
SNAILS AND SLUGS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Snails and slugs are among the most bothersome pests in many gardens and landscapes. The brown garden snail, *Cornu aspersum* (formerly *Helix aspersa*), is the most common snail causing problems in California gardens (Fig. 1). It was introduced from France during the 1850s for use as food. Another troublesome snail is the white garden snail, *Theba pisana* (Fig. 2). It currently is established only in San Diego County but has been found in Los Angeles and Orange counties as well.

Several species of slugs also cause damage including the gray garden slug (*Deroceras reticulatum*, formerly *Agriolimax reticulatus*) (Fig. 3), the banded slug (*Lehmannia poirieri*), the three-band garden slug (*L. valentiana*), the tawny slug (*Limacus flavus*) (Fig. 4), and the greenhouse slug (*Milax gagates*).

IDENTIFICATION AND BIOLOGY

Both snails and slugs are members of the mollusk phylum and are similar in structure and biology, except slugs lack the snail's external, spiral shell. These mollusks move by gliding along on a muscular "foot." This muscle constantly secretes mucus, which facilitates their movement and later dries to form the silvery "slime trail" that signals the presence of either pest.

All land slugs and snails are hermaphrodites, so all have the potential to lay eggs. Adult brown garden snails lay an average of 80 spherical, pearly white eggs (Fig. 5) at a time into a hole in the soil. They can lay eggs up to 6 times a year, and it takes about 2 years for snails to mature. Slugs reach maturity after about 3 to 6 months, depending on the species, and lay clear, oval to round eggs in batches of 3 to 40 beneath leaves, in soil cracks, and in other protected areas.

Snails and slugs are most active at night and on cloudy or foggy days. On sunny days they seek hiding places out of the heat and bright light. Often the only clues to their presence are their silvery trails and plant damage. In areas with mild winters, such as southern coastal locations, snails and slugs can be active throughout the year.

During cold weather, snails and slugs hibernate in the topsoil. During hot, dry periods or when it is cold, snails seal themselves off with a parchment-like membrane and often attach themselves to tree trunks, fences, or walls.

DAMAGE

Snails and slugs feed on a variety of living plants and on decaying plant matter. They chew irregular holes with smooth edges in leaves and flowers and can clip succulent plant parts. They also can chew fruit and young plant bark.

Because they prefer succulent foliage or flowers, they primarily are pests of seedlings and herbaceous plants, but they also are serious pests of ripening fruits that are close to the ground such as strawberries, artichokes, and tomatoes. They also will feed on foliage and fruit of some trees; citrus are especially susceptible to damage. Look for the silvery mucous trails to confirm slugs or snails caused the damage and not earwigs, caterpillars, or other chewing insects.

MANAGEMENT

A good snail and slug management program relies on a combination of methods. The first step is to eliminate, as much as possible, all places where they can hide during the day. Boards, stones, debris, weedy areas around tree trunks, leafy branches growing close to the ground, and dense ground covers such as ivy are



Figure 1. Brown garden snail.

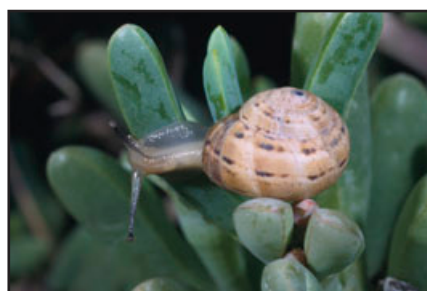


Figure 2. Adult white garden snail, *Theba pisana*.



Figure 3. Gray garden slugs with chewing damage and slime trails on leaves.

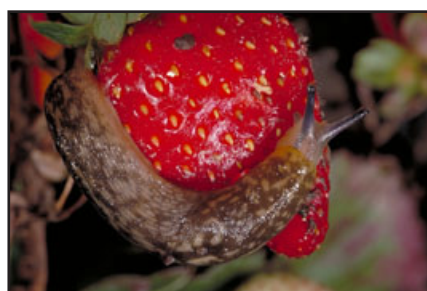


Figure 4. Tawny slug, also called yellow cellar slug.

PEST NOTES

University of California
Statewide Integrated Pest Management Program
Agriculture and Natural Resources

Publication 7427

November 2009

ideal sheltering spots. It won't be possible to eliminate some shelters such as low ledges on fences, the undersides of wooden decks, and water meter boxes, so make a regular practice of trapping and removing snails and slugs from these areas.

Locate vegetable gardens or susceptible plants as far away from snail and slug hiding places as possible. Reducing hiding places allows fewer snails and slugs to survive. The survivors congregate in the remaining shelters, where you can more easily locate and remove them.

Switching from sprinkler irrigation to drip irrigation will reduce humidity and moist surfaces, making the habitat less favorable for these pests. Choose snail-proof plants, such as those listed below, for areas where snails and slugs are dense. Copper barriers can be useful for protecting especially susceptible plants. Though baits can be part of a management program, it is better to use them in conjunction with other habitat modification, especially in gardens that contain plenty of shelter, food, and moisture.

Plant selection can greatly affect how difficult your battle with snails and slugs will be. Because snails and slugs favor seedlings and plants with succulent foliage, you will need to vigilantly protect these. Some plants these pests will seriously damage include basil, beans, cabbage, dahlia, delphinium, hosta, lettuce, marigolds, strawberries, and many other vegetable plants. On the other hand, many plants resist snail and slug damage including begonias, California poppy, fuchias, geraniums, impatiens, lantana, nasturtiums, and purple robe cup flower as well as many plants with stiff leaves and highly scented foliage such as lavender, rosemary, and sage. Most ornamental, woody plants, and ornamental grasses also aren't seriously affected. If you design your landscape using snail and slug resistant plants, you are likely to have very limited damage.

Handpicking

Handpicking can be very effective if done thoroughly on a regular basis. At first you should look for snails and slugs daily, paying careful attention

to potential hiding places. After the population has noticeably declined, a weekly handpicking can be sufficient.

To draw out snails and slugs, water the infested area in the late afternoon. After dark, search them out using a flashlight, pick them up (rubber gloves are handy when slugs are involved), place them in a plastic bag, and dispose of them in the trash. You also can put them in a bucket with soapy water and dispose of them in your compost pile after they are dead. Alternatively, crush captured snails and slugs and leave them in the garden. Another option for killing slugs you have collected is to spray them with a solution of household ammonia diluted to a 5 to 10% solution in water.

Traps

You can trap snails and slugs beneath boards or flower pots that you position throughout the garden and landscape. Inverted melon rinds also make good traps. Construct wooden traps using 12- by 15-inch boards (or any easy-to-handle size) raised off the ground by 1-inch runners (Fig. 6). The runners make it easy for the pests to crawl underneath. Scrape off the accumulated snails and slugs daily and destroy them; crushing is the most common method. Don't use salt to destroy snails and slugs, since it will increase soil salinity.

Some people use beer-baited traps buried at ground level to catch and drown slugs and snails that fall into them. Because it is the fermented part of the product that attracts these pests, you also can use a sugar-water and yeast mixture instead of beer. However, these traps aren't very effective for the labor involved. Beer traps attract slugs and snails within an area of only a few feet, and you must replenish the bait every few days to keep the level deep enough to drown the mollusks. Traps must have deep, vertical sides to keep the snails and slugs from crawling out and a top to reduce evaporation. You can purchase this type of snail and slug trap at garden supply stores.



Figure 5. Snail eggs.



Figure 6. This turned over board trap reveals snails on its underside.



Figure 7. Copper barriers can keep snails and slugs out of trees and raised beds.

Barriers

Several types of barriers will keep snails and slugs out of planting beds. The easiest to maintain are those made with copper flashing and screen. It is believed that copper barriers are effective because the copper reacts with the slime that snails and slugs secrete, causing a disruption in their nervous system similar to an electric shock. When erecting vertical copper screens, it is best to use ones that are at least 4 inches tall, so you can bury a portion of it a few inches below the soil to prevent slugs from crawling beneath the barrier.

Copper foil (e.g. Snail-Barr) wrapped around planting boxes, headers, or trunks (Fig. 7) will repel snails for several years. When banding trunks, wrap the copper

foil around the trunk, tab side down, and cut it to allow an 8-inch overlap. Attach one end or the middle of the band to the trunk with one staple oriented parallel to the trunk. Overlap and fasten the ends with one or two large paper clips to allow the copper band to slide as the trunk grows. Bend the tabs out at a 90° angle from the trunk. If the bands tarnish, you can clean them with a vinegar solution.

When using copper bands on planter boxes, be sure the soil within the boxes is snail free before applying them. If it isn't, handpick the snails and slugs from the soil after applying the band (but before planting new plants) until the box is free of these pests. Solarizing the soil—a technique that uses clear, plastic tarp and the sun's heat—is a good way to kill eggs in raised beds.

Instead of copper bands, Bordeaux mixture (a copper sulfate and hydrated lime mixture) or copper sulfate alone brushed onto trunks will repel snails. One treatment should last about a year. Adding a commercial spreader or white latex paint can help the Bordeaux mixture remain effective for two seasons.

Barriers of dry ashes or other abrasives heaped in a band 1 inch high and 3 inches wide around the garden also can be effective. However, these barriers lose their effectiveness after becoming damp, making them difficult to maintain and not very useful in most garden situations.

Natural Enemies

Snails and slugs have many natural enemies including ground beetles, pathogens, snakes, toads, turtles, and birds, but most are rarely effective enough to provide satisfactory control in the garden. One predator found in some California gardens is a large Staphylinid beetle called the devil's coach horse, *Ocyopus olens* (Fig. 8). However, this beetle, which is more than 1-inch long, also will feed on ripening or decaying fruits and vegetables.

Domesticated fowl—such as ducks, geese, or chickens—kept penned in infested areas can be effective snail predators that significantly reduce

problems. Be careful, though, as these birds also can eat seedlings.

The predatory decollate snail, *Rumina decollata*, (Fig. 9) has been released in Southern California citrus orchards to control young brown garden snails and is providing very effective biological control. It feeds only on small snails, not full-sized ones. Because of the potential impact of the decollate snail on certain endangered mollusk species, it can't be released in California outside of Fresno, Imperial, Kern, Los Angeles, Madera, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, Ventura, and Tulare counties. Decollate snails can feed on seedlings, small plants, and flowers and can be a nuisance when they cover the back patio on a misty day. Because snail baits will kill decollate snails, you shouldn't use them where these predators are active.

Baits

Snail and slug baits can be effective when used properly in conjunction with a cultural program incorporating the other methods discussed above. However, baits alone won't effectively control snails or slugs. Baits are toxic to all snails and slugs, including the predatory decollate snail and native species.

Several types of snail and slug bait products are available. Baits containing the active ingredient metaldehyde are most common; however, metaldehyde baits are particularly poisonous to dogs and cats, and the pelleted form is especially attractive to dogs. Don't use metaldehyde snail baits where children and pets could encounter them. Metaldehyde baits containing 4% active ingredient are more effective than those containing only 2%; however, they also are more toxic to dogs and wildlife. Avoid getting metaldehyde bait on plants, especially vegetables.

Some metaldehyde products are formulated with carbaryl, partly to increase the spectrum of pests controlled such as soil- and debris-dwelling insects, spiders, and sowbugs. However, carbaryl is toxic to earthworms and soil-inhabiting beneficial insects such as ground beetles, so it is better to avoid using snail baits containing carbaryl.



Figure 8. The devil's coach horse, *Ocyopus olens*, which is more than an inch long, is a predatory beetle that feeds on snails and slugs.



Figure 9. The decollate snail is a predator of snails.

Baits containing only metaldehyde are most reliable when temperatures are warm or during periods of lower humidity. When it is sunny or hot, these baits cause snails and slugs to die from desiccation or dehydration. The pests usually die with one day of ingesting the chemical or getting it on their foot. If cool, wet weather follows the baiting, they can recover if they ingest a sublethal dose. Don't water heavily for at least 3 or 4 days after bait placement, since watering will reduce effectiveness. Most metaldehyde baits break down rapidly when exposed to sunlight and high irrigation; however, some paste or bullet formulations (e.g. Deadline) hold up somewhat longer in these conditions.

Iron phosphate baits—available under many trade names including Sluggo and Escar-Go—have the advantage of being safe for use around children, domestic animals, birds, fish, and other wildlife, making them a good choice for an integrated pest management program in your garden. Ingesting even small amounts of the bait will cause snails and slugs to stop feeding, although it can take several days for

the snails to die. You can scatter the bait on lawns or on the soil around any vegetable, ornamental, or fruit tree that needs protection. Iron phosphate baits can be more effective against snails than slugs overall and more effective than metaldehyde during periods of higher humidity. Snails and slugs tend to hide before they die, so you won't see scattered empty shells or dead snails and slugs as you would if treating them with metaldehyde.

Sprinkle baits in areas that snails and slugs regularly frequent such as around sprinkler heads. Placing baits repeatedly in the same areas maximizes control, because mollusks tend to return to food source sites. Never pile bait in mounds or clumps, especially those products that are more hazardous, because piling makes bait attractive to pets and children and is not as effective as sprinkling. Thick, liquid baits might persist better when it is rainy or in areas that receive sprinkler irrigation.

The timing of any baiting is critical; baiting is less effective during very hot, very dry, or cold times of the year, because snails and slugs are less active during these periods. Irrigate before applying a bait to promote snail activity, and apply the bait in the late afternoon or evening. Sprinkle bait around sprinklers, close to walls and fences, or in other moist and protected locations, or scatter it along areas that snails and slugs cross to get from sheltered areas to the garden.

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AUTHORS: M. L. Flint, UC Statewide IPM Program, Davis/Entomology, UC Davis; and C. A. Wilen, UC Statewide IPM Program, San Diego Co.

EDITOR: M. L. Fayard

ILLUSTRATIONS: Figs. 1, 3–7 and 9, J. K. Clark, Fig. 2, D. Rosen; and Fig. 8, R. Weinstein.

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University of California scientists and other qualified professionals have anonymously peer reviewed this publication for technical accuracy. The ANR Associate Editor for Urban Pest Management managed this review process.

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This material is partially based upon work supported by the Extension Service, U.S. Department of Agriculture, under special project Section 3(d), Integrated Pest Management.

Produced by **UC Statewide Integrated Pest Management Program**
University of California, Davis, CA 95616



University of California
Agriculture and Natural Resources Program

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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