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# Predatory shell-drilling by the land snail *Haplotrema concavum* (Say, 1821) (Haplotrematidae)

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**ABSTRACT** The predatory land snail *Haplotrema concavum* (Say, 1821) consumed twelve species of land snails during feeding trials. *Haplotrema concavum* was able to force its head into the shells of prey species with relatively large apertures and body whorls (*Anguispira* species), but drilled the shells of smaller snails to gain access into the shell. The holes drilled by *H. concavum* in the shells of its prey were always through the lower periphery of the body whorl at a location about a quarter of a whorl in front of the aperture. A hole at this location provided *H. concavum* direct access to the body of the snail inside.

**KEY WORDS** Gastropoda, Stylommatophora, *Haplotrema concavum*, *Anguispira* species, predation, carnivorous snail

## INTRODUCTION

*Haplotrema concavum* (Say, 1821), the gray-footed lancetooth (Figure 1), is a widespread and common land snail of eastern North American forests (Hubricht, 1985). Although Hubricht was suspicious of the earlier observations that *H. concavum* was a predator of snails (Binney, 1851; Ingram, 1941; Webb, 1965), subsequent laboratory studies (Pearce & Gaertner, 1996; Atkinson & Balaban, 1997) confirmed that it indeed preyed on several species of snails (Table 1).

Pearce & Gaertner (1996) also noted that *H. concavum* drilled holes in the shells of some of its prey to gain access into the shell. Ingram (1942) reported that the western North American species *Haplotrema minimum* (Ancey, 1888) was also a snail predator, but it is not clear from his account whether the shells of prey were drilled. Here I give a list of additional species consumed by *H. concavum* and present information and photographs for the holes it drilled in the shells of its prey.

## METHODS AND MATERIALS

*Haplotrema concavum* and most prey snails were collected during the years 1999-2003 from forests and other habitats in Montgomery and Frederick Counties, Maryland, U.S.A.; *Oxyloma retusum* (Lea, 1834) was from stands of cattails (*Typha* sp.) near a lake, *Cochlicopa lubrica* (O. F. Müller, 1774) and *Vallonia pulchella* (O. F. Müller, 1774) were from the garden of my house. *Allopeas gracile* (T. Hutton, 1834) was the offspring of a snail that had been collected in A. L. Anderson Park in Tarpon Springs, Florida in 1999. *Haplotrema concavum* and potential prey snails were placed in petri dishes or plastic containers of various diameters (3-9 cm) lined with damp toilet paper and sometimes also containing small amounts of soil. Potential prey snails were offered to *H. concavum* either singly or in groups of two species, but the trials were not designed to determine the prey preferences of *H. concavum*. Species names follow Molluscabase (molluscabase.org). Representative shells of *H. concavum* (CM188838) and one drilled shell of each of the species *A. gracile* (CM188837),

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*Helicodiscus parallelus* (Say, 1821) (CM188839), *Strobilops labyrinthicus* (Say, 1817) (CM188840) and *Ventridens suppressus* (Say, 1829) (CM188841) have been deposited in the Carnegie Museum of Natural History, Pittsburgh, PA, USA.

## RESULTS AND DISCUSSION

Nine individuals of *H. concavum* with shell diameters ranging from ~3 mm to 13.8 mm attacked and consumed twelve species during the feeding trials (Table 2). *Haplotrema concavum* drilled the shells of *Allopeas gracile*, *H. parallelus*, *S. aenea*, *S. labyrinthicus*, *V. ligera* and *V. suppressus* (Table 2, Figure 2A-D, Figure 3A). In contrast, *H. concavum* was able to force its head into the shells of *Anguispira alternata* and *A. fergussoni* through their apertures and consume the snail inside. The empty *Anguispira* shells that were left behind were intact and had no marks on them attributable to *H. concavum* (Figure 3B). In one trial a juvenile *A. alternata* and a juvenile *V. ligera* were consumed by the same *H. concavum* (shell diameter, 12.8 mm). This *Haplotrema* was able to enter through the aperture of the *Anguispira* shell deep enough to reach the withdrawn snail but was forced to drill the *Ventridens* shell (Figure 3). Assuming each prey species could withdraw into its shell equally deeply, the difference in the feeding behavior of *Haplotrema* may be explained by both the aperture and the body whorl of the *Anguispira* shell being wider than those of the *Ventridens* shell (Figure 3).

*Haplotrema concavum* drilled the shells of prey snails always through the lower periphery of the body whorl at a location about three quarters of a whorl behind (or about a quarter of a whorl in front) of the aperture (Figure 2A-D, Figure 3A). The holes had jagged edges and were often surrounded with scrape marks from where the periostracum had been removed exposing the underlying white calcium carbonate layer (Figure 2). The areas of the holes relative to the areas of the apertures of the prey shells were variable, because sometimes a *Haplotrema* further enlarged its entry hole by consuming the shell of its prey in addition to the prey itself (Figure 2E). The species in Table 2 could all withdraw their bodies at least about half a whorl behind the aperture of their shells. Thus, an opening into a shell near the beginning of the body whorl provided *H. concavum* direct access to the body of the snail inside. The holes drilled in the shells of *Allopeas gracile*, *V. suppressus* and *S. labyrinthicus* continued through the whorls preceding the body whorl (Figure 2A-C). Curiously, *H. concavum* consumed the body of *A. gracile* but left its egg intact in the penultimate whorl (Figure 2A). In some instances, the portions of prey shells left behind after *H. concavum* had finished consuming them were too small to determine whether the shells had been drilled before they were consumed, although this was most likely the case. For example, only the apexes of the shells of *C. lubrica* and *O. retusum* were left behind and about a third of the aperture side of the shells of *V. excentrica* and *Z. arboreus* were consumed (Figure 2E).

During my surveys over the years I have occasionally collected empty shells that had holes similar both in their position and appearance to those drilled by captive *H. concavum* in the shells of prey snails. These similarities suggested that these shells had probably been drilled by *H. concavum* preying on the snails (Figure 4), although postmortem drilling of empty shells for calcium by snails, including *H. concavum*, cannot be ruled out.

Eight of the prey species were from forest habitats where *H. concavum* also lived (Örstan,

1999). *Cochlicopa lubrica* and *V. excentrica* are species of open grassy places, whereas *O. retusum* prefers wet habitats (Hubricht, 1985). *Allopeas gracile* is not native to North America, but may be found in plant nurseries and parks (Dundee, 1974). These four species are unlikely to encounter *H. concavum* where they normally live. Atkinson & Balaban (1997) reported feeding *H. concavum* young *Cornu aspersum*, another nonnative species absent in North American forests. These findings suggest that when it has no prey choice, *H. concavum* behaves like a generalist predator and will attack and consume even the species it would never encounter in its native habitat. During the tests carried out by Pearce & Gaertner (1996), *H. concavum* was offered four species, which it preferred in the order *Succinea ovalis*, *Z. arboreus*, *Discus catskillensis*, *S. labyrinthicus*. However, laboratory results may not always be relevant to situations under natural conditions. An *H. concavum* searching for prey in the leaf litter in a forest will probably attack and consume the first suitably sized snail it encounters even if it might not prefer that particular species if it had a choice. In other words, prey abundance and chance encounters are probably more likely to dictate which species *H. concavum* consumes in the wild.

## ACKNOWLEDGEMENT

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## LITERATURE CITED

**Atkinson, J.W. & M. Balaban. 1997.** Size-related change in feeding preference in the carnivorous land snail *Haplotrema concavum* (Pulmonata: Stylommatophora). Invertebrate Biology 116:82-85.

**Binney, A. 1851.** Terrestrial air-breathing mollusks of the United States, II:165. Charles C. Little and James Brown, Boston.

**Dundee, D.S. 1974.** Catalog of introduced molluscs of eastern North America (North of Mexico). Sterkiana 55:1-37.

**Hubricht, L. 1985.** The distributions of the native land mollusks of the eastern United States. Fieldiana (Zoology), New Series 24:1-191.

**Ingram, W.M. 1941.** Habits of land mollusca at Rensselaerville, Albany County, New York. American Midland Naturalist 25:644-651.

**Ingram, W.M. 1942.** Food habits of *Haplotrema minimum* Ancey and habits of associated mollusks on the Mills College campus. Nautilus 55:98-102.

**Örstan, A. 1999.** Land snails of Black Hill Regional Park, Montgomery County, Maryland. Maryland Naturalist 43:20-24.

**Pearce, T.A. & A. Gaertner. 1996.** Optimal foraging and mucus-trail following in the snail-eating snail *Haplotrema concavum* (Gastropoda: Pulmonata). Malacological Review 29:85-99.

**Webb, G.R. 1965.** Outdoor observations on land-snail feeding habits. Gastropodia 1(6):55-58.

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| | Field Observation | Experimental Observation | |
|---|---|---|---|
| *Anguispira alternata* (Say, 1817) | X | | Ingram, 1941 |
| " " " " " | | X | Atkinson & Balaban, 1997 |
| *Cornu aspersum* (O. F. Müller, 1774) | | X | Atkinson & Balaban, 1997 |
| *Discus catskillensis* (Pilsbry, 1898) | | X | Pearce & Gaertner, 1996 |
| *Mesodon elevatus* (Say, 1821) | X | | Webb, 1965 |
| *Mesodon thyroidus* (Say, 1817) | | X | Atkinson & Balaban, 1997 |
| *Mesomphix cupreus* (Rafinesque, 1831) | X | | Ingram, 1941 |
| *Neohelix albolabris* (Say, 1817) | X | | Ingram, 1941 |
| " " " " " | | X | Atkinson & Balaban, 1997 |
| *Neohelix dentifera* (A. Binney, 1837) | X | | Ingram, 1941 |
| *Strobilops labyrinthicus* (Say, 1817) | | X | Pearce & Gaertner, 1996 |
| *Novisuccinea ovalis* (Say, 1817) | | X | Pearce & Gaertner, 1996 |
| *Zonitoides arboreus* (Say, 1817) | X | | Ingram, 1941 |
| " " " " " | | X | Pearce & Gaertner, 1996 |

**Table 1.** Snails consumed by *Haplotrema concavum* as reported in the literature.

| Prey Species | Entry into prey's shell |
|---|---|
| *Anguispira alternata* | Aperture |
| *Anguispira fergussoni* (Bland, 1862) | Aperture |
| *Allopeas gracile* (T. Hutton, 1834) | Drill hole |
| *Cochlicopa lubrica* (O. F. Müller, 1774) | Drill hole[1] |
| *Helicodiscus parallelus* (Say, 1821) | Drill hole |
| *Oxyloma retusum* (Lea, 1834) | Drill hole[1] |
| *Strobilops aeneus* Pilsbry, 1926 | Drill hole |
| *Strobilops labyrinthicus* | Drill hole |
| *Vallonia pulchella* (O. F. Müller, 1774) | Drill hole[1] |
| *Ventridens ligera* (Say, 1821) | Drill hole |
| *Ventridens suppressus* (Say, 1829) | Drill hole |
| *Zonitoides arboreus* | Drill hole[1] |

**Table 2.** Snails consumed by *Haplotrema concavum* during the present study.
[1] Body whorl and preceding whorls were mostly consumed along with the snail inside the shell. The initial entry of *Haplotrema* into the prey shells, although not observed, was probably through a drill hole.

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**Figure 1.** An adult *Haplotrema concavum* (shell diameter, 13.9 mm).

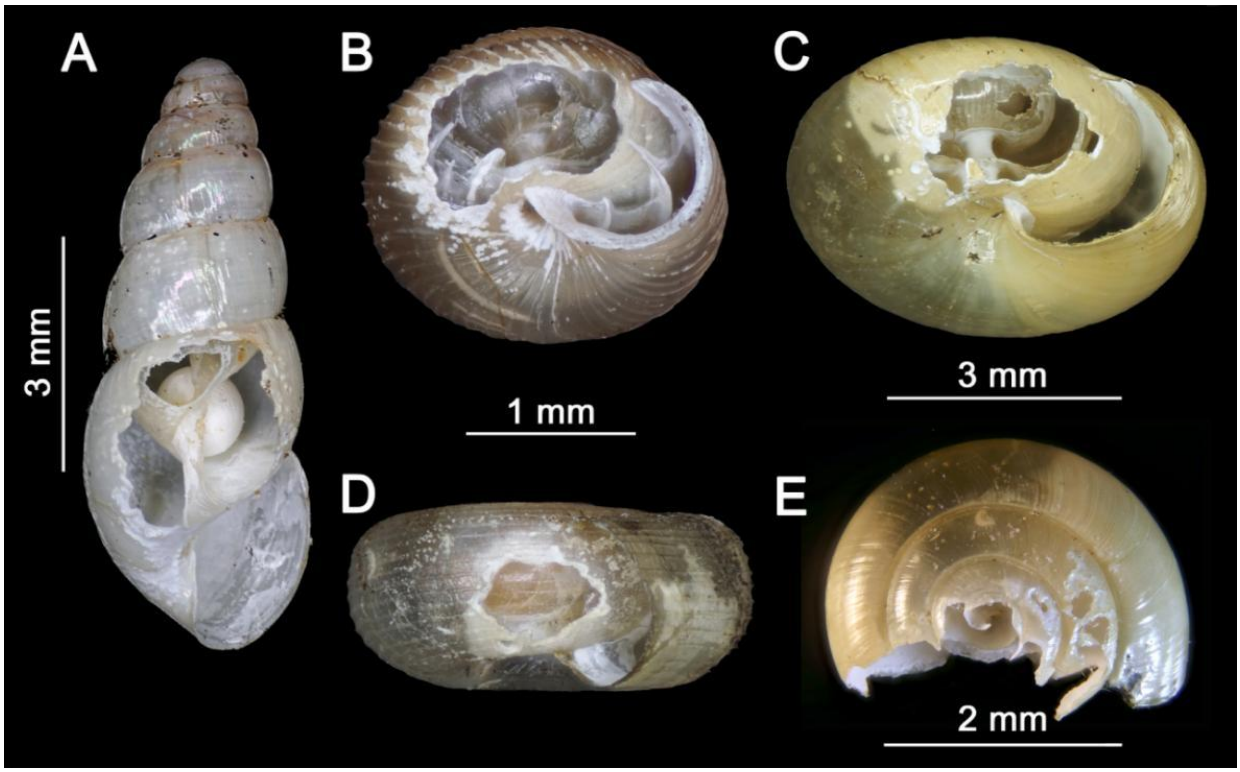


**Figure 2.** Prey shells drilled by *Haplotrema concavum*. **A=** *Allopeas gracile* with egg left behind. **B=** *Strobilops labyrinthicus*. **C=** *Ventridens suppressus*. **D=** *Helicodiscus parallelus*. **E=** *Zonitoides arboreus*. *Haplotrema* probably entered through a drill hole and consumed the snail along with a third of its shell.

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**Figure 3.** Shells of two juvenile snails consumed by the same *Haplotrema concavum*.**A=** *Ventridens ligera*, drilled. **B=** *Anguispira alternata*, intact.

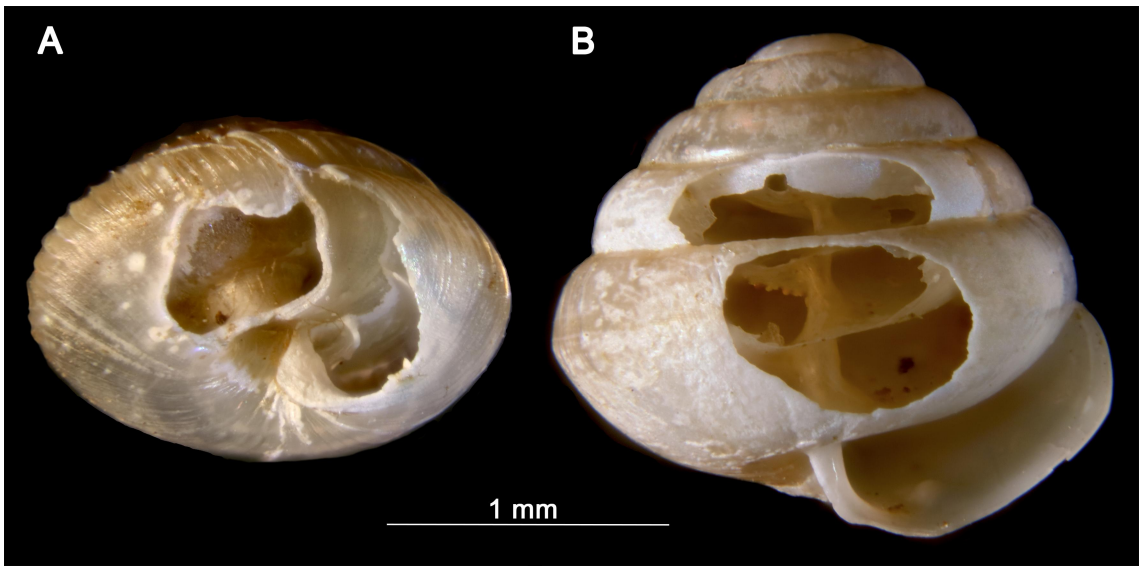


**Figure 4.** Shells that were collected empty with holes that may have been drilled by *H. concavum* preying on the snails. **A=** *Strobilops aenea*. **B=** *Euconulus dentatus* (Sterki, 1893).