all heavily wooded, and give the last touch of beauty to the park. It is, then, an area of streams, abrupt vertical sandstone bluffs, hills, valleys and woods. The ravines are bordered with hemlock (*Tsuga canadensis*), as are in places the river bluffs. The "bottoms" support gigantic sycamores (*Platanus occidentalis*), black walnut (*Juglans nigra*), and elms (*Ulmus americana*). A rich humus covers the ground and acts as an excellent retainer of water, and moss and ferns are abundant throughout the area. The fact that the water is well conserved is indicated by the abundance of terrestrial mollusks found within the park, 46 species having thus far been collected. Classes in geology, entomology, botany, and zoology from a number of mid-western universities visit the park annually to study the biological aspects of the region.

The molluscan fauna is so rich and so much in evidence that it has been thought advisable to offer a list of the terrestrial species found within the park, with some brief notes on the ecology of the species concerned, and it is hoped that further papers dealing with the life of this interesting region may be forthcoming. The present paper, dealing with the terrestrial mollusks, is offered as the first of such a series. Collections have been made during the past three years throughout the park, and hundreds of shells have been collected and identified. In the spring the ground is

---

\* Contribution from the Zoological Laboratory of the University of Illinois, No. 356.

fairly strewn with "dead shells," the remains of animals that died during the winter, washed out by the spring freshets. The high water has washed together great masses of drift and fine debris in the form of windrows. Innumerable specimens of the smaller species may be found by picking over these masses. Indeed, such windrows offer the most profitable collecting if only a variety of species is desired. Many live snails were brought into the laboratory and their rate of progression tested and timed. All the

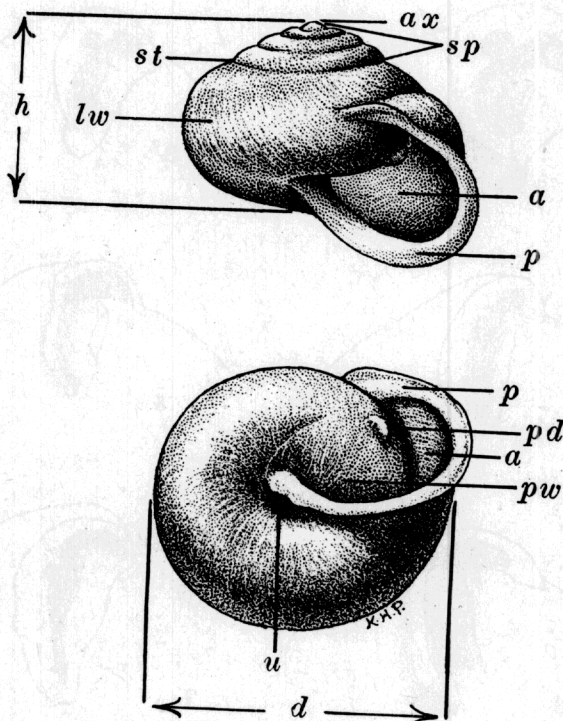
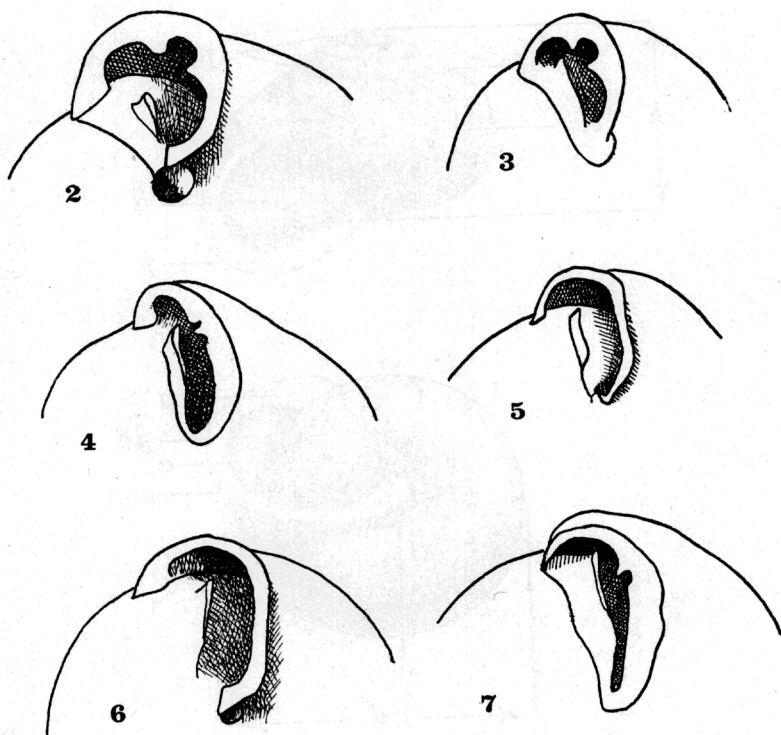


FIG. 1. *Polygyra thyroides*, a typical globulose land shell: *a*, aperture; *ax*, apex; *d*, diameter; *h*, height; *lw*, last whorl; *p*, peristome; *pd*, parietal denticle; *pw*, parietal wall; *sp*, spire; *st*, suture; *u*, umbilicus.

species herein enumerated have been checked and identified by Professor Frank C. Baker of the Natural History Museum of the University of Illinois, and the collections upon which this paper is based have been deposited with this museum for future reference. To Prof. Baker the writers offer their sincerest thanks and appreciation for his always cheerful cooperation, aid, and encouragement.

In the following key, no attempt has been made to include young or immature specimens, if for no other reason than the fact that it is often quite difficult to distinguish young animals by shell characters alone. And this key deals only with external characters; it is intended as an aid to the amateur student who would know what mollusks are present without having to delve into the difficult routine of radula extraction and anatomical dissection.



FIGS. 2-7. Six species of *Polygyra*: (2) *P. tridentata*, (3) *P. inflecta*, (4) *P. hirsuta*, (5) *P. fraterna*, (6) *P. monodon*, (7) *P. stenotrema*.

#### KEY TO THE ADULT LAND MOLLUSKS OF TURKEY RUN PARK

In using the following key the first figure represents the character under discussion. This is followed by a figure in parentheses which is the alternative character. If the character referred to by the first figure is the one desired, the figure at the end of the line, also in parentheses, tells you where next to go.

1. (86) External shell present. (2)
2. (39) Shell large, over 12.5 mm in diameter; spire globulose, not turreted. (3)
3. (10) Peristome dentate. (4)
4. ( 7) Umbilicus open. (5)
5. ( 6) Denticle curved. *Polygyra tridentata*.
6. ( 5) Denticle almost straight. *Polygyra fraudulenta*.
7. ( 4) Umbilicus closed. (8)
8. ( 9) Size large; denticle large, but not obstructing the aperture. *Polygyra palliata*.
9. ( 8) Size smaller; aperture somewhat closed by denticle. *Polygyra inflecta*.
10. ( 3) Peristome non-dentate. (11)
11. (26) Umbilicus open. (12)
12. (21) Umbilicus not partially covered by peristome. (13)
13. (14) Aperture with flaring peristome. *Polygyra profunda*.
14. (13) Peristome without flare. (15)
15. (20) Spire flattened. (16)
16. (19) Shell without color bands. (17)
17. (18) Umbilicus narrow, deep. *Omphalina fuliginosa*.
18. (17) Umbilicus wide, showing whorls. *Circinaria concava*.
19. (16) Shell with many color bands. *Anguispira alternata*.
20. (15) Spire not flattened; last whorl with two parallel brown bands. *Anguispira solitaria*.
21. (12) Umbilicus partially overhung by peristome. (22)
22. (23) Size large, over 20 mm; shell coarsely striated; occasionally a trace of rudimentary parietal denticle. *Polygyra thyroides*.
23. (22) Size under 15 mm; striae fine; no trace of parietal denticle. (24)
24. (25) Peristome with wide flare. *Polygyra clausa*.
25. (24) Peristome without flare. *Gastrodonta ligera*.
26. (11) Umbilicus closed. (27)
27. (32) Parietal denticle present. (28)
28. (29) Spire flattened. *Polygyra appressa*.
29. (28) Spire high. (30)
30. (31) Denticle large, conspicuous. *Polygyra elevata*.
31. (30) Denticle small, rudimentary. *Polygyra zaleta*.
32. (27) Parietal denticle absent. (33)
33. (36) Shell large, approximately 25 mm or more in diameter; peristome widely reflected, flattened. (34)
34. (35) Shell with many reddish brown bands. *Polygyra multilineata*.
35. (34) Shell without color bands. *Polygyra albolabris*.
36. (33) Shell smaller, approximately 15 mm or less; peristome without widely reflected flare. (37)
37. (38) Whorls 6; diameter approximately 12.5 mm. *Polygyra mitchelliana*.



38. (37) Whorls 7; diameter approximately 15 mm. *Polygyra pennsylvanica*.
39. (2) Shell small, 10 mm or less in diameter. (40)
40. (51) Parietal denticle present. (41)
41. (50) Shell not turreted: globulose. (42)
42. (49) Denticle nearly closing aperture. (43)
43. (44) Umbilicus open; shell not sculptured. *Polygyra monodon*.
44. (43) Umbilicus closed. (45)
45. (48) Denticle large, making aperture slit-like; peristome notched. (46)
46. (47) Diameter 9 mm. *Polygyra stenotrema*.
47. (46) Diameter 8 mm; rare. *Polygyra hirsuta*.
48. (45) Denticle large, but aperture not slit-like; peristome not notched. *Polygyra fraterna*.
49. (42) Parietal denticle not nearly closing aperture; size less than 3 mm; shell highly sculptured. *Strobilops affinis*.
50. (41) Shell highly turreted. *Gastrocopta armifera*.
51. (40) Parietal denticle absent. (52)
52. (65) Spire elongated, turreted. (53)
53. (58) Shell 3 mm high or over. (54)
54. (55) Aperture equal to more than half of the height of spire. *Succinea avara*.
55. (54) Aperture much less than half the height of spire. (56)
56. (57) Diameter of first whorl equal approximately to  $\frac{1}{2}$  the height of spire, which is acutely graduated. *Pomotiopsis cincinnatiensis*.
57. (56) Diameter of first whorl equal approximately to  $\frac{1}{3}$  the height of spire which is slender and not acutely graduated. *Pupoides marginatus*.
58. (53) Shell 2 mm high or less. (59)
59. (62) Shell approximately 2 mm high. (60)
60. (61) Whorls 4; last whorl with lateral notch. *Vertigo ovata*.
61. (60) Whorls 5; notch absent. *Gastrocopta contracta*.
62. (59) Shell a scant 2 mm high, or less. (63)
63. (64) Apex obtuse; whorls 5. *Carychium exiguum*.
64. (63) Apex acute. *Gastrocopta pentadon*.
65. (52) Spire depressed, not highly turreted. (66)
66. (75) Umbilicus large. (67)
67. (72) Shell over 4 mm in diameter. (68)
68. (71) Surface heavily sculptured or ribbed. (69)
69. (70) Umbilicus shallow, flaring, showing clearly all volutions to the apex; whorls 6. *Goniodiscus perspectiva*.
70. (69) Umbilicus deep, narrow, more precipitate; whorls 5. *Goniodiscus anthyoni*.
71. (68) Surface finely sculptured. *Zonitoides limatula*.
72. (67) Shell 3 mm or less in diameter. (73)
73. (74) Umbilicus flaring and very shallow, showing whorls to apex; dorsal surface flat, disc-like. *Helicodiscus parallelus*.

74. (73) Umbilicus narrow, precipitate. *Vallonia pulchella*.
75. (66) Umbilicus relatively small, dot-like. (76)
76. (79) Shell diameter under 3 mm. (77)
77. (78) Shell heavily sculptured; globulose. *Strobulops labyrinthica*.
78. (77) Shell finely sculptured; flattened. *Pseudohyalina minuscula*.
79. (76) Shell diameter over 3mm. (80)
80. (81) Umbilicus so small as to be almost obliterated. *Glyphyalina indentata*.
81. (80) Umbilicus small, but distinctly open. (82)
82. (85) Aperture widely expanding, ovate. (83)
83. (84) Whorls tightly coiled, regular. *Zonitoides arborea*.
84. (83) Whorls loose, irregular; last whorl dilate. *Retinella hammonis*.
85. (83) Aperture lunate. *Paravitrea multidentata*.
86. (2) External shell absent. (87)
87. (90) Size large; body mottled. (88)
88. (89) Mantle covering entire body. *Philomycus carolinensis*.
89. (88) Mantle small, anterior. *Limax maximus*.
90. (87) Size small; color blackish, unspotted. *Agriolimax campestris*.

### *Polygyra tridentata* (Say).

This is a very abundant species on the hillsides and on the slopes of the tributary ravines. It is most often found under logs in moist situations, or under the loose bark of decomposing logs. Dead shells are conspicuous in the spring, showing that many individuals are winter killed. The species is slow in its movements, progression being at the rate of 2 inches in 130 seconds. A number of shells found under logs in the early spring show that the animal is used as food by some species of mouse. (Fig. 2)

### *Polygyra inflecta* (Say).

Abundant on exposed slopes and often associated ecologically with *P. tridentata* under logs in moist situations. Its rate of progression is a trifle faster than that of the preceding species, as it covers 2 inches in 120 seconds. During progression the shell is tilted at a slight angle to the right. It, too, is used for food by mice, and many individuals are winter killed. (Fig. 3)

### *Polygyra profunda* (Say).

This is strictly a woodland species, and an inhabitant of the moist situations under dead and decaying logs. It is not common within the park, and is found more often on the high ground than on the slopes. It is a more rapid moving species than either of the preceding, covering 2 inches in approximately 60 seconds.

*Polygyra albolabris* (Say).

This is the largest representative of the genus within the area, and shells measuring 30 mm in diameter are not unusual, though the species is not very common. It frequents hill slopes and is sometimes found crawling about the base of trees. The species hibernates under logs or behind loose bark. The shell is so large and heavy that the animal does not progress upward with any great rapidity, and even on a horizontal plane it covers 2 inches in 70 seconds. Shells have been found bearing the tooth marks of mice, but few have been found in which the mice have succeeded in penetrating the hard covering.

*Polygyra zaleta* (Binney).

This is one of the most abundant Polygyrinae within the area, and is found throughout the region. The great numbers of dead shells washed out by the spring freshets indicate a high mortality during the winter. The animal inhabits moist situations under leaves, stones or wood, and feeds almost exclusively on the ground stratum of vegetation.

*Polygyra multilineata* (Say).

This beautifully shelled species is distinctly uncommon within the park, and there are but four specimens in the writers' collection. All four were found living under the loose bark of a highly rotten elm trunk, being nearly buried in the loose, moist but powdery debris. The trunk was lying in a very moist, swampy spot at the edge of Sugar Creek, showing the species' preference for moisture. Its rate of speed is 2 inches in 55 seconds.

*Polygyra palliata* (Say).

Not uncommon under logs and debris in moist situations, and quite frequently associated with *P. tridentata* and *inflecta*. More common on exposed hillsides than in the highland woods, and the number of dead shells indicates again a high winter mortality. The young *palliata* often ascend vegetation to a height of a foot or more above the ground, but the adults frequent the ground stratum. In fully mature specimens the umbilicus is closed, but in the young it is widely open, and all stages may be found between the two extremes, depending on the age of the individual. Specimens on hand seem to indicate that it requires three years before the animal is mature and the umbilicus closed.

*Polygyra elevata* (Say).

Another of the extremely abundant species, found throughout the area, but more frequently on exposed slopes than among living timber. Again, dead shells are strikingly abundant in the spring, perhaps more of this species being found than of any other member of the genus. The adults live under logs and feed on the ground stratum. The rate of progression is 2 inches in 70 seconds.



*Polygyra pennsylvanica* (Green).

A very rare species within the park, but three specimens having been collected in three years. All came from under moist logs on ravine slopes, and all were living specimens. The progression is 2 inches in 45 seconds.

*Polygyra thyroides* (Say).

A very abundant species. These animals show a preference for woods rather than for open spaces and may be found under logs and debris in the woods, quite away from water, but only if moisture is held by the protecting shelter. On May 11, 1927, a female was found under the bark of a huge rotting elm tree in the act of laying her eggs in what apparently was the excavation of the Betsy beetle (*Passalus cornutus*). Thirty seven eggs had already been deposited when discovered, and twenty-six more were promptly laid in the vial to which she was transferred, the handling not seeming to affect ovulation in the least. The eggs varied from 3.0 to 3.2 mm in diameter, and hatched in 24 days at room temperature. The rate of progression is 2 inches in 55 seconds.

*Polygyra clausa* (Say).

Very rare within the park. Two living specimens have been found, and one dead shell. The living specimens were under rotten wood in association with *P. thyroides* and *tridentata*, and were completely buried in the loose debris of a rotten oak stump.

*Polygyra mitchelliana* (Lea).

Two living specimens and two dead shells are the only representatives of this species so far found. The living animals were crawling on the under surface of a sloping rock in a sheltered ravine. One of the dead shells contained the remains of the animal which had but recently died; the other had been opened by mice. The rate of progression is 2 inches in 70 seconds.

*Polygyra hirsuta* (Say).

The typical *hirsuta* is very rare here, and is easily confused with the similar *monodon*, *stenotrema* and *fraterna*, which are common. It is found under moist wood and leaves. It differs from *monodon* in having a closed umbilicus; from *fraterna* in that the parietal denticle nearly closes the aperture; and from *stenotrema* in being smaller and less globulose. Progresses at the rate of 2 inches in 135 seconds. (Fig. 4)

*Polygyra fraterna* (Say).

Common under moist logs, pieces of bark, leaves and sometimes under stones. It is fairly uniformly distributed, but is less common



in the highland woods than on the slopes. Some dead shells are found, but far less frequently than in the case of *stenotrema*; the number of dead shells is entirely out of proportion to the relative abundance of the two species. The rate of progression is 2 inches in 120 seconds. (Fig. 5) In old dead shells the denticle sometimes drops off without leaving a scar, and may cause some confusion in identifying the shell.

*Polygyra mondon* (Rackett).

Very common on exposed slopes where it lives under moist wood and in decaying logs. Occasionally met with among the lower vegetation two feet above the ground, especially after rain. Its rate of progression is about 2 inches in 120 seconds, though in the laboratory the animals exhibited a strong dislike toward covering the arbitrarily standard 2 inches without pause. (Fig. 6)

*Polygyra stenotrema* (Ferussac).

The most abundant of the four rather similar Polygyrinae. They inhabit moist situations under logs and piles of leaves, and are frequently discovered under loose bark. The number of dead shells brought out by the spring freshets is little short of astonishing, and leads one to speculate as to whether the species may not be normally short lived. Frequently shells are found that have been opened by mice, and nine shells of this species were found in the nest of the house *Peromyscus leucopus noveboracensis*. The rate of progression is 2 inches in 100 seconds. (Fig. 7)

*Polygyra fraudulenta* (Pilsbry).

A common species, often associated with *P. tridentata* under moist logs. It is more common on hill sides and along the ravines than in the highland woods. It is frequently fed upon by mice and dead shells are numerous in the spring. The animal is very slow in its movements and timid in its actions, and in the laboratory required 175 seconds to traverse 2 inches, even after it got under way, which was in itself a painfully slow performance.

*Polygyra appressa* (Say).

Not a common species, and decidedly uncommon in the adult condition. Young, open umbilicated specimens are more common than the closed umbilicated adults, and are found under moist bark and under leaves more frequently than under logs. The adult can traverse 2 inches in 65 seconds, while the young do the same distance in 50.

*Circinaria concava* (Say).

Very abundant throughout the region, though more often dead shells are found than living specimens. Our collections show nineteen dead shells to one living animal, and the numbers of dead shells washed out in the spring again leads one to speculate on the length of life of the species. The shell is rather thin, and the species is

often eaten by mice. The living animals are often found buried in the moist soil under stumps and leaves which hold the desired moisture. They are more common in shaded ravines than on the open hillsides. That they are carnivorous is well known, and the writers have found the animals extended within the shell of *Omphalina fuliginosa* and *Anguispira alternata*, feeding upon its victims. The progression is erratic and the rate is approximately 2 inches in 80 seconds.

*Omphalina fuliginosa* (Griffith).

Extremely abundant, especially on the hillsides. Apparently the species likes sunshine, for they are seldom found in the highland woods. As in the preceeding species, the shell is relatively thin and affords easy picking for mice which destroy numbers of the forms. Dead shells are common, the pigmented outer layer chipping off within a month or so after the animal dies, leaving the shell white. The rate of progression is 2 inches in 70 seconds.

*Retinella hammonis* (Ström).

Quite common under bark and in rotten logs; also found under leaves and among debris. The species apparently is gregarious, as it is frequently found in considerable numbers in one location. It is often associated with *Zonitoides arboreus* from which it can readily be distinguished by the rapid enlargement of the last whorl which, in *Z. arboreus* does not enlarge. Progression: 1 inch in 100 seconds.

*Glyphyalina indentata* (Say).

Five specimens, all dead shells, were collected from a mass of debris washed into a windrow along the bank of Sugar Creek. Two living animals were found under a fallen hickory. The rate of progression is 1 inch in 55 seconds.

*Paravitrea multidentata* (Binney).

A single dead shell picked out of the debris of a windrow is the only record on hand for the species within the limits of the park.

*Zonitoides arboreus* (Say).

Very abundant locally under dead logs and bark, and under masses of leaves which hold moisture. The animal is gregarious, and thirty or more are often found in an area six inches square. After heavy rains they ascend the lower shrubs, but do not remain up after the vegetation has once dried off. They can traverse 1 inch in 70 seconds.

*Zonitoides limatulus* Ward.

One specimen taken from rotten wood is the only record at hand. This was the shell of an animal but recently dead, and was associated with numerous *Z. arboreus*.

*Pseudovitrea minuscula* (Binney).

This tiny species is not uncommon, but it is so small that it is easily overlooked, as it inhabits the damp interior of rotten wood. It is more often found in highland woods than in lowlands. It is so small and so slow in its movements that it requires more than 200 seconds to traverse an inch.

*Gastrodonta ligera* (Say).

This prettily sculptured shell is not uncommon under logs, especially those in the wetter lowland localities. The shell is so thin and fragile that it is apparently much prized by mice as an item of food. In the adult the peristome tends to overhang the umbilicus, but this is not the case among young individuals.

*Anguispira alternata* (Say).

This strikingly marked shell is very abundant throughout the area, but especially on the southern slopes and in the more moist localities. The animals hibernate in the loose soil under logs and are often completely buried. Many dead shells are found in the spring, and of these many show the activity of mice. The remains of nine of these animals were found in the nest of *Peromyscus leucopus noveboracensis*, and a chipmunk (*Tamias striatus*) was observed in the act of eating one. The rate of progression is 2 inches in 80 seconds.

*Anguispira solitaria* (Say).

Readily identified by the two parallel brown bands which parallel the whorls, this species is found to be common throughout the region. It shows a preference for low ground, and is found under logs and in brush piles, and occasionally crawling over moss-covered rocks. It attains a large size, and specimens 28 mm in diameter are on hand. It covers 2 inches in 75 seconds. Occasionally used as food by mice, but not as frequently as the preceeding species.

*Goniodiscus perspectiva* (Say).

Fairly common throughout the region under bark and in rotten logs; sometimes under leaves and rarely under rocks. They insist on a considerable amount of moisture and are less frequent on high ground than on low. Dead shells are often encountered in the spring. It is readily distinguished by its heavy sculpturing and by the very wide umbilicus which makes it possible to see the whorls to the apex.

*Goniodiscus anthonyi* Pilsbry.

This is a rare species in the park, and but three specimens are on hand. It resembles the preceeding species, but is much smaller. All the specimens found were dead, one being but recently dead. All under the bark of one elm trunk partially decayed.



*Helicodiscus parallelus* (Say).

Often associated with *Zonitoides arboreus*, this species is rather uncommon, but it is occasionally found under bark and in rotting logs. Confined to the lower regions of the slopes.

*Succinea avara* Say.

Rare within the park, as there are few areas suitable for the species. It is distinctly a wet, swampy form, often associated with vegetation growing out of water. Beyond the limits of the park, in suitable localities, it is fairly common. This is the only "land" snail in the area that is "physaform." It is rather fast in its progression, covering 2 inches in 40 seconds or less.

*Strobilops labyrinthica* (Say).

A single shell of this tiny animal is the only record the writers so far have collected. This was a dead shell picked out of the fine debris of a windrow.

*Strobilops affinis* Pilsbry.

Two specimens found in the same windrow and at the same time as the preceding species are the only records on hand in the park.

*Pupoides marginatus* (Say).

This acutely turreted little shell is found commonly, but it is local in its distribution. Common among the roots of grass and on or under fallen leaves. It is gregarious, and fifteen or twenty individuals may frequently be found together if one searches carefully. It ascends grass and low vegetation, rarely going above an elevation of a foot, however. Common in the debris of windrows.

*Gastrocopta armifera* (Say).

Very abundant locally. Like the preceding species, it frequents grass areas, and may also be found about the roots of trees. It is highly gregarious, and much more common than a superficial examination of the region would indicate. One of the very characteristic shells found in windrows.

*Gastrocopta contracta* (Say).

This small edition of *G. armifera* is abundant locally, and in similar habitats. It is gregarious, and associated with the preceding two species. Abundant in windrows, but requires careful search before it is discovered.

*Gastrocopta pentadon* (Say).

This tiny species is apparently rare, but it is so small that it may well have been overlooked. The single specimen on hand is 1.6 mm in length and was found in the windrow along with *G. contracta* and *armifera*.



*Vertigo ovata* Say.

Two dead shells, collected from the same windrow and at the same times as the preceeding species, are the only records we have.

*Vallonia pulchella* Muller.

This is a gregarious species that is not uncommon under logs and bark of decaying trees. More rarely it is found under stones or in the moss overgrowing rocky areas. It prefers the lowland habitats and requires considerable moisture for its habitat.

*Carychium exiguum* (Say).

Two specimens from the windrow above mentioned, and one living animal from the wet moss covering an old stump are all the records we have. Another tiny species that is easily overlooked.

*Pomatiopsis cincinnatiensis* Lea.

Apparently rare, as but two specimens have so far been found. These are both dead shells picked from the debris of a windrow.

*Philomycus carolinensis* (Bosc.).

This is the common slug of the region. It is crepuscular and nocturnal, and may be found during the hours of darkness crawling over the vertical face of the sandstone cliffs and ravines. During the day they seek the dark, either in crevices in the rocks or they disappear under stones and fallen logs. Their slime trails are clearly visible during the day and show the erratic wanderings of the slugs. While they are solitary in their habits, they are so numerous that they appear to be gregarious. When under way they traverse 2 inches in 40 seconds or less.

*Agriolimax agestis* (Linn.).

Much less common than the preceeding species, this little dark brown, unmottled slug is found under bark and in decaying wood more often than on the face of cliffs. Being also nocturnal, it is sometime associated with *Philomycus carolinensis*, but it is more likely to be met with about the smaller stones on the ground. They traverse 2 inches in 65 seconds. This is the only native slug.

*Limax maximus* (Linn.).

A single specimen of this big slug was found crawling about on the damp stones in the basement of the hotel. It is a European species, most often found in greenhouses. It progresses at the rate of 2 inches in 40 seconds, or less.