SNAILS AND SLUGS

Integrated Pest Management for Home Gardeners

Snails and slugs are among the most bothersome pests in many garden and landscape situations. The brown garden snail (*Helix aspersa*) (Fig. 1), is the most common snail causing problems in California gardens; it was introduced from France during the 1850s for use as food.

Several species of slugs are frequently damaging, including the gray garden slug (*Agriolimax reticulatum*) (Fig. 2), the banded slug (*Limax marginatusi*), the tawny slug (*Limax flavus*), and the greenhouse slug (*Milax gagates*). 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.

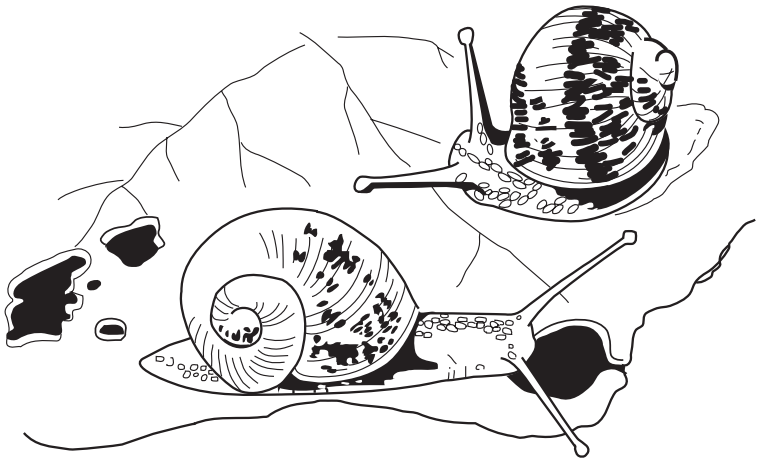

Figure 1. Brown garden snail.

IDENTIFICATION AND BIOLOGY

Snails and slugs move by gliding along on a muscular "foot." This muscle constantly secretes mucus, which later dries to form the silvery "slime trail" that signals the presence of either pest. Slugs and snails are hermaphrodites, so all have the potential to lay eggs. Adult brown garden snails lay about 80 spherical, pearly white eggs at a time into a hole in the topsoil. They may lay eggs up to six times a year. It takes about 2 years for snails to mature. Slugs reach maturity after about 3 to 6 months, depending on species, and lay clear oval to round eggs in batches of 3 to 40 under 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 mild-winter areas such as southern coastal locations, young 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 parchmentlike membrane and often attach themselves to tree trunks, fences, or walls.

DAMAGE

Snails and slugs feed on a variety of living plants as well as on decaying plant matter. On plants they chew irregular holes with smooth edges in leaves and flowers and can clip succulent plant parts. They can also chew fruit and young plant bark. Because they prefer succulent foliage or flowers, they are primarily pests of seedlings and herbaceous plants, but they are also serious pests of ripening fruits, such as strawberries, artichokes, and tomatoes, that are close to the ground. However, they will also feed on foliage and fruit of some trees; citrus are especially susceptible to damage. Look for the silvery mucous trails to confirm damage was caused by slugs or snails 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, to the extent possible, all places where

Figure 2. Gray garden slug.

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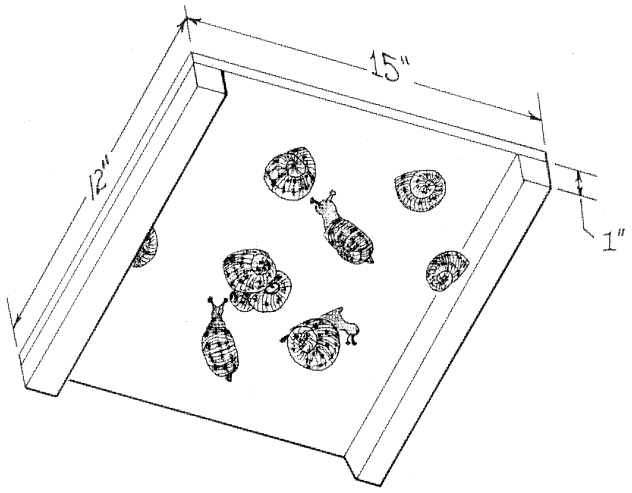

Figure 3. A snail trap can be made from a board with 1-inch strips.

snails or slugs 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 ideal sheltering spots. There will be shelters that are not possible to eliminate—e.g., low ledges on fences, the undersides of wooden decks, and water meter boxes. Make a regular practice of trapping and removing snails and slugs in these areas. Also, locate vegetable gardens or susceptible plants as far away as possible from these areas. Reducing hiding places allows fewer snails and slugs to survive. The survivors congregate in the remaining shelters, where they can more easily be located and removed. 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 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 for snails and slugs, by themselves they don't provide adequate control in gardens that contain plenty of shelter, food, and moisture.

Choice of plant can greatly affect how difficult your battle with snails and slugs will be. Snails and slugs favor seedlings and plants with succulent foliage and these plants must be vigilantly protected. Some plants that are seriously damaged include basil, beans, cabbage, dahlia, delphinium, hosta, lettuce, marigolds, strawberries, and many vegetable plants. On the other hand, many plants resist damage from snails and slugs including begonias, California poppy, fuchias, geraniums, impatiens, lantana, nasturtiums, and purple robe cup flower, and many plants with stiff leaves and highly scented foliage like lavender, rosemary, and sage. Most ornamental woody plants and ornamental grasses are also not seriously affected. If you design your landscape using plants like these, you are likely to have very limited damage from snails and slugs.

Handpicking

Handpicking can be very effective if done thoroughly on a regular basis. At first it should be done daily. After the population has noticeably declined, a weekly handpicking may be sufficient. To draw out snails, 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; or they can be put in a bucket with soapy water and then disposed of in your compost pile. Alternatively, captured snails and slugs can be crushed and left in the garden. Household ammonia diluted to a 5 to 10% solution in water can also be sprayed on collected slugs to kill them.

Traps

Snails and slugs can be trapped under boards or flower pots positioned throughout the garden and landscape. Inverted melon rinds make good traps. You can make traps from 12" x 15" boards (or any easy-to-handle size) raised off the ground by 1-inch runners (Fig. 3). 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 of destruction. Do not use salt to destroy snails and slugs; it will increase soil salinity.

Beer-baited traps have been used to trap and drown slugs and snails; however, they are not very effective for the labor involved. Beer traps attract slugs and snails within an area of only a few feet, and must be refilled every few days to keep the level deep enough to drown the mollusks. Traps are buried at ground level, so the mollusks easily fall into them. It is the fermented product that attracts them and a sugar-water and yeast mixture can be used in place of beer. Traps must have deep, vertical sides to keep the snails and slugs from crawling out and a top to reduce evaporation. Snail and slug traps can also be purchased at garden supply stores.

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. Copper barriers are effective because it is thought that the copper reacts with the slime that the snail or slug secretes, causing a flow of electricity. Vertical copper screens can be erected around planting beds. The screen should be 6 inches tall and buried several inches below the soil to prevent slugs from crawling through the soil beneath the barrier.

Copper foil (for example, Snail-Barr) can be wrapped around planting boxes,

headers, or trunks to 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. The bands need to be cleaned occasionally with a vinegar solution. When using copper bands on planter boxes, be sure the soil within the boxes is snail-free before applying bands. If it is not, handpick the snails and slugs from the soil after applying the band until the box is free of these pests.

Instead of copper bands, Bordeaux mixture (a copper sulfate and hydrated lime mixture) or copper sulfate alone can be brushed on trunks to repel snails. One treatment should last about a year. Adding a commercial spreader or white latex paint may increase the persistence of Bordeaux mixture through two seasons. Barriers of dry ashes or diatomaceous earth, heaped in a band 1 inch high and 3 inches wide around the garden, have also been shown to be effective. However, these barriers lose their effectiveness after becoming damp and are therefore 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. An exception is the use of domesticated fowl—ducks, geese, or chickens—kept penned in infested areas. (Be careful, though, as these birds may also eat seedlings.) The predaceous decollate snail *(Rumina decollata*) has been released in southern California citrus orchards for control of the brown garden snail 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 cannot be released in California outside of Fresno, Imperial, Kern, Los Angeles, Madera, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, Ventura, or Tulare counties. Also, decollate snails may feed on seedlings, small plants, and flowers as well as be a nuisance when they cover the back patio on a misty day. Decollate snails will be killed by snail baits.

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 will not effectively control snails or slugs. Several types of snail and slug bait products are available. Baits containing the active ingredient metaldehyde are most common. Metaldehyde baits are particularly poisonous to dogs and cats, and the pelleted form is especially attractive to dogs. Metaldehyde snail baits should not be used where children and pets cannot be kept away from them. Some metaldehyde products are formulated with carbaryl, partly to increase the spectrum of pests controlled to include soil and debris-dwelling insects, spiders, and sowbugs. However, carbaryl is toxic to soil-inhabiting beneficials like ground beetles and earthworms and should be avoided if snail and slug management is all that is required. Metaldehyde baits containing 4% metaldehyde are significantly more effective than those products containing only 2% metaldehyde; however, they are also more toxic to dogs and wildlife. Most currently available 4% products are formulated for use in enclosed bait stations to minimize their hazard.

Avoid getting metaldehyde bait on plants, especially vegetables. Baits containing only metaldehyde are most reliable when temperatures are warm or following a rain when snails and slugs are active. Metaldehyde does not kill snails and slugs directly unless they eat a substantial amount; rather, it stimulates their mucous-producing cells to overproduce mucous in an attempt to detoxify the bait. The cells eventually fail and the snail dies. When it is sunny or hot, they die from desiccation. If baiting is followed by cool and wet weather, they may recover if they ingest a sublethal dose. Do not water heavily for at least 3 or 4 days after bait placement; watering will reduce effectiveness and snails may recover from metaldehyde poisoning if high moisture conditions occur. Most metaldehyde baits break down rapidly when exposed to sunlight; however, some paste or bullet formulations (such as Deadline) hold up somewhat longer under conditions of sunlight and moisture.

A recently registered snail and slug bait, iron phosphate (available under many trade names including Sluggo and Escar-Go), has the advantage of being safe for use around domestic animals, children, birds, fish, and other wildlife and is a good choice for a garden IPM program. Ingestion of the iron phosphate bait, even in small amounts, will cause snails and slugs to cease feeding, although it may take several days for the snails to die. Iron phosphate bait can be scattered on lawns or on the soil around any vegetables, ornamentals, or fruit trees to be protected. Iron phosphate baits may be more effective against snails than slugs.

Sprinkle baits in areas that snails and slugs regularly frequent such as areas around sprinkler heads. Placing baits repeatedly in the same areas maximizes control because molluscs tend to return to food source sites. Never pile bait in mounds or clumps, especially those baits that are hazardous, because piling makes a bait attractive to pets and children. Placement of the bait in a commercial bait trap reduces hazards to pets and children and can protect baits from moisture, but may also reduce their effectiveness. Thick liquid baits may persist better under conditions of rain and sprinklers.

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. Application on a warm, humid evening is ideal. Apply bait in a narrow strip 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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