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Slimy Friends and Foes: Understanding Slugs and Snails©

Jody M. Thompson and Jeff L. Sibley
Auburn University, Department of Horticulture, Auburn, Alabama 36849

Slugs and snails are common in almost any ecosystem and particularly in nurseries where ideal habitats are a given. As a general rule, slugs and snails are almost always considered as unwanted pests. Most slug and snail problems as horticultural pests are caused by invasive species. There are few educational resources available describing the great diversity of snails, many of which are beneficial and suffer unnecessary controls. Beneficial snails contribute to the organic fraction of the soil cycle while some species are predators of other snails. Many of the products currently used for slug and snail control kill nontarget arthropods and lead to an increase in mite populations and therefore, increased pesticide usage. Additional research is needed to identify more effective, affordable, and environmentally sound control of harmful slugs and snails. This paper presents an overview of slugs and snails, identifying harmful and beneficial species and providing web sites where color images of each can be viewed.

INTRODUCTION

Slugs and snails are Gastropods (class Gastropoda). Slugs and snails are typically met with the same negative reception as snakes — often expressed with the sentiment of “the only good snake is a dead snake”. There are approximately 40,000 gastropod species inhabiting terrestrial, freshwater, and marine environments across the globe. Eastern North America has over 500 species of terrestrial snails and slugs (Hubricht, 1985). Morphologically, the great difference between slugs and snails is fairly simple; slugs lack the calcium carbonate shell common to snails. The shell provides increased protection from the environment; as most snails can seal themselves in their shell with a thin mucus layer at the opening (aperture). The shell can also make it difficult for a predator to reach a snail because of the structures (lamellae) in the aperture. A slug’s lack of a shell increases its mobility and access to food. Most snails (henceforth referring to slugs and snails) eat detritus (decaying organic material) and fungi. Some of a snail’s more important functions are to aid in the decay of organic material and act as a calcium source for the soil and other animals. The remainder of snails can be classified as herbivorous, omnivorous, and even carnivorous. To the ecosystem, a snail's function is invaluable. To the horticulturist and home gardener, a snail's function may also include the destruction of plants.

PEST HABITS

A snail that destroys plants falls into the minority. The most common effect that a snail has on a plant is to eat holes into its leaves. Snails have teeth arranged in rows that rasp through a leaf. Snails such as *Helix aspersa* (invasive spp.) are major pests of citrus crops. *Zonitoides arboreus* is a major pest of plant roots (Wood, 2003). Slugs do most of their damage to leaves. Plant damage normally occurs after dark when moisture levels are higher and temperatures are lower. During the day, snails usually hide in a moist dark place unless there is ample shade and high levels of moisture. These animals move across a mucus layer secreted through what is called a foot (the ventral side of the animal), which leaves a trail that is often considered unattractive. Some of the snails commonly encountered as pests include all species of Arionidae (i.e., *Ariolimax columbianus* — banana slug, western United States) and Limacidae (i.e., *Limax maximus*, *Helix* sp., *Cepaea* sp., and *Zonitoides arboreus*).

PEST CONTROL

Generally speaking, information on snails is not readily available. In fact, only a few scientists study snails. Information of specific snail habits and especially identification is difficult to obtain. Once a snail problem is identified, one must decide on control measures. Herein lies a big problem. There are very few control options for snails (chemical, cultural, biological, or organic).

One of the most common methods of snail control is the use of a chemical such as metaldehyde, which paralyzes the snail and allows for exposure to environmental conditions such as heat and lack of moisture leading to dehydration and death. Metaldehyde is generally applied in pellet form as bait. Recently, caffeine was reported as a possible control method for snail pests common in orchid production (Hollingsworth et al., 2002). Other reports indicate that the use of copper screening placed around trees, table legs, or beds protruding from the ground around an area might provide control. When a snail comes in contact with the copper, there is an electrical discharge that is uncomfortable to it, thus acting as a deterrent (Canyon Communications, 2002). Biological control can involve anything from molluscicidal nematodes (Ester et al., 2003) to predatory snails like the omnivorous *Rumina decollata.* Several home remedies are commonly used in attempts to control snails (i.e., salt, beer, broken egg shells, ashes, diatomaceous earth, etc.) as well as other reports of organic controls (Singh and Singh, 2000; Speiser, 1999). Unfortunately, controls currently are mediocre at best and there is little being done to provide a remedy for this problem.

BENEFICIAL SNAILS

Before snails were considered pest problems, they were shipped to the United States with good intentions. Some snails such as *H. aspersa,* that we now consider pests, were brought into the U.S.A. as a food commodity. *Helix aspera* is the most common snail used in meals or hors d'oeuvres as escargot. Heliciculture (snail farming) is a multi-million dollar a year global business.

Most slugs seen in urban areas were introduced plant pests from Europe (Burch, 1995). Most native slugs stay in the woods feeding on decaying plant material and fungus (Burch, 1995). This decomposition activity of gastropods helps to build soil. With the great diversity of gastropods, most snails seen in or around the garden are not pests at all. Many snails seen in these settings are actually after fungus or algae growing on a plant, the plant container, mulch, or the growing substrate. More often than not, when a home gardener or commercial grower turns over a pile of leaves or stirs up growing medium, snails seen are the beneficial ones.

Beneficial snails (i.e., *Mesodon thyroidus)*, as mentioned before, usually eat detritus or fungus. In 1939 leaves of lilac (*Syringa vulgaris*) in Durham, North Carolina, were found infected by the powdery mildew (*Microsphaera alni*), with peculiar markings noted on some of the plants. When examined at night, the markings were identified as feeding tracks of *M. thyroidus*. Snails placed in jars were found to consume numerous larger fungi, as well as slime molds and a lichen. All of the species of fungi offered were eaten in preference to lettuce or other chlorophyll-containing food (Pilsbry, 1939). There are also snails (*Euglandina rosea*) that prefer to eat other snails. *Euglandina rosea* tracks other snails by the scent of their mucus trail. Many *E. rosea* have probably died from the lack of proper identification for these members of the native environment when they should have been left alone to eat the harmful species. However, *E. rosea* has become a major pest in other countries and in Hawaii, by severely reducing the populations of their native snail fauna, while remaining a very valuable part of the southeastern U.S.A. ecosystem. Two of the largest families of terrestrial gastropods in the U.S.A., Polygyridae (*Mesodon* sp., *Triodopsis* spp., *Inflectarius* sp., etc.) and Zonitidae (*Ventridens* spp., *Mesomphix* spp., *Glyphyalinia* sp., etc.) contain very few pest species. Zonitidae has at least one species that is a major pest, which is *Z. arboreus*.

SUMMARY

Little information exists relative to the impact of beneficial and pest snails in horticultural crops. The few snail taxonomists are generally those in the field of biological sciences. Additionally, snail control methods and product research is a great need. Many of the chemical controls used contain carbaryl (Sevin™), which kills many nontarget arthropods and causes an increase in mite populations and, therefore, increased pesticide usage. Another major chemical control is metaldehyde products, but due to the nontarget and vertebrate toxicity levels of metaldehyde, it is under much scrutiny. More research is needed to validate the effectiveness of many currently recommended controls (i.e., diatomaceous earth, beer baits, etc.). Without being listed on the product package, a product cannot be legally used for snail control. Also, recent work with caffeine needs to be further evaluated to determine efficacy and economical use to the horticulture industry. Biological controls must be investigated carefully to determine ecosystem impacts. Integrated pest management strategies incorporating chemical, biological, and cultural practices may lead to more effective controls with minimal environmental impact.

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Benzyladenine-Induced Shoot Formation in Indian Hawthorn (*Rhaphiolepis indica*)©

Jayme Oates and Gary Keever
Department of Horticulture, Auburn University, Auburn, Alabama 36849

In an outdoor nursery experiment conducted in summer 2001, benzyladenine (BA) was applied at concentrations up to 5000 ppm in 1250 ppm increments to plants (*Rhaphiolepis indica*) in 3.8-L (#1) and 26.5-L (#7) containers. By 30 days after last treatment (DALT) plants in 3.8-L (#1) containers treated with three weekly applications of 1250 ppm BA formed 169% more new shoots than controls and up to 331% more with 5000 ppm BA. Controls in 26.5-L (#7) containers formed 4.7 new shoots, and increased from 83 to 126 new shoots with two weekly applications of 1250 and 5000 ppm. Plants in 26.5-L (#7) containers were retreated in September, at which time shoots were inactive. By 30 DALT controls formed less than one new shoot per plant, while plants averaged 18 new shoots when treated with 1250 ppm BA and 105 new shoots when treated with 5000 ppm BA. In an outdoor experiment conducted in Spring 2002 new shoot formation increased up to 374% at 30 DALT after three BA applications. Injury rating increased with increasing BA rates at 30 DALT. By 90 DALT new shoots had matured normally and exhibited minimal phytotoxic symptoms.

INTRODUCTION

Indian hawthorn [*Rhaphiolepis* Lindl. Cor. Poir *indica* (L.) Lindl. (syn. *Crataegus indica* L.)] is a dense, mound-forming evergreen shrub growing 1 to 2 m (3 to 6 ft) tall and forming dark glossy green leaves. White to pink fragrant flowers are borne in dense upright tomentose racemes or panicles from mid April to early May. Hardy in U.S.D.A. Cold Hardiness Zones 7b-10, Indian hawthorn is widely utilized for textural effect in containers, groupings, or mass plantings (Dirr, 1998).

Indian hawthorn displays very little natural branching during commercial production, and without pruning, plants are sparsely branched, misshapen, and